Routledge Advances in Production and Operations Management

SUPPLY CHAIN OPERATIONS IN THE ARCTIC

IMPLICATIONS FOR SOCIAL SUSTAINABILITY

Edited by
Antonina Tsvetkova and Konstantin Timoshenko

ROUTLEDGE

“This is an enthusiastic book that offers captivating insights into a multiplicity of supply chain management practices across various Arctic regions. It highlights the often-overlooked social implications, making it an important contribution to Arctic research. With its diverse collection of case studies, rigorous research, and thought-provoking content, it will undoubtedly be of great interest to scholars, practitioners, and policymakers.”

Frode Mellemvik, *Professor, Director of High North Center for Business and Governance, Nord University, Norway*

“The Arctic region is warming four times faster than the rest of the planet. Freed from the pack ice that melts in summer, access routes to hydrocarbon resources and various ports are more numerous and easily accessible. However, the Arctic region is not like other regions due to its lack of industrial infrastructure, its geography and, above all, the way of life of the local populations who live along the Arctic coastline. Logistics supply operations are complex and often require costly dedicated resources to respect this environment, which is more fragile than elsewhere. While the Arctic is the subject of numerous scientific publications, particularly on climate, there are fewer studies on the logistical and sociological issues centered around the demands of local populations. This is precisely what this book does remarkably well and accurately, covering all the subjects it covers.

Reading the 13 chapters, which cover a wide range of topics, provides a spectacular overview of all the issues involved in logistics operations in this hostile region, which is only accessible during the summer months. These different studies give a large place to the problems of the Indigenous Peoples for whom supplies, mainly by sea, are essential. All these studies lead to the same conclusion. The Arctic is a region that is opening up as a result of climate change and the potential for exploiting its resources. All the experts are unanimous in saying that the ecosystem needs to be managed in a sustainable way by giving priority to shipping corridors, but above all, by placing greater trust in the management of resources by local populations. Because it is remarkably clear that all the issues linked to preserving the environment and ensuring the safety of supply chains have the same thing in common: taking account of local populations. Although the deadlines may still seem a long way off (between 2024 and 2029), the ban on the use of heavy fuel oil as fuel for ships in the Arctic Ocean is a strong sign of the need to preserve this particularly vulnerable region. The idea of creating maritime access corridors has already been adopted in some parts of Nunavut.

The lessons learnt from the environmental impact of the various rail corridor projects in Finland on the Sami people clearly demonstrate the vulnerability of a systemic approach that does not take account of the cultural and geographical environment. This approach, centered on industrial needs, must not be reproduced in the Arctic. This book shows examples of a much more responsible approach, adapted to the populations and environment endemic to the Arctic, such as the practice of responsible fishing or the establishment of shipping corridors with low environmental impact. The main merit of this book is that it shows that solutions for respecting the environment cannot be based solely on the industrial players involved locally but that a more sustainable approach must prevail, based on the needs of local populations who have a more sustainable and sociable vision of the exploitation of Arctic resources. The modes of governance must be more conducive to research in this direction rather than seeking to make the exploitation of resources acceptable as a source of profit, even if some of the profit is destined for local populations.

The holistic approach of this book means that all the topics covered are highly accessible to all readers, whether they are students, teachers, industrialists, or simply anyone interested in the development of the Arctic. The quality of the authors, who are all outstanding specialists in their respective fields, lends enormous credence to this study, which covers an area that is still poorly analyzed or even neglected. The book *'Supply Chain Operations in the Arctic: Implications for Social Sustainability'* fills this gap."

Hervé Baudu, *Senior Lecturer in Arctic Nautical Sciences, French Maritime Academy, France*

"This book, with contributions from a global set of academic authors, deals with two different yet related topics within Supply Chain Management (SCM), namely social responsibility and supply chain operations, with focus on the Arctic. This part of the world is characterized by rough weather conditions, a vulnerable natural environment, and dispersed settlements often with weak connectivity to regional centres. Therefore, balancing the social, environmental, and economic outcomes of supply chain activities is of paramount importance in these areas. The volume deals with interesting and relevant elements from the rather broad field of SCM, like production, transportation, sustainability, and resilience, with social responsibility as a common denominator. These elements are put into an Arctic context by means of numerous case studies. Chapters on health care provision and accessibility in rural areas, extraction of natural resources through fisheries and herding, social responsiveness, tourism in the vulnerable Arctic, carbon capture and storage to reduce global warming, and various aspects of transportation are provided to illustrate the importance of having the social part of the 'triple bottom line' in mind. The book ends with useful reflections on future directions for research. It will be extremely useful for students, academics and others who are interested in the Arctic, with its steadily increasing pressure on resource extraction and geo-political activities. The relevance is underlined by the fact that the literature on SCM in the Arctic is scarce. Hence, this book gives a timely and important contribution."

Svein Bråthen, *Professor in Transport Economics, Molde University College, Norway*

"This volume widens the understanding of the discipline of Supply Chain Management and includes a neglected dimension in Arctic logistics and transportation research. It is made abundantly clear that supply chains are essential not only for economic activities, but also for social conditions. Thus, it includes analyses of local food supply, safe maternity services, sustainable reindeer herding and tourism. Interview data and an anthropological approach bring out information from locations hitherto poorly researched. The book also provides comprehensive and new insights into large infrastructure projects connected to oil development, shipping and railway construction and explains how such projects can collide with environmental and social sustainability. By using supply chain management as a common framework – but not a straitjacket – the reader easily sees the commonalities and links between very different areas of activity in the Arctic. A rich literature review is very useful for students and scholars who want to pursue further research."

Arild Moe, *Research Professor, Fridtjof Nansen Institute, Norway*

"This well-written book, edited by Antonina Tsvetkova and Konstantin Timoshenko, two well-known experts in supply chain and Arctic issues in which renowned experts took part, questions the development of the Arctic in a very interesting way. It stresses the complexity of the Arctic environment and the need to implement a sustainable supply chain. The authors approach this topic from economic, human, and environmental perspectives. One of the innovative contributions of the book is to question the integration of northern communities into the development of the Arctic area. The authors demonstrate that these communities' knowledge of the complexity of the system is a major asset for the implementation of a sustainable supply chain system. They highlight that Arctic development, and therefore sustainable supply chains, cannot be implemented without the involvement of Nordic communities. To conclude, I would say that this book is a very well-written book, in which esteemed experts have participated in examining the development of the Arctic in a very interesting way and shed new light on the sustainable development of Arctic regions."

Olivier Faury, *Associate Professor in Supply Chain Management and Logistics, EM Normandie Business School, Le Havre, France*

"The emerging and necessary societal dialogue about the expansion of supply chain operations in the Arctic requires comprehensive and transparent evaluation of its environmental, social and economic implications. To date, the topic has largely been explored from an environmental perspective, presenting an important, but one-sided argument. *'Supply Chain Operations in the Arctic: Implications for Social Sustainability'* offers valuable insights to support a balanced discussion to shape the path ahead for socially responsible supply chain practices in the Arctic."

Niklas Witte, *Sustainability Manager, Hamburg Süd, Germany*

"This is a pioneering book focusing on social responsibility in the unique region: the Arctic. The book addresses the issue in the Arctic through the lens of supply chain management and operations. It is an insightful collection of thirteen relevant topics contributed by prestigious experts and scholars from the Arctic. The well-researched book provides valuable and broad knowledge on social responsibility and sustainable development in the Arctic."

Zhi Tao, *Associate Professor in Logistics, University of Alaska Anchorage, USA*

Supply Chain Operations in the Arctic

The extant corpus of research on supply chain sustainability in the Arctic exhibits a conspicuous neglect of the social dimension, rendering it the most underprivileged among the three pillars of sustainability. A deep dive into the Arctic, this edited volume endeavors to fill this opulent lacuna by placing the unjustly forsaken concept of social sustainability at the forefront of supply chain management (SCM) research.

By showcasing real-life case studies of supply chain operations, all in different industries and located in various Arctic regions, this book delves into the intricate interplay between business interests, political ambitions, and social issues. In response to the burgeoning demand for more in-depth empirical studies within the SCM landscape, it offers a compelling tapestry of experiences and candid views on the complexities of implementing socially sustainable and responsible policies in Arctic supply chains. Featuring contributions by 26 esteemed scholars worldwide, this collection proffers 13 thought-provoking and insightful chapters, arranged in a logical and coherent sequence that enables readers to follow a clear thread of argumentation.

With abundant theoretical insights and empirical data, *Supply Chain Operations in the Arctic: Implications for Social Sustainability* will appeal to a wide range of readers keeping a close eye on Arctic operations and sustainable issues. It is a timely and essential resource for students and scholars of SCM and sustainability studies, as well as businesses, policymakers, Indigenous Peoples, and non-governmental organizations seeking to promote socially responsible supply chain practices in the Arctic.

Antonina Tsvetkova, Ph.D., is an Associate Professor in Supply Chain Management at Molde University College, Norway.

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Lovingly dedicated to my beloved mom, Vera, whose endless faith in me has never wavered. I am forever grateful for your unwavering support and encouragement. Your wisdom and inspiration continue to guide me, and the values and principles that you instilled in me are reflected in this work. Thank you for being my mentor and my best friend!

Antonina Tsvetkova

Dedicated to my beloved mom, Roza, whose unwavering support and guidance have been a constant source of inspiration in my life. You have taught me to live meaningfully, chase my dreams with dedication, and never give up. Without your love and guidance, I would not be the person I am today, and for that, I am eternally grateful. This research anthology is dedicated to you, as a tribute to the remarkable impact that you have made on me. Thank you for being the best mom anyone could ask for. I love you deeply!

Konstantin Timoshenko

Additionally, this anthology is dedicated to those intrepid enthusiasts who, at the risk of their lives, overcome challenges with courage and endurance: men who, through perilous and heavy polar expeditions into the great silent and frozen area, made the subsequent development of the Arctic lands and seas possible…

By following tracks in the snow and the echoes of the voices that led us there, into the mystical Arctic…

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Contributors

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Foreword

Never has the Arctic been more relevant as a research theme. Extensive climate change has had an immense impact on ice conditions both onshore and offshore. Already, it is possible to sail north of the North American and Eurasian continents through the Northwest and Northeast Passages, cutting off considerable transport time between Europe and Asia. However, this development does not come without costs. First, due to still harsh weather conditions, sailing through Arctic waters remains dangerous for equipment, cargo, and ship crews. Furthermore, of general importance is the impact on both environmental and social sustainability that economic activities in the Arctic have. The impact on environmental sustainability is the most obvious due to melting ice masses and, therefore, increasing sea levels in the rest of the world but is also due to the risk of failures and accidents with, e.g., oil spills that harm the delicate Arctic nature. One only has to recall the alarming pictures from the grounding of the Exxon Valdez oil tanker in 1989 in Alaska, see https://en.wikipedia.org/wiki/Exxon_Valdez_oil_spill. A vast number of birds and many other sea creatures were impacted on a more than 2,000-kilometer-long coastal stretch. However, Indigenous People still live in Arctic regions in the United States, Canada, Norway, Sweden, Finland, Russian Siberia and, of course, Greenland. Economic activities may have a positive impact on these people, but in any case, their lives will be changed. Therefore, placing more of a spotlight on the social impact of these activities in the Arctic is highly needed.

This book, *Supply Chain Operations in the Arctic: Implications for Social Sustainability*, provides insights into the Arctic through the lens of supply chain management and operations. Supply chain management (SCM) is an overarching term that signifies the connecting of primarily industrial activities through transport and logistics. Arctic economic activities are – due to the regions' remoteness – particularly dependent on their supply chains, including maritime shipping, so this is an interesting perspective. Furthermore, supply chain management as a field is now paying more and more attention to the environmental and social implications of supply chains. Well known in the news and in scientific literature is the Rana Plaza incident in 2013 in Bangladesh, where around 1,200 people died and many more were injured in the collapse of a factory building. Though SCM mostly addresses industrial activities and their supply chains, little has so far been written about supply chains of the Arctic and their implications. This is another good reason for delving into the chapters of this book.

The knowledge of the Arctic presented in this book is comprehensive and will appeal to a broad range of readers interested in the Arctic regions, especially those from the SCM field. Readers will learn about the social issues of economic development from Indigenous People in Alaska who need the supply chains to deliver their health care products; about reindeer herders in Siberia who, surprisingly, interact with oil and gas businesses; about a new railway through Finnish Lapland to the Barents Sea; and about much more. Again, from an SCM perspective, it is interesting to learn about the topics mentioned through anthropological studies, an approach that the field of SCM should take much more.

Readers will learn from the interesting cases in this book that there are, of course, problems with social sustainability because economic development is often prioritized at the expense of social and environmental sustainability. Economic development is not necessarily bad as it brings better living conditions for many. However, my hope is that responsible politicians will use the so-called ecological dominant logic (Montabon et al., 2016) when prioritizing development projects in the future. This means that environmental sustainability should first be assessed; if deemed satisfactory, the next step is social sustainability; and if that is found to be satisfactory, then economic consequences can be assessed as an enabler of sustainable projects. Noteworthy is that environmental sustainability is often a precondition for social sustainability. It is also important to note that this book does not question the extraction of raw materials, fossil fuels included, in the Arctic and thereby overall climate change. This debate must be taken up by other studies.

Until recently, the Arctic was relatively untouched by the geopolitical tensions and conflicts in other parts of the world. With climate changes and the present conflict in Ukraine, this is unfortunately no longer the case. Whether this situation will change soon or not, my hope is that more knowledge and knowledge exchange about the conditions in the Arctic will open the eyes of the world regarding the preservation of the astonishingly beautiful Arctic regions and their people.

This book will be of great interest to politicians, both those directly and indirectly responsible for economic development in the Arctic. Moreover, the book will be of interest to political scientists, both professionals and students of all levels, and to anthropologists as well as transport and supply chain managers, students, and scholars. Given the era in which we live, I trust that all members of the book's target group will be highly interested in sustainable Arctic nature and populations, both Indigenous and immigrant.

Reference

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Britta Gammelgaard
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May 2023

Preface

The Arctic – which stretches across vast expanses of ice, harbors myriad mysteries and hidden secrets, and is so hard to reach – has always been attractive to her desperate enthusiasts and explorers of all stripes. So alluring and magnetic, she also captured our hearts and truly became a long-standing focus of our research efforts. Having traveled aboard a containership along the Northern Sea Route in 2016, the editor-in-chief of this collection had managed to gather so much unique data and nurture such extraordinary skills as containership operation through heavy ice fields that a solid empirical foundation for her Ph.D. project was laid. Being enchanted with what she experienced and learnt, she unhesitatingly made up her mind to devote her academic career to researching various facets of the Arctic. With his background in (public sector) accounting, the other co-editor had once been invited to take part in a research project geared toward gauging value-creation in the Arctic context. This ushered in a new phase in his academic life, for reasons he is still unable to fully explain. After years of dedicated research, we, as the editors of this volume, finally have knowledge of our own to contribute.

A deep dive into the Arctic, this edited book provides a multilayered perspective on supply chain operations in this magnificent region, where cargo transportation really matters. Drawing on contributions from 26 international scholars and experts in the field, the text makes an assiduous effort to bring the undeservedly marginalized *social* dimension to the forefront of supply chain management (SCM) research. Although it may seem to the inexperienced eye that the Arctic is rather homogeneous and uniform, the evidence gathered in this volume eloquently demonstrates the diversity and heterogeneity of supply chain practices within this vast region. Reflecting the so-called multifaceted Arctic, this anthology is littered with empirically rich real-life cases of supply chain operations, shining a light on the intricate interplay between business interests, political ambitions, and social issues. A particular emphasis is placed on evolving socially responsible practices and their far-reaching implications for Arctic sustainable development. With its wealth of theoretical insights and empirical data, this timely and candid book will appeal to all readers keeping a close eye on Arctic operations and sustainable issues. The readership will include but not be limited to students and scholars of SCM and sustainability studies, businesses, policymakers, Indigenous communities, and non-governmental organizations.

As the editors of this anthology, we have been extremely fortunate to interact with a host of researchers and practitioners throughout the course of working on this project, who, without exaggeration, left an indelible mark on us and our mindset. One of the greatest pleasures of completing this volume is this opportunity to thank them. First and foremost, we are immensely indebted to all the wonderful co-authors' teams for their enduring commitment to pushing the quality of their chapters to a loftier level during the review process. We would also like to express our heartfelt appreciation to the reviewers for providing invaluable feedback and suggestions for the enhancement of quality, coherence, and content presentation of chapters. Next, we owe a myriad of intellectual and personal debts to Professor Britta Gammelgaard of Copenhagen Business School. She has made an invaluable contribution to this research anthology, and it is very hard to put into words our appreciation for the roles she has played during the last two unforgettable years. Without her ideas, support, encouragement, care, and professional advice along the way, we could not have brought this book to fruition.

Additionally, we wish to voice our sincere gratitude to the Publication Funds at Molde University College – Specialized University in Logistics (Norway) and at the University of South-Eastern Norway, for making the open access publication of this volume possible. A very special vote of thanks goes to Linda March, of The Good English Company, who dedicated hours of her precious time to ramping up the English language in this anthology, making it more accessible to a wider audience. Last but not least, we owe a special debt to the academic and administrative staff at Routledge, particularly Alexandra Atkinson and Manjusha Mishra, for giving us a splendid opportunity and enlightening experience to lead this book project. Their support and guidance have been instrumental in its successful completion, and we are honored to have collaborated with such a renowned publisher.

We earnestly hope that you will relish reading the meticulously curated chapters on the thrilling subject of Arctic supply chain operations and social sustainability, and that each one will prove to be as influential to your thoughts and ideas on SCM as they were to the editors! It is our unwavering belief that this enlightening volume will raise the level of awareness and knowledge about the topic in question and spark a dynamic and productive process of discussion that, in turn, may evince the so-much-needed changes.

Finally, we hold a fervent aspiration that readers of this book – scholars, academics, policymakers, and businessmen – will find something within its pages that is valuable and insightful and that will make the Arctic, and ultimately our entire world, a little more socially responsible and sustainable!

Antonina Tsvetkova, Ph.D.
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May 2023

1 Paving the Way for Social Sustainability in Arctic Supply Chain Operations

A Novel Research Agenda

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The extant corpus of research on supply chain sustainability in the Arctic exhibits a conspicuous neglect of the social dimension, rendering it the most underprivileged among the three pillars of sustainability (Ahi and Searcy, 2015; Mani et al., 2016; Govidan et al., 2021). Notwithstanding the mounting attention thrust on the environmental dimension of Arctic supply chain operations, with a clear-cut emphasis on reducing their carbon footprint, the social implications of these operations have largely been shunted aside (Tsvetkova, 2020a). This is particularly worrisome, especially considering that such operations frequently entail Indigenous communities and other local stakeholders who may be impacted by them in myriad ways (Brooks and Frost, 2012). Thus far, there is a critical need for research into social sustainability in Arctic supply chain operations, in order to ramp up our comprehension of, and to address, the social issues and opportunities elicited by these activities.

As the title of this introductory chapter eloquently implies, it seeks to fill this opulent lacuna by outlining a much-needed and novel research agenda that paves the way toward social sustainability in Arctic supply chain operations. Drawing on the existing scholarship, this chapter illuminates the current status of research within the realm of supply chain operations, with an explicit emphasis on the social sustainability aspect. It commences by examining supply chain operations as a captivating research phenomenon, followed by a nuanced discussion of the neglected and unjustly forsaken concept of social sustainability in the supply chain management landscape. The intricate and multifaceted nature of the concept at hand is underscored in this discussion, making it challenging to develop a one-size-fits-all framework that can

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effectively address the multifarious social dynamics inherent in context-specific supply chains. The Arctic is then portrayed as a distinctive research terrain that demands special attention due to its crucial role in advancing sustainability efforts. Finally, the outline of the anthology is unveiled, affording a concise and lucid overview of the research to come.

Supply Chain Operations as a Research Phenomenon

The discipline of Supply Chain Management (hereafter, SCM) has acquired the status of a rapidly and widely developing field of knowledge, since its inception in the early 1980s. The mainstream of SCM research has traditionally revolved around optimizing business processes and customer satisfaction to ramp up efficiency and achieve market responsiveness by building models and testing hypotheses. However, in recent years, a particular focus of SCM research has also been put on establishing and forging collaborative relationships and mutually beneficial partnerships within and across organizations (Stock et al., 2010). As a result of the synthesis of these two streams, SCM has morphed into an integrating mechanism that connects key business processes for planning, organizing, monitoring, and governing all supply chain activities, with mutual information sharing within and beyond organizations (Lambert and Cooper, 2000; Mentzer et al., 2001; Handfield and Nichols, 2002). At a more strategic level, supply chain integration has been recognized as a top priority for collaboration and the sharing of intra- and inter-organizational processes and routines among supply chain members, in order to make material flows efficient and better synchronized (Frohlich and Westbrook, 2001; Flynn et al., 2010; Schoenherr and Swink, 2012). As a consequence of these processes and routines, supply chain integration has been inaugurated for the purpose of creating value for customers and stakeholders (Cooper et al., 1997; Lambert, 2008).

In parallel, SCM practices have become operationalized along the entire supply chain, as constituent organizations implement necessary adaptations and adjust their operations, in a concerted and integrated fashion, to roll out new practices and solutions and establish novel inter-organizational links (Nair et al., 2016). Seen from this perspective, SCM ensures strategic behavior such as interaction and collaboration, provides mutual objectives in organizational actions, and embraces control tasks to support operational management (Dekker and Van Goor, 2000). Although SCM has historically been viewed as a function of operations management, recent research posits that it has a greater impact on operations than previously realized. Throughout this volume, the term SCM is used quite broadly, incorporating various facets of the operations and supply chain management knowledge. At least two main facets can be observed: (1) supply chains deal with the flow of material and information, which (2) have to be managed by all partners embedded in the supply chain (Seuring, 2005).

Despite the plethora of definitions and scopes touted by scholars, SCM remains a field that is vastly under-researched. Although it has increasingly gained traction among practitioners, its theoretical foundation lags behind that of other fields (Chen and Paulraj, 2004; Burgess et al., 2006), leading to such malfunctions as fragmentation and inconsistency of core findings (Zsidisin et al., 2000; Cousins and Menguc, 2006). As a consequence of this scarcity, a certain set of theories, approaches, and views has been preferred by the academic community to capitalize on the moment (Halldorsson et al., 2003; Ketchen and Hult, 2007; Shook et al., 2009). The fundamental assumption upon which most of these preferred theories rest is imprisoned within holistic systems thinking (Johannessen and Solem, 2002; Johannessen, 2005). This organizational perspective views the supply chain terrain as a system composed of independent components that are fragmented into parts and then examined as separate entities (Nilsson and Gammelgaard, 2012). As a result, the majority of SCM research boils down mostly to the consideration of parts of the system, while undeservedly eclipsing the various complex interactions between the parts (Neher, 2005). This indicates that systems thinking is characterized by the dualistic nature, since the reality is viewed as a part of the organization, while also standing outside it, due to a spatial boundary that separates parts of the system from each other and from the system as a whole. Although systems thinking is conceived of as more of the methodological foundation of SCM, rather than a theory, it is rarely mentioned explicitly. Nonetheless, it can be of great value in helping researchers formulate concrete research tasks (Gammelgaard, 2023). Overall, holistic systems thinking leads to a fragmented and often incomplete picture of supply chain operations.

As critically asserted by Johannessen (2005), holistic systems thinking fails to provide a convincing explanation for organizational change that both managers and local employees experience in practice. Change is often reckoned as an external pressure, driven by the rational decisions of managers who are seen as autonomous individuals standing outside the organization and striving to make the system as effective as possible. Conversely, the behavior of local employees within the system is assumed to be predictable and stable (Nilsson and Gammelgaard, 2012). However, this view presents formidable difficulties in comprehending how managers outside the organization are able to spark a change in the organizational patterns of actions and behavior of those who implement these patterns in practice. Furthermore, this view fails to recognize that human activity brings about change in organizational life through day-to-day routines, experiences, and interactions (Johannessen, 2005). Without accounting for the impact of human behavior and social interaction, the predictive accuracy of models and hypotheses appears to be limited in the real-world practical issues and challenges of SCM (Tokar, 2010).

The core idea of SCM centers around the relationships and interconnections between companies, which are created and governed by people who design, manage, and execute almost all supply chain activities and functions (Sweeney, 2013). The role of humans is considered of paramount importance in supply chain decision-making. This is because their actions can have far-reaching implications for organizational operations and outcomes in day-to-day activities, which are often habitual, routine, or even unconscious (Tsvetkova, 2021). But the ground reality continues to be that the human dimension has been largely shunted aside in SCM research (Storey et al., 2006; Fawcett et al., 2008; Tokar, 2010; Sweeney, 2013; Huo et al., 2013). The potential benefits of systems thinking notwithstanding, prior research on SCM has principal shortcomings in addressing the role of human actions and social interaction on driving organizational change. This is a serious limitation, as these factors are critical to achieving sustainable and socially responsible supply chain operations.

As clear from the above, most of the theories that feature prominently in the SCM field adopt a reductionist and static view of the supply chain and its management. These theories approach change in practice as a rational and planned activity, while rejecting the possibility of unpredictable and unknowable outcomes. Acknowledging this view, supply chains tend to be operated without much regard for their contextual environment. This perspective largely overlooks the fact that supply chain operations are fluid and intricately woven into the fabric of political-economic and social processes (Wieland, 2021). Nor does this view acknowledge the very fact that local institutional environments are instrumental in the implementation of almost all supply chain activities (Tsvetkova, 2016). As has also been spelled out eloquently in the extant literature, supply chain operations may impinge upon the context itself by responding to contextual and institutional challenges (Tsvetkova and Gammelgaard, 2018). All this makes it imperative to assess institutional underpinnings or contexts in which supply chain operations take place.

This anthology gears its efforts toward unveiling the diverse and often hidden intricacies of the human dimension in SCM. To achieve this ambitious goal, it advocates for a shift in methodological thinking toward an interpretive perspective. As a viable alternative to the dominant systems thinking, and supported by a handful of scholars (Arlbjørn and Halldorsson, 2002; Johannessen, 2005; Nilsson and Gammelgaard, 2012), this perspective seeks to enrich the scope of SCM by delving deeper into how supply chain activities are operationalized through social interactions and responsibilities. By shedding light on the social and human dynamics underlying supply chain activities, the interpretive perspective tends to offer a more inclusive and comprehensive approach to SCM.

Social Sustainability as a Missing Pillar in the SCM Landscape

There is hardly a term as ubiquitous today as the notion of sustainability. Having gained traction in the late 20th century, it has spurred huge interest and concern worldwide, serving as an important beacon to guide our current efforts for the sake of the future. No exception to the global trend, supply chains and their management are also under the relentless pressure of the sustainable policy challenge (Punte et al., 2020; Matos et al., 2020). As a result, SCM has evolved over the two-decade history of its development into a domain that amalgamates, although to varying degrees, the environmental, social, and economic facets of supply chains into a common framework (Seuring and Müller, 2008; Carter and Rogers, 2008).

This framework, commonly known as the triple bottom line (Elkington, 1997), has enabled illuminating insights to be provided into various issues in supply chains. Premised on this framework, sustainability-driven SCM appeals for greater integration and cooperation between partners. This is done to make supply chain practice and performance sustainable, by pushing environmental and social criteria beyond the confines of any single company to capture the whole supply chain (Bai and Sarkis, 2010). As prior research has posited (Ansari and Kant, 2017), embracing the sustainability concept in core business functions of the supply chain has enabled firms to expand their operational scope beyond traditional processes and hone competitive advantage in the market. The positive aspects notwithstanding, the SCM literature is replete with cases that provide documented evidence of supply chains being compelled to adopt novel and/or costly practices, all in the name of sustainability. Unsurprisingly, such pressures can bring a deluge of detrimental implications for the local environment and communities. This makes it imperative to rekindle a debate about the perception of social benefits. Overall, the role of SCM in addressing socially sustainable issues remains largely uncharted, offering immense possibilities for exploring how SCM facilitates the implementation and further embeddedness of sustainable practices (Tsvetkova, 2020a).

Complex Dynamics in Achieving Sustainable Supply Chain Practices

A host of scholars shares the view that sustainability can only be attained by giving equal and simultaneous attention to environmental, social, and economic concerns or so-called responsibilities and by involving all partners in the supply chain (Faisal, 2010; Bai and Sarkis, 2010; Mani et al., 2016; Tsvetkova, 2020a). This poses a formidable challenge for firms to manage sustainability along the supply chain, which involves interdependent actors that can impact each other's performance. Thus far, understanding the triad of these three distinct but interrelated responsibilities is at the very heart of SCM research (Pagell and Wu, 2009; Mani et al., 2016; Tsvetkova, 2020a).

The reality is that, despite some indications of the complexity of the sustainability concept, the extant literature cannot boast a wide range of studies shining a light on the complex nature of the transformations toward sustainable SCM practices. This is especially evident at the operational level, as opposed to the strategic level, where a quite profound view of complexity in sustainable SCM has been reached. As Silvestre has spelled out (2015, p. 157), "sustainable supply chains are not a destination but rather a journey because as supply chains move toward more sustainable practices, they go through a complex, dynamic, and evolutionary learning process". Some organizations have yet to go down this pathway toward sustainability, while others that have embarked on it underestimate its complexity. This calls for delving deeper into the implications of sustainability theory for SCM in the scramble to better understand the complex dynamics in the journey toward sustainable practices and operations (Pagell and Shevchenko, 2014; Quarshie et al., 2016).

Unpacking Social Sustainability: A Multifaceted Concept in SCM Literature

Although the concept of sustainability has trickled down into the SCM field, the extant literature has largely centered around issues of making supply chain operations "green" or environmentally friendly, through measures such as reducing fuel consumption and mitigating environmental impact (Carter and Rogers, 2008; Silvestre, 2015; Lam and Lai, 2015; Mansouri et al., 2015), with the overarching goal of boosting economic performance. There is burgeoning evidence that, while the quantity of research on the environmental dimension has recently more than tripled (Gurtu et al., 2015), social issues in pursuit of sustainability have, on the contrary, been marginalized in the research agenda (Seuring and Müller, 2008; Wu and Pagell, 2011; Beske, 2012; Sarkis, 2012; Ahi and Searcy, 2015, Mani et al., 2016; Tsvetkova, 2020a). It comes as no surprise, then, that the social dimension of sustainability is often conceived of as the weakest link in the triad.

Resulting from this clear-cut bias, the scope of social sustainability has been conscripted to environmental issues, such as the potential adverse effects of pollution on human health, safety, and quality of life (Tsvetkova, 2020a). Furthermore, there has been a focus on the product and process measures geared toward safeguarding the safety and welfare of people in the chain (Mani et al., 2016). Thus far, studies addressing social issues remain scarce, and greater attention is needed to raise awareness of the social impacts across the supply chain (Rajeev et al., 2017; Tsvetkova, 2020a). This lacuna in the literature makes it challenging to gauge advances in sustainable SCM practices (Davidson, 2011).

The social sustainability concept has encountered a significant challenge and criticism, centering around its obscure alignment with the other dimensions of sustainable development and other social development issues (Boström, 2012). One of the defining characteristics of this concept is its frequent association with a multitude of related terms and definitions, making it tempting for scholars to buy into the social sustainability of their choice. All this is to contend that social sustainability is largely a complex and multifaceted concept, laden with value statements, morals, and other intangible and non-measurable facets (Govindan et al., 2021). Among those facets or images widespread in the extant literature are social well-being, quality of life, social capital, social justice, social cohesion, cultural diversity, democratic rights, workers' rights, social inclusion, social exclusion, and individual capabilities, to name a few. As Dempsey et al. (2011, p. 292) have elucidated, "social sustainability is neither an absolute nor a constant... [it] has to be considered as a dynamic concept, which will change over time (from year to year/decade to decade) in a place". There is a profound lack of a clear and unambiguous consensus on what constitutes social sustainability, which gives rise to certain struggles and contradictions aimed at the institutionalization of this concept. This, in turn, leads to a bewildering diversity of specific typologies and frameworks.

Prioritizing Social Sustainability: A Critical Look at Corporate Social Responsibility

Social sustainability undoubtedly features prominently in a supply chain context. This is not only because it raises awareness among relevant stakeholders about human safety but also because it deals with the 'how', 'who', and 'under what conditions' questions SCM can contribute to community development and address social issues that are high on the agenda in extremely remote areas (Tsvetkova, 2020a). With some minor exceptions, there is, however, still a dearth of research into the underlying meaning of social sustainability and social issues in the SCM field. Reflecting this paucity, some scholars have dubbed the social dimension of sustainability mostly an ethical code of conduct for human survival and future development that needs to be accomplished "in a mutually inclusive and prudent way" (Sharma and Ruud, 2003). Instead of explicitly referring to sustainability (Quarshie et al., 2016), proponents of this view incline more toward the term "corporate social responsibility" (CSR), which encompasses corporations' legal, economic, ethical, and discretionary responsibilities, placing extra emphasis on moral management and organizational stakeholders by avoiding harm (Carroll, 1991). Seen from this vantage point, the scope of social sustainability has been narrowed down to human rights, working conditions, welfare, and labor safety (Quarshie et al., 2016).

Another stream of research advocates for the integration of CSR in the supply chain, which can take various forms, e.g., through socially responsible supplier development (see Krause, 1999). Viewed from this perspective, the bulk of studies within SCM has centered around purchasing decisions resulting from the unethical behavior of suppliers and inadequate provision of services. Supplier relationships are conceived of as a challenge to social sustainability in this view (Carter and Jennings, 2002; Boyd et al., 2007; Ciliberti et al., 2008). As Andersen and Skjoett-Larsen (2009) have contended, CSR practices can entail intensively developing suppliers and incentivizing them through long-term contracts and large orders.

One of the basic features of the CSR approach is that it focuses mainly on practices adopted by individual firms. Rather than confined to any single entity, the scope of SCM encompasses a broad range of organizations from varying fields of business, each with its own goals and ways of managing. This makes it necessary to extend the coverage of CSR initiatives well beyond the boundaries of individual firms, to act "as a multiplier effect for social responsibility" (Preuss, 2000, p. 143). It seems that the CSR approach falls short of reflecting the social cohesion that various actors, including residents as end customers of supply chain services, can express and, even more so, the desire for the well-being of local communities. In one of the earliest definitions of CSR, Bowen (1953, p. 6) equated it with a commitment "to pursue those policies, to make those decisions or to follow those lines of actions that are desirable in terms of the objectives and values of our society", thereby appealing to the need to cater to communities' needs.

Empowering Communities for Social Sustainability: A Community-Based Approach

As alluded to earlier, SCM is marked by the intricate interplay of multiple actors, each with their own set of goals and ways of managing. These diverging goals engender hindrances in achieving a shared understanding of social responsibility among all actors involved. This raises a thorny question of whether and eventually how these differences can be resolved and, if possible, how they can be integrated into efforts toward social responsibility and sustainability. Against this background, the so-called community-based approach proposed by Dempsey et al. (2011) may serve as an appropriate framework. Specifically tailored for urban settings, this approach is rooted in the European Union's notion of "sustainable communities", which are defined as places

> *where people want to live and work, now and in the future. They meet the diverse needs of existing and future residents, are sensitive to their environment, and contribute to a high quality of life. They are safe and inclusive, well planned, built and run, and offer equality of opportunity and good services for all.*
>
> *(ibid, p. 290)*

As evident from this excerpt, this community-based approach valorizes social interactions among community members, promotes social inclusion, entails the equitable distribution of opportunities and resources between all actors enmeshed, and recognizes the vital role of local collective institutions, whether formal or informal, in advancing sustainable practices. Equally important, it posits that honing sustainability is not the sole responsibility of business corporations but necessitates the collaborative efforts of all community members. We argue that the community-based approach, which has previously been used in an urban context, can also serve as a versatile strategy for maintaining social coherence and integrity in SCM practice. By elevating the importance of social responsibility principles among all actors involved, we can hopefully advance the literature on how these principles evolve in existing SCM practices (Tsvetkova, 2020a), ultimately boosting the overall understanding of social sustainability in SCM.

In light of the preceding discussion, a fundamental question arises regarding what it truly means to be socially responsible, especially in a supply chain context. Previous research (Maignan and Ferrell, 2001; David et al., 2005) has asserted that social responsibility requires adherence not only to economic imperatives but also to moral, ethical, and social standards that are partly determined by actor demands. Yawar and Seuring (2017) have proposed communication and compliance strategies as responsible supply chain activities. However, determining what constitutes social issues remains the principal challenge. This is due to the fact that social issues vary drastically among diverse stakeholders, are constantly evolving, and are largely contingent on the circumstances in which a firm operates (Klassen and Vereecke, 2012; Hoejmose et al., 2014). As a consequence of this diversity and fluidity, a mosaic of partly discordant perspectives on reality ensues (Davidson, 2009). Furthermore, the integrative and collaborative nature of SCM may have a singular impact on socially responsible activities that may not be reflected in conventional private sector practices (Spence and Bourlakis, 2009), particularly with regard to societal needs (Tsvetkova, 2020a). The move toward supply chain responsibility necessitates that all members strive to achieve social and environmental benefits beyond economic gains and appreciate the divergent ethical approaches of various organizational forms within the supply chain (De Vlieger, 2006; Spence and Bourlakis, 2009).

Rethinking Social Sustainability through Social Responsiveness?

As an intricate and multifaceted concept, social sustainability is recognized as both a crucial task and a very big challenge. It entails grappling with a wide array of pressing social issues that impact individuals, organizations, and local communities. Despite the burgeoning efforts to tackle these issues, a comprehensive understanding of social sustainability is still lacking. As previously alluded to, one potentially viable strategy for advancing social sustainability is to adopt a community-based approach that entails working closely with local communities. To further amplify the impact of this approach, we suggest enriching it with two closely intertwined concepts – social responsibility and social responsiveness. The former refers to an individual or entity's moral obligation and duty to society (Waddock, 2004), while the latter involves responding to societal needs and key actor demands by taking explicit and proactive actions (Crampton and Patten, 2008). Coalescing these two concepts under the umbrella of a community-based approach may enable individuals and groups of people to benefit the development of local communities by elevating the standard of living and enhancing the environment of those in their vicinity. Furthermore, this approach has the potential to foster collaboration and trust among local communities, organizations, and institutions through social integrity and coherence. Consequently, such efforts may result in more equitable and sustainable outcomes.

It is our unwavering belief that the proposed approach has potential applications within SCM practice by acknowledging and addressing human-centered issues. This belief stems primarily from the approach's view of SCM as a series of consistent patterns of human actions that perform ongoing operations, produce outcomes, and envision new forms of collaboration among supply chain members (Tsvetkova, 2021). It is worth noting that, despite the prominence of social responsibility in SCM literature through the CSR approach, social responsiveness has not garnered the same level of attention thus far (Tsvetkova, 2021). Therefore, more effort is required to give social responsiveness the prominence it deserves in the SCM domain. With this argument in mind, one of this book's endeavors is to highlight social responsiveness in the context of the Arctic, to which we now turn our attention.

The Arctic as a Research Context

The Arctic is a vast region that is highly abundant in mineral resources, but its sparsely populated areas lack essential infrastructure on a widespread scale (Høifødt et al., 1995). Until the 20th century, the Arctic was considered a remote and inhospitable region, with limited economic prospects for harnessing its natural resources. However, the region is presently experiencing noteworthy transformations, largely attributed to the observable and contentious effects of climate change. With the advent of industrial development, the role of supply chains has undoubtedly become important in driving economic progress in far-flung Arctic areas. These supply chains are instrumental in distributing cargo to the market, catering to industrial needs, and ensuring the survival of not only large manufacturers but also remote communities, encompassing local residents and Indigenous Peoples. Furthermore, the exponential growth of commercial activities in the Arctic, notably involving oil and gas exploration, mineral extraction, and shipping, has led to the expansion of the region's economy and heightened demand for streamlined and resilient supply chain services.

The distribution of cargo in the Arctic region is significantly impeded by its harsh natural conditions. The traditional land-based transportation methods such as railways and roads are often impractical, making maritime transportation a vital means of cargo distribution. Consequently, SCM practices are predominantly focused on the operations related to maritime transportation of goods. The Arctic maritime routes, such as the Northern Sea Route, the Northwest Passage, and other critical channels, are rightfully considered crucial connecting arteries for the social, economic, and cultural advancement of remote northern regions and global trade (Høifødt et al., 1995; Hong, 2012; Tsvetkova, 2020b). In recent years, there has been a burgeoning potential for maritime activities along the Northern Sea Route, which incorporates offshore petroleum resource extraction and intra-regional transportation of extracted minerals and onshore energy resources, as well as international transit, although it has remained limited in volume.

However, the scope of SCM advances beyond the maritime domain, comprising the complex land-based logistics challenges and air services of the Arctic's rugged and remote hinterlands. During the summer months, certain settlements become entirely cut off from neighboring villages and urban centers, making the delivery of critical supplies, including food, an insurmountable challenge. These areas can only be reached via temporary winter roads or "zimnik" originating from the closest port and town, underscoring the logistics complexities involved in the Arctic region's SCM practices. Additionally, heavy-lift freight resupply to isolated coastal settlements is often seasonal, with yearly requirements only able to be provided by ship in the summer navigation (Brooks and Frost, 2012). These challenges are compounded by numerous stressful situations that companies and professionals working in the Arctic confront while carrying out their daily supply chain operations. While not exhaustive, the roster of stressors encompasses navigating through ice floes for most of the year, harsh natural Arctic conditions, the need for icebreaker assistance, lack of technology, time constraints, and long distances (Tsvetkova, 2020a, Tsvetkova, 2021). These factors make the supply chains in this area susceptible to delays and disruptions, which can have formidable societal impacts on local communities. To mitigate these risks, specific supply chain strategies are needed that not only address industrial activities but also recognize the needs and well-being of local communities (Tsvetkova, 2016).

As previously mentioned, the Arctic region is currently experiencing swift and unprecedented changes, primarily due to the expansion of existing industrial activities and the emergence of new ones, along with the tangible effects of climate change. These changes give rise to dramatic societal impacts, impinging upon social needs and resulting in far-reaching repercussions for local communities and Indigenous Peoples. Remote settlements and traditional lifestyles – such as the nomadic lifestyle of reindeer herders – are especially vulnerable to these societal impacts, which affect their quality of life and ability to maintain their cultural heritage. This is further aggravated by the susceptibility of the Arctic environment to the adverse effects of business activities and high-risk technological projects that are backed by political ambitions. In such a fragile environment, encroachments and accidents can have lasting consequences and impose significant financial burdens. Last, but not least, contending priorities, fueled by the pursuit of economic growth and resource extraction, often spark tensions between business interests and political ambitions that affect the needs and well-being of local communities.

Echoing the mounting interest in the Arctic, research on the region has gained prominence (Timoshenko and Mineev, 2021). Much of the conducted research is centered around exploring the newfound economic opportunities that have ensued due to climate change and globalization across various sectors (Stephen, 2018). Of particular interest is how these alterations inflict environmental impacts and risks that challenge long-standing subsistence-based lifestyles, leading to fierce competition between traditional ways of life and new economic activities (Moerlein and Carothers, 2012; Hossain et al., 2014; Torrecuadrada Garcia-Lozano and Egea, 2017). Although economic activity in the Arctic is on an upward trajectory, there is a profound lack of opportunities for local residents and Indigenous Peoples to participate in, as evidenced by a number of scholars (Bell, 2011; Hendriksen et al., 2014; Saxinger, 2016). Several factors contribute to this situation, but the primary one is a shortage of skilled labor and the required qualifications to support the nascent industries that have emerged in the region. As a result, social cohesion within Arctic communities is on the decline. Against this background, supply chains that prioritize socially responsible practices have greater potential to promote the authentic needs and values of local communities in the Arctic, thereby enhancing social sustainability (Tsvetkova, 2020a).

The concept of “sustainable development” has gained momentum in the Arctic region, yet there is still a gigantic gap in the understanding of how supply chain operations intersect with social sustainability in this unique milieu. While some strides have been made in infusing social responsibility into SCM practices, a pressing need remains for comprehensive research to tackle the complex challenges faced by Arctic Indigenous communities. This book seeks to bridge this knowledge gap and, ultimately, contribute to the truly sustainable development of the Arctic.

Outline of the Anthology

We are delighted to offer you in this volume a meticulously curated collection of scholarly works that rekindle the fascination with the social dimension of sustainability in Arctic supply chain operations. By showcasing real-life case studies of supply chain operations, all in different industries and located in various Arctic regions, we seek to delve into the intricate interplay between business interests, political ambitions, and social issues. Comprising chapters by contributors hailing from Norway, Finland, Russia, Iceland, Greenland (Denmark), the United States, Canada, Alaska (the United States), Turkiye, and Japan, this edited volume brings to your attention a compelling tapestry of experiences and candid views on the complexities of implementing socially sustainable and responsible policies in Arctic supply chains. With the breadth of perspectives, this volume proffers 11 thought-provoking and insightful contributions, arranged in a logical and coherent sequence that allows readers to follow a clear thread of argumentation.

Serving as a point of departure and scanning the extant literature over the past century, the next thematic chapter, penned by Amulya Gurtu, Hamid Afshari, and Mohamad Y. Jaber (Chapter 2), seeks to synthesize state-of-the-art knowledge on supply chain activities and transportation in the Arctic and identify research gaps. In so doing, the chapter shines a light on opportunities and challenges that exist in the SCM field and comes up with effective ways to address them. Building on that, a research agenda for future work and direction in the field is set up. The findings indicate that the focus has shifted drastically from supply, in the early 1980s, to transportation activities and, more recently, to service delivery. Next, a need to develop regulatory and investments frameworks is voiced, to enhance navigation safety without harming the environment. Last but not least, the authors persistently urge the research community to embrace social factors in managing supply chains, along with economic, environmental, and governance issues. As exemplified in the chapter, there is a compelling imperative to address the social aspects of developing northern ports and their impact on the Indigenous Peoples and local residents.

Chapter 3, by Antonina Tsvetkova, Alexey Fadeev, and Natalia Anikeeva, aims to delve deeper into how SCM practices in the extreme environments of the Arctic have been continuously (re)shaped by the complex and evolving interactions between oil and gas businesses and Indigenous reindeer herders. Abundant data from 18 interviews, personal observations, and archival materials are interpreted through the ecosystem approach. This in-depth study eloquently demonstrates that a paradigmatic shift in the conceptual focus of SCM – from networks toward ecosystems – contributes to value-creation and value-capture for both oil and gas project activities and local communities. The synergy between value-creation and value-capture is achieved by ensuring social responsibility practices under limited doing-business conditions and in extreme environments. The chapter posits that integration between key actors – big businesses, politicians, and Indigenous Peoples – into ecosystems may result in unexpected social consequences, thanks to the complex interplay of collective interdependencies of co-existence.

Taking a close look at the "Arctic Corridor" railway project between Finnish Lapland and the coast of the Barents Sea, Juha Saunavaara, Ritva Kylli, and Aileen A. Espíritu (Chapter 4) offer a compelling account of how the development of new transportation routes and SCM practices in the Arctic triggers social contradictions at the local, regional, and national levels. Relying on the institutional logics approach as a lucrative theoretical lens and multiple data-gathering techniques, the chapter unravels the collision of the conflicting views and opposing interests of the key stakeholders involved. A clash of the main competing institutional logics is brought to light in terms of economic benefits, the protection of the fragile Arctic environment, and the rights of the Sámi and their traditional ways of life. While proponents of the railway construction primarily emphasize its economic benefits, a considerable lack of socially responsible and sustainable practices has placed a question mark over the entire project's implementation.

Flagging the importance of the social dimension of sustainability within the tourism industry, Guðrún Helgadóttir, Doris Effah-Kesse, Eyrún Jenný Bjarnadóttir, Georgette Leah Burns, and Guðrún Þóra Gunnarsdóttir

(Chapter 5) aim to examine resident perceptions of the tourism supply chain in Iceland, where rapid pre-COVID growth led to wide-ranging discussions on over-tourism. Leveraging data from a longitudinal study based on surveys and interviews, the chapter provides an in-depth understanding of why it is vital to embrace resident perceptions and social sustainability within the SCM domain. The authors assert that residents possess profound knowledge of certain parts of the supply chain – such as local infrastructure and destination safety – and are deeply concerned about them. However, their perceptions often diverge sharply from those of other stakeholders, mainly tourism companies, and are even disregarded. The need to develop socially sustainable practices within SCM is underlined, as this has far-reaching implications for local communities. In particular, it is contended by the authors that the government can play a critical intermediary role in bringing together different actors, including residents and businesses.

In their anthropological study of social responsiveness initiatives in SCM, Antonina Tsvetkova and Marina Nenasheva (Chapter 6) offer thorough reflections on how local residents in 13 isolated northern islands and coastal settlements of the White Sea respond to social needs. Drawing upon 50 semi-structured and in-depth interviews with local residents and authorities, the chapter traces the development of socially responsible food supply chains in most coastal communities in the Russian Arctic. The findings showcase that economic concerns and the need to adapt and maintain mobility result in evolving social responsiveness, squarely manifested in residents' explicit and proactive actions without support from the local authorities. The active mediating role of commitment and trust in amalgamating SCM practices and social exchange is elucidated. The authors conclude that social issues and cultural attributes can act as both a challenge and a source of innovation and inspiration within existing SCM practices. The chapter adds to the current body of knowledge by highlighting how social responsibility principles and responsiveness enable supply chains to cater to the needs of local communities.

Taking a deep, critical dive into the Greenlandic fishing industry, Javier L. Arnaut and Rikke Østergaard (Chapter 7) strive to uncover how key stakeholders envision environmental, economic, and social adaptation of fisheries and their overall supply chain operations. Based on a series of semi-structured interviews with the main actors involved, the chapter provides evidence of some progress in strengthening the industry's capacity to adapt to climate change and the environmental impact on fisheries. As argued by the authors, stringent and conservative quotas are a "rush" to environmental sustainability, which, however, shunts social aspects – such as small-scale fishers and the cultural identity of coastal communities – to the sidelines. The chapter concludes that trade-offs among key actors notwithstanding, the maritime operations of Greenland's fisheries are moving unduly slowly toward sustainability.

As a global seafood supply chain governance mechanism, the Marine Stewardship Council's (MSC) standards are the primary focus of an in-depth study by Antonina Tsvetkova, Svetlana Tulaeva, and Igor Khodachek (Chapter 8). Shining a spotlight on the global–local nexus, the chapter deliberates on how MSC standards have enabled sustainable local fishery practices in Arctic waters. Preached by institutional theorists, a "following standards" framework serves as a theoretical backdrop. The empirical evidence is based on nine semi-structured interviews and archival data. The findings reveal that the multiplicity of governance arrangements, which have ensued as a result of exposure to global standards and the local response to them, have provided a stimulus for nascent integration mechanisms. Instead of exerting coercive pressures on fishermen, MSC standards have displayed such symbolic power locally that fishermen have found it beneficial to adopt a more socially responsible attitude toward fishing activities in the Russian Barents Sea. The most notable conclusion of the study is that a hybrid form of state and private sustainability governance institutions and arrangements has been gradually formed, contributing to synchronization between the actors within the fishing and supply practice and their sustainability commitment.

In her study of the healthcare delivery system to mitigate risks associated with remote childbirth for rural Alaska Native maternal patients, Lisa Schwarzburg (Chapter 9) seeks to explore how this social transport policy figures in the sustainable provision of safe maternity services. The chapter shines a light on how the notion of "social responsibility" has morphed from its onset to the present and questions sustainability over time. Content analysis is used as a versatile tool to gauge findings from ethnographic interviews of impacted Alaska Native mothers. From an anthropological perspective, the findings reveal the unique social and political driving forces involved in the supply and value chain networks of indigenous healthcare in the Arctic Alaskan surface. The chapter also provides a more sustainable, equitable Arctic SCM framework, with benchmarks that supplement the long-term efficiency of perinatal healthcare service supply in remote Arctic areas with more inclusive measures. By revealing overlooked socio-cultural elements in delivering healthcare, the author persistently and disingenuously calls for the inclusion of social responsibility in making supply chains truly sustainable.

Antonina Tsvetkova and Alexandra Middleton (Chapter 10) are inspired by the idea of contributing to a heated debate on the feasibility of adopting costly, advertiser-rich technologies and practices geared toward curbing the adverse effects of CO_2 and driving climate-resilient carbon cycle strategies. Leveraging empirical evidence from the realization of a carbon capture, transport, and storage project on the Norwegian seabed, the chapter ponders how SCM facilitates the implementation of global sustainable and climate strategies in the North Sea, with subsequent application in the Arctic Ocean. The authors caution that, despite the lack of a legal framework, political ambitions and forces make such projects politically feasible, but this frequently runs counter to the basic tenets of sustainable development. Against the backdrop of burgeoning concerns about debilitative environmental and social impacts on coastal communities and Indigenous Peoples, the chapter underscores the importance of social values and attitudes.

Applying a comparative perspective, the chapter by Frédéric Lasserre (Chapter 11) provides in-depth insights into Arctic shipping along the Canadian and Russian coasts, their constraints, challenges, and dimensions, including in terms of logistics operations and sustainability goals. Particular attention is paid to juxtaposing traffic along the Northwest Passage and the Northern Sea Route over time. The chapter is equipped with a wide panoply of data sources, encompassing various datasets and interviews. A host of challenges that Arctic shipping faces are presented by the author, ranging from natural conditions to high costs to structural constraints. To surmount them, transport companies in both the Canadian and Russian Arctic are forced to adapt to these peculiar conditions and become acquainted with nascent, unique ways of doing business. The chapter provides compelling evidence that, notwithstanding the enormous challenges, there is a distinct trend toward the increasingly confident involvement of overseas-based shipping companies in the Arctic, indicating that the globalization of economic activity in the region is accelerating. Like other contributors to the volume, the author is in favor of creating meaningful social sustainability orientation in the Arctic – supporting the availability of more affordable consumer goods and construction materials to address the housing crisis and the development of a reliable two-way service that could support burgeoning small-scale manufacturing with shipping to southern markets, in the frame of low-impact corridors to protect the environment.

Centering around the temporal and spatial variations in shipping in the Russian Arctic, the penultimate chapter, by Ebru Caymaz, Barbaros Y. Buyuksagnak, and Burcu Ozsoy (Chapter 12), endeavors to elucidate the nexus between supply chain resilience and sustainability. It is built on a case study approach that is further enriched by archival data. The findings demonstrate that existing projects unequivocally put the business function on a pedestal, as if that were the chief – if not the sole – dimension of sustainability, thereby deprioritizing the environmental and social aspects of the concept. The authors identify several social factors that are often overlooked, including the insufficient qualification of crew members on international vessels, numerous human navigation failures, and Arctic peoples and communities, on whom supply chain operations have the most direct impact. The chapter advocates for the research community to calibrate an adaptive and inclusive governance model that can effectively bolster resilience measures and ensure the sustainability of supply chain operations.

A critical reflection on the key findings expounded in the preceding thematic chapters of the present volume is brought to light in the epilogue (Chapter 13). By revisiting the themes and questions originally laid out in this introductory chapter, it illuminates a handful of lessons learned and future directions surrounding the pursuit of social sustainability in Arctic supply chain operations and potentially beyond.

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2 Managing Supply Chains and Transportation in the Arctic – Challenges and Opportunities

A Literature Review and Research Directions

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Introduction

This chapter synthesizes current knowledge of supply chain (SC) activities in the Arctic, identifies research gaps on supply chain management (SCM) in the Arctic, and develops a research agenda. In this chapter, we considered all activities from the extraction of raw materials through delivery of the finished products to consumers and safe disposal of goods at the end of their useful life as parts of SCM. The Arctic has been an area of exploration for more than 100 years, but with an accelerated pace in the last two decades. While global warming has many potential adverse effects on the environment and societies, it has a few potentially positive effects. One such benefit is the commercial access to the Arctic routes. As a result, the distance and travel time between countries in the Eastern and Western hemispheres will reduce.

Lasserre and Pelletier (2011) provided an overview of the opening up of sea routes in the Arctic region and its effects. As per the study, the Arctic route will not be available in the 21st century. The authors based their conclusion on investigating the intentions of 98 shipping companies. Some authors have contrary views about the timeline of ship movements in this region (Lackenbauer and Lajeunesse, 2014, Lajeunesse, 2012). Later, Lasserre (2014b) provided

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options for traveling via the Arctic route and their economic viability because the studies in the 1990s did not show economic viability due to the cost of breaking the ice. Other studies, such as the Arctic Report Card, show that the temperature has been rising, and ice has been melting in the last decade faster than ever (Richter-Menge et al., 2019). Huang et al. (2017) evaluated the consequences of climate change at the pace of melting ice and developed scenarios to predict when the Arctic ice caps will melt. This scenario creates a possibility of the movement of ships in the Arctic region sooner than previously thought. It will adversely affect marine life and native communities in that region when that happens.

It is essential to ensure the environmental and social sustainability of the Arctic region. In this regard, the role of governance becomes pivotal in ensuring that all countries in that region contribute to its sustainability. The Arctic Council was formed with "the role of stewards of the region" and the participating eight nations signed the agreement in 1996 called the Ottawa Declaration (Arctic Council, 1996). Eight countries – Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the United States – constitute the Arctic Council (Arctic Council, 2020). China is not an Arctic country. However, it has shown a deep interest in this region (Lanteigne, 2017, Tobin, 2018, Agnihotri, 2013). This interest may be due to cost savings in the movement of raw materials and finished goods between China and its major international markets such as Europe and North America. Some authors feel that it will likely cause a backlash from the West (Lasserre et al., 2015). Although a deeper discussion on this issue is not in the scope of this chapter, however, it is worth mentioning that international regulations, conventions, and policy could play a greater role in conflict-free operations of the Arctic transportation and SC activities.

An SC includes all parties collaborating, directly or indirectly, to fulfill a customer order (Chopra, 2019). Based on this definition, each product needs a particular SC. Each SC could involve a variety of stages such as suppliers, manufacturers, distributors, retailers, and customers. Several interests and activities have been reported in the Arctic, including oil and gas exploration, fishing, maritime operations, tourism, and search and rescue. Dividing SC activities in the Arctic based on their stages enables us to review and investigate such activities comprehensively, as presented in Figure 2.1.

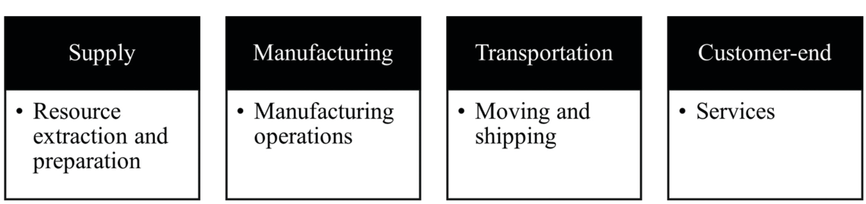

Figure 2.1 The schematic view of SC stages in the Arctic (*Source*: the authors' elaboration).

An SCM perspective on the Arctic activities helps investigate research gaps and build a research agenda based on the challenges and opportunities in each stage of the SC. Other benefits of such analysis are exploring the balance between stages, the share of local communities in SC activities, and the potential to establish a reverse flow of sustainable SCs in the Arctic. This chapter's main contribution is to provide a long-term view of the region and develop a research agenda to work on SCM, including transportation in the Arctic. The next section provides an overview of the current state of research on SCs in the Arctic.

The remainder of the chapter is organized as follows. The next section discusses the current state of research and explains the methodology deployed in developing this chapter, followed by a section analyzing SC activities in the Arctic. The latter section is followed by one that provides an overview and synthesis of SCM and transportation activities in the Arctic region. The section before the last presents a SWOT analysis. The last section presents the implications of using the Arctic route for trade, as well as discusses some limitations and future research agenda.

Current State of Research

Data Sampling and Selection Criteria

The research began with the definition of the research objective, scope, boundaries, and search words/terms. Several researchers have used this methodology to identify the literature for review in various fields (Gurtu, 2019; Gurtu et al., 2015b; Hamed, 2020; Seuring and Müller, 2008; Afshari et al., 2022). Figure 2.2 shows the process of identifying the relevant articles through various search terms using the constraints described below. The research objectives are as follows:

- Identifying the focus and trends in SCM in the Arctic region.
- Investigating the themes of research based on SC stages as discussed in the introduction.
- Synthesizing existing knowledge, challenges, and opportunities based on SC stages.
- Proposing future research agenda through gap analysis and knowledge synthesis.

The review started by limiting the search to the scope of this chapter, which includes specific terms in the title, keywords, and abstract in peer-reviewed academic journal articles in English published from 1900 until 2021 in the EBSCO premium database. EBSCO database has been chosen because it is a comprehensive multidisciplinary database that contains peer-reviewed, non-open access journals and open access journals with no embargo indexed in Web of Science or Scopus. An example of search syntax is "TI (arctic AND

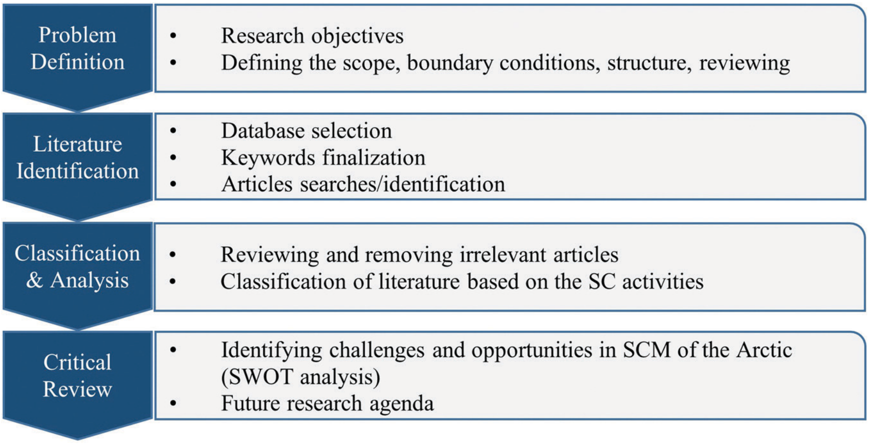

Figure 2.2 Literature search and distillation process (*Source*: the authors' elaboration).

transport) OR AB (arctic AND transport) OR KW (arctic AND transport)" for Peer Reviewed; Source Types: Academic Journals; Academic Published Date: 19000101-20211231; Language: English.

Each search iteration also looked for the combination of terms in the title, keywords, or abstract. Various minor variations in search terms such as "Oil & Gas" and "Oil and Gas" or "Fishing," "Fishery," and "Fisheries" were combined into one. Figure 2.1 shows different search results for combining terms to represent SCM categories better. For example, Fisheries and Oil & Gas represent the first block of Figure 2.1, that is, Resource Extraction and Preparation.

The abstract was reviewed to validate the suitability of the paper. Most papers on fishing were related to biosciences and filtered out from further analyses. Table 2.1 summarizes the number of papers from the initial search and after reviews of abstracts. The totals may not match because some papers may fall under two (or more) categories. Two researchers reviewed these papers for suitability and then compared them to ensure consistency. The papers appearing in the search for the SCM in the Arctic region are too few and belong to the Transportation stage.

Trends and Statistics

The first paper on the Arctic was on the lives of Polar Eskimos who lived in Greenland (Ekblaw, 1927). Before the 1980s, research focused on biodiversity, animal behavior, ecology in the Arctic, temperature studies, etc. Table 2.1 also shows the number of papers appearing after 1980 and the SCM categories considered. These were published from the 1980s onward. This subset of data

Table 2.1 Papers with different combinations of terms

Stage of SCM	*Terms*	*Papers from search*	*Papers after review*
Supply: Resource extraction and preparation		2005	197 (18.64%)
	Fishery	1,575	64 (6.05%)
	Oil and Gas	276	79 (7.47%)
	Mining	194	55 (5.2%)
Manufacturing: Manufacturing operations		468	33 (3.12%)
	Manufacturing (19)	19	3 (0.28%)
	Operations (453)	453	30 (2.84%)
Transportation: Moving and shipping		2,485	662 (62.63%)
	Transportation (2,049)	2049	398 (37.65%)
	Shipping (303)	303	306 (28.95%)
	Logistics (144)	144	50 (4.73%)
	Reverse Logistics (0)	0	0 (0%)
Customer-end: Services		225	164 (15.52%)
	Tourism (122)	122	55 (5.2%)
	Sustainability (112)	112	115 (10.88%)
Supply Chain Management		4	4 (0.38%)
Total		**4,779**	**1057 (100%)**

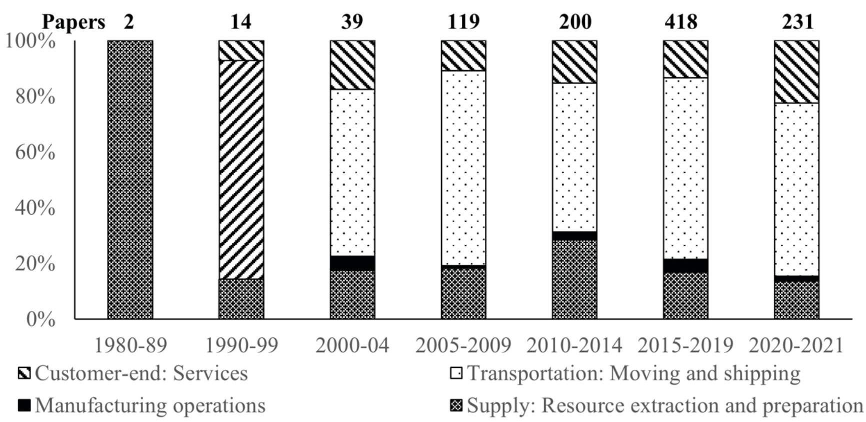

Figure 2.3 Annual number of papers published in different areas of SCM in the Arctic (*Source*: the authors' elaboration).

was used for further analysis. Figure 2.3 illustrates the change in the focus of research in the Arctic region in the last half of the century.

Interest in Arctic research picked up pace in 2014 (Table 2.2). It is also evident from Table 2.1 that the research on SCs in the Arctic started with a focus on transportation/shipping, that is, the movement of goods through the Arctic.

Most manufacturing papers are on the scientific study of the effect of manufacturing in different atmospheric conditions (e.g., low temperatures). The most relevant ones on SCM are focused on transportation and service. Two subsequent sections of this chapter explore these two areas from 2000 to 2021 in further detail. Three hundred thirty-seven journals published these papers, averaging about three per journal title. The majority of journals (56.1% or 189) published one article each (Table 2.3). Only six journals published 20 or more papers (Table 2.4), while they account for about a fifth of all the publications.

However, none of them is ABDC (Australian Business Deans Council), CABS (Chartered Association of Business Schools), or Academic Journal Guide (AJG) listed journal. The recent research has started appearing in ABDC, CABS, or AJG-listed journals, but their numbers are very small. Nonetheless, the listed journals (in alphabetical order) are *Alberta Law Review, Ecological Economics, Energy Journal, Europe-Asia Studies, Food Policy, Journal of Cleaner Production, Journal of Environmental Management, Journal of Sustainable Tourism, Journal of Transport Geography, Marine Resource Economics, Reliability Engineering & System Safety, Safety Science, Social Indicators Research, Tourism Geographies, Transport Policy, Transport Reviews, Tulane Maritime Law Journal, the Vanderbilt Journal of Transnational Law,* and *World Policy Journal.*

Another added value of this chapter is the strength, weakness, opportunity, and threat (SWOT) analysis. The goal of performing SWOT analysis is

Table 2.2 Annual number of papers on supply chains in the Arctic

	1987	*1991*	*1995*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
Fishing	–	–	–	–	1	1	–	–	1	1	–	2
Oil and Gas	2	–	–	1	–	–	1	–	1	–	1	1
Mining	–	–	–	–	–	–	–	–	1	1	1	–
Supply subtotal	*2*	–	–	*1*	*1*	*1*	*1*	–	*3*	*2*	*2*	*3*
Manufacturing	–	–	–	–	–	–	–	–	–	–	–	–
Operations	–	–	–	–	–	–	–	–	1	1	–	–
Manufacturing subtotal	–	–	–	–	–	–	–	–	*1*	*1*	–	–
Transport	–	1	2	4	3	3	3	4	4	8	11	9
Shipping	–	–	–	–	–	–	–	1	1	–	1	–
Logistics	–	–	–	–	1	–	–	–	–	1	–	1
Reverse logistics	–	–	–	–	–	–	–	–	–	–	–	–
Transport subtotal	–	*1*	*2*	*4*	*4*	*3*	*3*	*4*	*5*	*9*	*12*	*10*
Tourism	–	–	–	–	–	–	–	–	–	–	1	–
Sustainability	–	–	1	–	–	1	–	–	1	5	–	6
Service subtotal	–	–	*1*	–	–	*1*	–	–	*1*	*5*	*1*	*6*
Total	**2**	**1**	**3**	**5**	**5**	**5**	**4**	**4**	**10**	**17**	**15**	**19**

to investigate the internal and external factors contributing to the expansion of SC activities in the Arctic. SWOT will also help propose a future research agenda, as shown in the following sections.

Literature on Existing SCM Activities in the Arctic

SC activities in the Arctic have been analyzed according to the stages shown in Figure 2.1. So, this section follows the discussion by stage in four subsections. Such division also enables us to discuss challenges and opportunities within each stage. A set of examples are provided to present current activities in the Arctic. The analysis focused primarily on forward SCs in the Arctic because all the papers we found were on forward flow supply chains. It is worth noting that the extant literature has not addressed any reverse logistics, recycling, and remanufacturing activities in the Arctic (Table 2.1). These are important areas and research gaps in these areas that present opportunities for future research. In addition, there is an imbalance in the research focus on different stages of SC activities in the Arctic (Table 2.1). For example, research on transportation, that is, movement of goods (primarily), is the most studied area in the Arctic and accounts for over 60% of all research on SCs in the Arctic (Table 2.1).

Table 2.2 (Continued)

2007	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*Total*
4	1	3	4	7	2	6	6	1	7	2	5	2	3	5	64
1	2	4	2	4	4	4	9	4	9	3	8	8	5	5	79
2	–	–	1	3	3	2	2	2	4	1	5	12	5	10	55
7	*3*	*7*	*7*	*14*	*9*	*11*	*17*	*7*	*20*	*6*	*18*	*22*	*13*	*20*	*197*
–	–	–	–	–	1	–	–	–	1	–	–	1	–	–	3
–	–	1	–	–	–	3	2	3	4	2	7	2	3	1	30
–	*–*	*1*	*–*	*–*	*1*	*3*	*2*	*3*	*5*	*2*	*7*	*3*	*3*	*1*	*33*
8	16	13	14	9	11	10	14	21	29	24	32	55	39	51	399
5	4	14	6	11	13	13	16	24	22	21	29	40	39	46	306
1	2	–	–	2	1	–	–	4	4	3	5	9	10	6	50
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
14	*22*	*26*	*19*	*20*	*24*	*20*	*26*	*47*	*46*	*47*	*56*	*88*	*69*	*81*	*663*
1	1	–	2	–	1	–	4	1	11	–	9	4	10	10	55
–	3	1	2	7	4	5	6	3	6	7	6	12	19	20	115
1	*4*	*1*	*4*	*7*	*5*	*5*	*10*	*4*	*17*	*7*	*14*	*16*	*27*	*27*	*164*
22	**29**	**35**	**30**	**41**	**39**	**39**	**55**	**61**	**88**	**62**	**95**	**129**	**112**	**129**	**1023**

Table 2.3 Journal and papers published combination

Paper published in a journal (a)	*No. of journals (b)*	*Total papers (c=a.b)*	*% Journals* $\left(\frac{b}{\sum b}\right)$	*% Papers* $\left(\frac{c}{\sum c}\right)$
1	189	189	56.1	18.5
2	54	108	16.0	10.6
3	27	81	8.0	7.9
4	15	60	4.5	5.9
5	8	40	2.4	3.9
6	7	42	2.1	4.1
7	6	42	1.8	4.1
8	5	40	1.5	3.9
9	6	54	1.8	5.3
10	4	40	1.1	3.9
11	4	44	1.1	4.3
12	1	12	0.3	1.2
13	1	13	0.3	1.3
14	1	14	0.3	1.4
16	2	32	0.6	3.1
19	1	19	0.3	1.9
20	1	20	0.3	2.0
23	1	23	0.3	2.2
27	1	27	0.3	2.6
30	1	30	0.3	2.9
43	1	43	0.3	4.2
50	1	50	0.3	4.8
Total	**337**	**1023**	**100**	**100**

Table 2.4 Top publishing journals

Name of Journals	*# of Papers*	*%*	*Cum %*
Arctic	50	5	5
Arctic & North	43	4	9
Environmental Science & Technology	30	3	12
Geophysical Research Abstracts	27	3	15
Geophysical Research Letters	23	2	17
Science of the Total Environment	20	2	19

Supply Activities

The Arctic region is rich in non-renewable underground resources such as oil and gas (Silber and Adams, 2019) and various metals and minerals (Brigham, 2017; Bajrektarevic, 2011; Afenyo et al., 2017; Bert, 2012). For example, oil and gas resources in Alaska and Russia's northern areas, and metal mining in Red Dog Zinc Mine in Alaska (Jorgenson, 2004), Norilsk Nickel mine in Siberia, Russia (Bert, 2012), Baffin Basin for iron ore in Canada (Heffernan, 2004), and Greenland for gold, zinc, and lead in Denmark (Bajrektarevic, 2011) have been reported. Extraction of oil and gas and mining minerals provide raw materials for manufacturing and other stages in downstream SCs. Factors such as weather conditions, risks, and exploration costs have limited resource extraction in the Arctic (Weidacher Hsiung, 2016). Long distances, remoteness, scarce transportation systems, and lack of infrastructure are other challenges in the Arctic (Tsvetkova and Gammelgaard, 2018).

The Arctic also contains valuable renewable resources that could benefit the food SCs. The fishery in the Arctic region is growing (Fossheim et al., 2015), and global warming has increased the commercial value of marine species (Fossheim et al., 2015; Misund et al., 2016). This has shifted the fishery industry to the Arctic seas (Watson and Haynie, 2018). Therefore, traditionally native/local and family-based businesses are transitioning toward or getting replaced by organizations that employ a non-native worker force. This non-native workforce rotates, that is, stays for a shorter duration in that region. It is worth noting that the distribution of fisheries across the Arctic region is unbalanced. It is primarily limited to the Norwegian, Bering, and Barents seas (Silber and Adams, 2019). In Greenland, for example, government investment has shifted fishing toward industrialization, making Greenland a major exporter of shrimp to Asia (Duhaime and Caron, 2006). In general, most of the resources are exported outside the Arctic.

Manufacturing Activities

The next block of activities in SCs is manufacturing (Figure 2.1). The Arctic has minimal manufacturing operations (Larsen and Petrov, 2020). This is due to the scarcity of infrastructure, a skilled workforce, and places to grow modern communities. However, there are a few exceptions. For example, Oulu, in Finland, is a rare location and is considered one of the most developed cities in the Arctic region. It is located 100 miles from the Arctic circle. It is a center for the IT and wireless industries. Many high-tech industries are located in this city (Heleniak, 2020).

Another example is areas developed under the Arctic Development Program of the Russian Federation (Borisov and Pochukaeva, 2017). As a result, some industries and regions have been reported to be more productive than others, such as steel manufacturing, machine-building, and petroleum refining. A challenge in manufacturing in Russia's Arctic region is a dependency on the domestic market; therefore, a lack of stability in the domestic market could significantly harm existing manufacturing clusters. In the North American Arctic (Canada and United States), food, beverage, and tobacco products are the major manufacturing activities. In recent years, attention to aerospace and air transportation industries for research and testing has increased (NAM, 2020; GC, 2017).

In general, several factors limit the expansion of manufacturing activities in the Arctic, such as distance to market, poor transport infrastructure, harsh weather, and increased cost of production/manufacturing if materials are supplied from outside the Arctic (Ratnayake, 2016). In addition, advanced technologies such as additive manufacturing (AM) potentially increase the manufacturing/production in the Arctic due to the available raw material and capability of AM for manufacturing products with limited equipment, space, and materials (Kozlova et al., 2020; Afshari et al., 2020), which is a good fit for the scattered population in the Arctic.

Transportation

The third block of activities in SCs is transportation (Figure 2.1). There are four possible routes in the Arctic region (Figure 2.4), which are the Arctic Bridge, the Northern Sea Route (NSR), the Northwest Passage (NWP), and the Transpolar Sea Route (TSR) (Rodrigue, 2020). However, the literature focuses on three routes: NSR, NWP, and TSR (Melia et al., 2016). TSR is unlikely to be available in the near future and can be considered a hypothetical route in the foreseeable future. Further development of these routes will affect the SC and logistics strategies and decision-making in SCM (Tsvetkova, 2021).

NSR will be the first widely available route as ice along the Russian Arctic coast is expected to be the first to melt. The NSR has been used at least since the 1930s, both for domestic needs and international and officially since the 1990s. However, this route is used for Russia's domestic cargoes and international commercial transportation as the primary route. This will reduce the distance between East Asia and Western Europe by about 40%, that is, from 21,000 km to 12,800 km. It will lead to a significantly shorter transit time. Two German vessels, *Beluga Fraternity* and *Beluga Foresight*, crossed NSE in 2009, making them the first to complete a commercial journey in NSR (Rodrigue, 2020). Since then, the traffic on NSR has significantly increased, reaching 34.9 million tons of cargo and 86 transit voyages by the end of 2021 (Humpert, 2022).

The NWP from Canada to the Arctic Ocean will likely be usable soon. This will reduce the distance between East Asia and Western Europe by about 45%, that is, from 24000 km to about 13,600 km. The TSR will pass through the central part of the Arctic. However, this is a hypothetical route, as it will not be available until the ice is completely melted (Rodrigue, 2020). NWP will be the least interesting Arctic route by mid-century, as the ice will not thaw there for some considerable time, making navigation not possible. However, it remains the most efficient route for shipping to and from the Eastern coast of North America (Stephenson and Smith, 2015). Therefore, countries would invest in methods and technologies to use NWP since it reduces the distance to/from North America by 30% over NSR.

Figure 2.4 Shipping routes in the Arctic region (*Source*: Rodrigue, 2020).

Other Arctic routes are not as active as NSR, especially TSR. However, studies show that all the Arctic routes will be navigable by mid-century (Stephenson and Smith, 2015). Unlike NSR and NWP, TSR will use the high seas. It means that all countries could access TSR without permission from any other. This ease of access is a tremendous advantage of TSR, which has made some countries (e.g., China) interested in exploration and investments in this route. Also, TSR would not limit the size of trespassing ships compared to NSR and NWP because of the central ocean bathymetry.

Each of these routes has its advantages and disadvantages. The increased attention to these routes has grown primarily due to their economic benefits. For example, several authors have studied the cost-efficiency of NSR relative to traditional maritime routes (Agnihotri, 2013; Bajrektarevic, 2011; Borgerson, 2008, Verny and Grigentin, 2009; Liu and Kronbak, 2010). Transportation companies could save about 40% in the distance traveled by using NSR instead of the Suez Canal Route (SCR) (Hill, 2007). Such savings could take different forms, e.g., rapid delivery of products, lower inventory levels, reduced fuel consumption, less resources such as ships and containers, and cheaper costs for end-user. Another advantage is that ships traveling at slower speeds can still reach their destination on time. Thus, reducing the risk of accidents in the Arctic (Humpert and Raspotnik, 2012).

Transporting people or goods through the Arctic could also enhance the current governance of international marine transportation. There is, therefore, an opportunity to establish a central agency that controls the speeds of ships, like the International Air Transport Association (IATA), which controls air traffic. Such regulations and supervision by a central agency would limit subjective approaches to the safety and security of the total Arctic route transportation. There is also another advantage of transporting through the Arctic compared to traditional routes, where the risk of piracy and capacity constraints are reported as two challenges that vessels face (Hill et al., 2015). Shipping organizations affected by sea piracy on traditional routes will benefit from using a safe Arctic route. An Arctic route will reduce the dependency on traditional ones that have reached their maximum capacity, while others will in several years. Countries and global companies benefiting from the Arctic route are likely to divert their future investments toward building and developing the infrastructure in that region. NSR is shorter, up to 60%, based on origin and destination. However, the reductions in transport costs and transit times depend on many factors, such as ice and wind conditions (Theocharis et al., 2019). For instance, a trip between Asia and Europe via NSR could save up to $500,000 compared to using SCR as the traditional route (Stephenson et al., 2013). According to a more recent study, NSR saves up to 40% of the cost in ice-free conditions compared to SCR. The savings decline in the range of 20% to 5%, depending on the severity of the ice (Pham and Miltiadis, 2019).

Customer-end

Customer-centric activities are the last block of SC activities (Figure 2.1). One of the prominent customer activities is tourism. The Arctic is a new tourism destination (Bert, 2012), and studies show that tourism activities in the Arctic are on the rise (Bert, 2012; Silber and Adams, 2019; Nilsen, 2018). Iceland has invested in the tourism industry through the Arctic portions of the Scandinavian countries. Such investment in road infrastructure has enabled linking the northern fringes with the rest of the European continent (Duhaime and Caron, 2006). Tourism increases jobs for the Arctic region and develops new tourism-related industries such as helicopter tours, hotels, and food services. Besides tourism, search and rescue services are expanding in the Arctic, enhancing the security of transportation activities in the region.

Analysis and Synthesis of Knowledge on Transportation and the Arctic Routes

A majority of the extant literature has focused on transportation in the Arctic (Table 2.1). Therefore, this section discusses issues related to transportation in greater detail. The following subsections also represent the most studied topics in Arctic transportation research.

Transportation and Sustainability

Sustainability, by far, is the most frequent topic in Arctic SCM and transportation research. Based on the triple-bottom-line definition, sustainability includes economic, social, and environmental pillars. The economic attractiveness of transportation through the Arctic was discussed in a section titled "Literature" on existing SCM activities in the Arctic. Social sustainability has not received attention in the literature until recently. It addresses critical issues such as welfare, security, health and safety, human rights, education and culture, and community development, to name a few (Afshari et al., 2022). Discussion of social issues in the Arctic is a live and ongoing field of research, as elaborated in the other chapters of this edited book. The third pillar is environmental sustainability, which is the focus of this section.

Ensuring minimal emissions and adverse effects on the environment is another uneasy challenge to address. The bulk of the cargoes (from the extraction of oil, gas, minerals, and other natural resources) passing through Arctic routes will potentially cause severe harm to the environment. Therefore, using those products will most probably pollute the Arctic environment. A system is needed to prevent polluting vessels on the Arctic routes (Guy and Lasserre, 2016). The challenge of transportation emissions is linking them to traffic. Silber and Adams (2019) studied traffic changes in the Arctic region between 2015 and 2017. Further, Stephenson et al. (2018) and Xing et al. (2014) expressed concerns about ships' emissions in the Arctic region due to the increased traffic.

Increased traffic of vessels in the Arctic could increase accident risks (Afenyo et al., 2016; Lee et al., 2015, United States Coast Guard, 2010), and an accident in the Arctic will affect environmental sustainability. The traffic in the Arctic has been increasing. Reducing harmful emissions from traffic remains an environmental challenge (Johansson et al., 2017). Such risks are negligible presently in the Arctic region, and the increased traffic would amplify them in that region. Products that are not safe on traditional routes will go through the Arctic route. The pollution also affects the communities there. Not to mention the risk of oil leakage from passing vessels or oil extraction sites/pipelines (Agnihotri, 2013). If such a thing happens, it could ruin small communities, ports, and related industries in the Arctic region, as witnessed in the Exxon Valdez oil spill (Ritchie, 2012). Also, Arctic transportation activities would impact both the environmental and social pillars.

Arctic transportation also affects that region's ecosystem. Ships that have passed through or explored the Arctic region have identified a noticeable number of non-indigenous species (Miller and Ruiz, 2014), which could impact the local species, fishes, and regional resources for local communities (Huntington et al., 2015). Bajrektarevic (2011) argued that increased traffic would impact flora and fauna due to the release of chemicals such as methane. The noise from the passing vessels and the exploration of oil, gas, and other natural resources could impact or disrupt the expected behavior of mammals and species under the sea (Fournet et al., 2018). Drake (2011) discussed the effect of melting arctic ice on the mixing of Pacific and Atlantic ecosystems due to transportation, which results in a change in marine ecology. These examples highlight the need to address sustainability issues in Arctic transportation and present an opportunity for future research.

Feasibility of Transportation through the Arctic

The literature has widely studied the feasibility of adopting transportation through the Arctic routes compared to traditional sea routes. The focus is mainly on the economic advantages of using the Arctic routes, and in most cases, the environmental impact of shipping is translated to cost functions. Table 2.5 presents a list of papers that evaluated the feasibility of shipping along the Arctic routes compared to SCR. The last column of the table summarizes such analysis results, including rejecting, favoring, and conditional favoring the Arctic routes to the traditional shipping routes.

Many interested parties have noticed that the feasibility of adopting the Arctic routes remains controversial. A potential source of conflicting results is using different measurement parameters and assumptions. Despite a lack of agreement on the feasibility of Arctic transportation, it is prudent to be prepared for different transportation scenarios through the Arctic routes.

Policy and Infrastructures

Geopolitical challenges and opportunities exist on three existing shipping routes in the Arctic region (Bajrektarevic, 2011; Depledge and Kennedy-Pipe, 2018). These researchers also reviewed many political and geopolitical issues that might arise in the future. The Arctic and the Antarctic regions may seem similar. However, they are different in many aspects, including the agreements and governing treaties (Bajrektarevic, 2011). An international treaty governs the Antarctic region with a legal framework under negotiation. The countries involved in the Arctic Council have different claims, different expectations of regulations, and different mutual interests with others (Guy and Lasserre, 2016; Hill et al., 2015, Krafft, 2009). For example, one of the

Table 2.5 A summary of the literature on the feasibility analysis of the Arctic routes

Author(s)/Year	*Methodology*	*Routes*				*Objective(s)*				*Arctic route preferred?*
		NSR	*NWP*	*SCR*	*Others*	*Eco*	*Env*	*Soc*	*Saf*	
Somanathan et al. (2009)	Simulation		✓		PCR	✓				C
Verny and Grigentin (2009)	Quantitative analysis	✓		✓	✓	✓				N
Lasserre (2014a)	Quantitative analysis	✓	✓	✓		✓				N
Chang et al. (2015)	Quantitative analysis	✓		✓		✓				Y
Pierre and Olivier (2015)	Quantitative analysis	✓		✓		✓	✓			N
Faury and Cariou (2016)	Quantitative analysis	✓		✓		✓				Y
Lindstad et al. (2016)	Quantitative analysis	✓				✓	✓			N/A
Wang et al. (2016)	Quantitative analysis	✓		✓		✓				Y
Zhang et al. (2016)	Statistical analysis	✓				✓				N/A
Lin and Chang (2018)	Quantitative analysis	✓		✓		✓				N
Wang et al. (2018)	Quantitative analysis	✓		✓		✓				N
Theocharis et al. (2019)	Quantitative analysis	✓		✓		✓	✓			C
Ding et al. (2020)	Quantitative analysis	✓		✓		✓	✓			Y
Faury et al. (2020)	Quantitative analysis	✓		✓		✓				C
Wang et al. (2020)	Quantitative analysis	✓		✓	✓	✓	✓			C
Xu and Yang (2020)	Quantitative analysis	✓				✓	✓			Y

Note: Y, Yes; N, No; C, Conditional; Eco, Economic; Env, Environmental; Soc, Social; Saf, Safety; PCR, Panama Channel Route.

Arctic countries, Canada, has plans to expand its polar patrol fleet to take care of the security and national territories (Hill et al., 2015). However, they do not seem sufficient to cover the whole Arctic area and the trade aspirations in that region. Other challenges in this category are sovereignty and cross-border conflict between the Arctic countries, such as the conflict between the United States and Canada in NWP (Agnihotri, 2013; Bajrektarevic, 2011) and between Russia and Norway in NSR (Østreng et al., 2013). Such conflicts could make a quick response to incidents and environmental disasters impossible. Thus, regulations and conventions are required to organize and control traffic and minimize potential risks (Tsvetkova, 2020a). Lasserre (2022) wrote about Canadian challenges and opportunities in Arctic transportation. The author considered that increasing traffic would cause many challenges and recommended improving infrastructure, regulating shipping, and prioritizing compliance to address these challenges.

On the other side, each Arctic country has its regulation for the passing vessels. For example, Russia charges a fee for passing services like monitoring, escorting, and icebreaking (Hill et al., 2015). Canada does not charge any mandatory fee and provides no support; however, Canada mandates that each ship inform the Canadian side when passing NWP (Lanteigne, 2017). Conflicting policies and different levels of support from the Arctic Council members can endanger the strategic planning for shipping firms to utilize the Arctic Routes. Additionally, non-Arctic countries also need to invest in ice-strengthened vessels and icebreakers (Lanteigne, 2017) and explore natural resources (Bajrektarevic, 2011) in the Arctic region. Hence, a more comprehensive treaty for the Arctic region is needed than ever (Guy and Lasserre, 2016).

Safety of the Arctic Transportation

Hamilton et al. (2005) addressed a lack of rescue services in the Arctic to respond to emergencies that commercial ships (tourists or cargo) could face. Since then, many discussions have taken place on the necessity of providing such rescue services in the Arctic. For example, Ford and Clark (2019) highlighted that the current Canadian Search and Rescue (SAR) preparedness does not efficiently handle large-scale evacuations for shipping accidents. One serious concern of such traffic is its impact on the environment (Chircop et al., 2020). Ciuriak and Ciuriak (2013) reviewed the relationship between climate change and trading systems. They discussed the environmental impact of using the Arctic route. There have already been many accidents (e.g., oil spillage) that have severely impacted the ecosystem of that region (Eliopoulou and Papanikolaou, 2007; Kelly et al., 2018).

Hill et al. (2015) reviewed transportation risks, safety, and security in the Arctic region. To control the challenges of ship movements in the Arctic region, Guy and Lasserre (2016) suggested developing a policy to regulate commercial shipping. Dalaklis et al. (2018) reviewed available resources for SAR operations in the Arctic, especially icebreakers, and suggested proper planning of critical resources. Within Canada, voluntary low-impact shipping corridors have been initiated to reduce the risk of Arctic shipping transportation (Chircop et al., 2020). Tsvetkova (2020b) investigated the role of multi-function vessels for monitoring offshore operations and weather conditions and coordinating the logistics operations in the Arctic. The author further suggested sharing the activities to reduce costs (Tsvetkova, 2020c). Papkovskii (1997) suggested using nuclear-powered ships to minimize the environmental effects. Nuclear-powered vessels minimize environmental impact so long as there are no accidents. If an unfortunate incident ever happens, there will be detrimental effects on the environment and all species in that region. Another solution is using other types of fuels for vessels, such as hydrogen. Safety and security concerns used to be one of the reasons for the slow adoption of hydrogen vehicles (Gurtu et al., 2015a; Gurtu et al., 2017). This is an ongoing area of research.

Strength, Weakness, Opportunity, and Threat (SWOT) Analysis

In order to investigate the internal and external factors contributing to the expansion of SC activities in the Arctic, this section summarizes the results of an analysis based on the SWOT method. The outcome of this analysis enables us to propose future research directions to be discussed in the next section.

The analysis is performed based on each stage of SC in the Arctic (Figure 2.1). We also considered "reverse logistics" to enhance the analysis. However, it is ignored in the current SC activities in the Arctic. Table 2.6 summarizes the SWOT analysis for the SC activities in the Arctic. In this analysis, we also considered all sustainability pillars to provide a comprehensive perspective in the analysis. This table represents each SWOT item using a three-character code. The first character shows if it is a strength (S), weakness (W), opportunity (O), or threat (T). The second character represents the related stage of SC, including supply (S), manufacturing (M), transportation (T), customer-end (C), and reverse logistics (R). The last character counts the number of items as a combination of the first and second characters.

Conclusion and Future Research Directions

This chapter reviewed the existing academic literature on SC activities in the Arctic. It listed opportunities and challenges that would arise in this area. It also suggested some solutions to overcome these challenges. The main contribution of this chapter is to provide a long-term view of current research on SCM and transportation in the Arctic due to the melting of the polar ice cap and propose a research agenda to work on various requirements of the SCs in the Arctic. Manufacturing and customer-oriented services are much behind

Table 2.6 A summary of SWOT analysis for SC activities in the Arctic

Strengths (S)		*Weaknesses (W)*	
SS1:	Rich natural resources	**WS1:**	Harsh weather and related risks
SM1:	Low cost of access to some raw materials and land for manufacturing	**WS2:**	Exploration costs
ST1:	Shorter distance to markets compared to traditional routes	**WS3:**	Lack of infrastructure (e.g., ports, airports, roads)
ST2:	Lower risk considering piracy	**WM1:**	Lack of skilled workforce
ST3:	Large capacity for transportation (lower waiting time)	**WM2:**	Higher manufacturing costs if the material is supplied from outside of the Arctic
ST4:	Less oil consumption for transportation	**WM3:**	Inventory management of perishable products
ST5:	Less chance of impact by a global crisis (e.g., delays due to SC disruption)	**WM4:**	Lack of agility for time-sensitive activities
SC1:	Attractiveness for tourism	**WT1:**	Lack of access to some routes all year round
		WT2:	Weak access to transportation technologies (e.g., GPS, satellite coverage, data)
		WC1:	Limited SAR services
		WC2:	Sparse population and higher cost of retail services
		WR1:	Lack of active reverse logistics in SCs
Opportunities (O)		*Threats (T)*	
OM1:	Exploiting the economies of scale of manufacturing facilities	**TS1:**	Unresolved political issues for extracting natural resources
OM2:	Ideal for test facilities and industries that need to be operated in cold regions	**TS2:**	Changes in marine ecology and natural ecosystem
OM3:	Establishing advanced manufacturing technologies that need limited resources such as material and labor	**TS3:**	Social issues due to the change in workforce demography
OT1:	Profitable transportation routes compared to traditional ones	**TM1:**	Staying limited to manufacturing a specific type of products
OT2:	Developing ports and infrastructures that benefit locals and nearby cities out of the region	**TT1:**	Environmental and social concerns about increased traffic
OT3:	Developing innovative transportation technologies such as autonomous vessels	**TT2:**	Insurance costs
OC1:	Profitable investment in tourism	**TT3:**	Imbalance regulations and treaties across different Arctic routes
OC2:	Improve the social sustainability indicators such as employment and welfare for locals	**TC1:**	Dissatisfaction with services and being replaced by alternative routes
OR1:	Exploiting opportunities in reverse logistics, such as generating energy from waste and a hub for reverse logistics activities		
OR2:	Opportunity to implement sharing economy in the region		

transportation and supply activities. However, the Arctic nations must prepare to embrace the increased flow of ships in the future. The increased flow of ships will have many long-term effects on the environment, marine ecosystem, and communities. The increased traffic flow will need better infrastructure for communication, safety, and security of people and cargoes passing through this region. Policies to maintain the pristine environment are a huge challenge, and policies are urgently needed to ensure that it remains, as much as possible, in pristine condition in the future. These policies must include punitive measures to keep the environment and marine ecology intact in case of an accident. Many arrangements need to be planned and developed to serve a large number of ships, cargo, and people in that region. These include housing, power, water, sewage, schooling, healthcare for communities, and a robust infrastructure of roads, railways, ports, and airports to move cargoes, passengers, and people working in these places.

Intermodal transportation has been considered more sustainable, and faster modes of transportation, such as the hyperloop, have also been considered sustainable (Gurtu et al., 2019). However, the first hyperloop has yet to become operational. These concepts that could minimize emissions in the Arctic are worth investigating. Norway is one of the Arctic countries and developing autonomous ships as the future of shipping (Munim, 2019). When successful, this will be applicable everywhere, not just in the Arctic region. All these measures are due to the environmental concerns of fossil fuels (Prior and Walsh, 2018).

The Arctic routes are an intriguing and inspiring research topic for the future to unleash their economic benefits for society. There is uncertainty in determining the volume and timeline of traffic in the Arctic region in the next decade (Lackenbauer and Lajeunesse, 2014; Lajeunesse, 2012). However, the planning for infrastructure to manage regular traffic and policies to protect the environment and ensure safety must be decided long before this route becomes widely available for commercial purposes. Arctic transportation safety also needs to use uniform technologies for the seamless and efficient transfer of information and communication. Some of the proposed research directions are classified as follows:

Infrastructure development: Safe and sustainable operation and transportation activities along the Arctic route require a set of infrastructure projects. The infrastructure has already been discussed in the chapter; however, several questions are to be answered, especially for developing new ports or expanding existing ports. Studies on identifying suitable locations for such ports, social aspects of developing new or expanding existing ports, and environmental concerns for such location decisions are vital issues to be discussed. In particular, addressing social aspects of developing ports (e.g., the impact of infrastructure development on Indigenous People) is essential to ensure the long-term operations of these facilities are funded by a consortium of countries. In this regard, the structure of foreign investments, sharing the costs and revenues, and required regulations are necessary to maximize their benefits.

Developing ports will lead to developing logistics networks as well. There is a possibility of developing an underwater tunnel connecting Europe (via Russia through the Bering Strait) and Canada, similar to the Channel Tunnel or Eurotunnel connecting Britain to France. The new tunnel may use a hyperloop besides trains, cars, and trucks. Roads and highways, transportation hubs, route selection, and proper modes of transportation are stimulating research topics in this field.

Management of traffic in the Arctic routes: Each Arctic route would potentially absorb a specific type of commodities and products. The existing mechanism does not seem efficient as the traffic is uneven among the routes. Selecting a route depends on the available support and services along that route and the fees charged. In this regard, studying optimal charges (e.g., tax) for each route according to the provided services could result in reasonable criteria for trespassing vessels. Developing tourism is also a factor in the optimal design of the charging mechanism. The charges could vary based on the effect of tourism on the economic development of small ports and communities within each route. In addition, there should be some mechanism to restrict the type of goods that are shipped and control navigation and traffic. Future research could initiate more case studies (Tsvetkova and Gammelgaard, 2018). Such case studies could investigate the role of local, national, and international interventions to facilitate SC activities in the Arctic without negatively impacting current and future generations. As presented in the SWOT analysis, social sustainability should be one of the major research directions due to its impact on promoting SC activities in the Arctic.

Designing eco-friendly vessels, restricting the type of goods shipped via Arctic routes, and controlling navigation and traffic could also contribute to safe and sustainable transportation in this region. The transition from fossil fuel will reduce the likely exploration of oil in the Arctic region and other places. A reduction in dependence on oil will eliminate conflicts in the various regions.

In addition, tourism activities in the Arctic are expected to increase. Several research gaps exist to explore the impact of tourist traffic in the region. For example, the impact of tourism traffic on other transportation and SC activities, as well as the safety and security of tourism in the Arctic, are potential research topics.

Route selection based on economic, social, and environmental goals: Emissions and risks are inevitable when considering the current level of transportation technology. The critical decision is selecting a route to minimize such environmental impact while keeping the transportation profitable. The optimal route selection should also reflect the interconnection between social and environmental issues, e.g., natural disasters could end the immigration of a local community from polluted areas. Thus, the penalty for severe, social, or environmental impact should be revisited and embedded in the optimal route selection.

Despite the attractive benefits of the Arctic routes, a set of challenges limits the adoption of these routes. The challenges are multi-tiered, including regional, national, and international levels. Therefore, there is no unique solution to these challenges without global cooperation, especially between the Arctic countries. One of Arctic operations' biggest challenges, even though the ice is much thinner, is severe cold weather and its impact on sailing. Freezing temperatures affect navigation equipment, which is likely to cause problems. Many sensitive parts of a vessel are vulnerable to the ice, wind chill, and icebergs (Kraska, 2010, Lasserre, 2011). Due to such risks, operations in the Arctic region are costly (Stephenson and Smith, 2015), including insurance. Global positioning system (GPS) does not work well in the Arctic region and endangers vessels' safety when passing through one of the Arctic routes (Hill et al., 2015). Weak satellite signals and low geocoding/geo maps cause these challenges for the traffic. Bathymetric mapping has also not been provided over a majority of NSR. As a result, shipping routes could be limited to a certain number, creating bottlenecks and consequences for other vessels on that route.

SCM in the Arctic has the potential to contribute to the global economy. As we proceed, new challenges and opportunities will show up. Thus, sustainably enhancing our advantages from the Arctic remains an interesting and dynamic research field.

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3 Reindeer Herders in Arctic Supply Ecosystems

Searching for the Harmony between Value-Creation and Value-Capture

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Introduction

Contemporary supply chains are inherently complex and have often been conceptualized as networks (Carter et al., 2015). Introducing the term "network" in the supply chain management (SCM) field has therefore extended our understanding of the SCM concept from a strategic perspective (Mills et al., 2004). Indeed, the actors in the supply chain are highly connected logistically, informationally and financially. It is often said that competitive advantages are provided not only between companies and manufacturing but within supply chains and networks (Mills et al., 2004). However, recent studies have demonstrated that government interventions and institutional and contextual factors substantially affect supply chain practices (Tsvetkova and Gammelgaard, 2018). In this study, we argue that we are witnessing another conspicuous shift in the conceptual focus of management – from networks toward ecosystems. This shift reflects the increasing interdependence, interaction and co-evolution of business activities, actors, technologies and institutions, therefore demanding a different theoretical and empirical approach than commonly adopted in network studies. Ecosystem members pursue dual goals of cooperation to create value and competition for scarce resources, to capture value (Ketchen et al., 2014; Hannah and Eisenhardt,

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2018). However, the interplay of both goals may make it difficult to achieve a balance between value-creation and value-capture, especially over time; that is what is still lacking in our understanding and why a thorough examination is called for (Hannah and Eisenhardt, 2018), particularly at the operational level.

Arctic oil and gas field projects are inherently complex communities of specific interactions and interdependencies among different actors involved both upstream and downstream. They represent distinct ecosystems that have recognizable institutional boundaries within which operations take place. The Arctic provides unique empirical settings where manufacturing and supply operations are challenged by extremely harsh climatic conditions, remoteness, sparse transportation links with other regions and global markets, and a limited number of suppliers and logistics providers. While technological advances have driven significant breakthroughs in the oil and gas industry, making their operations smoother and better thought out, they may also drastically affect the natural environment. Value-creating activities within oil and gas supply chain operations include not only ensuring regular deliveries of cargoes for manufacturing needs and their customers but also extra support regarding the safety of operations and local settlements in extremely remote Arctic areas (Tsvetkova, 2020a). However, collaborative relationships among ecosystem actors can be overshadowed by the competition for limited resources and profits that takes place within these relationships. It seems that there is a lack of knowledge of value-creating implications when companies transition from a traditional supply chain environment to surviving and thriving within an ecosystem.

By taking into account the contributions of various actors toward achieving shared-value outcomes, this study seeks to examine the interplay between value-creation and value-capture in supply ecosystems. Of particular interest is *how SCM practices under Arctic extreme environments have been continuously (re)shaped by the complex and evolving interactions between oil and gas businesses and Indigenous reindeer herders where the latter are impacted by the oil and gas ecosystem.* In doing so, a single case study approach is employed to showcase a supply ecosystem that originated from the onshore oil and gas field operations located on the Yamal Peninsula. This ecosystem, comprising multiple actors, technologies and institutions, was selected for its ability to enable value-creation activities by absorbing and integrating diverse operations, even in the presence of competition and the need for value-capture.

The study proceeds as follows: the next section outlines our research method. This is followed by presenting our empirical case, with the findings discussed thereafter. The study concludes with theoretical and practical implications and guidelines for future research directions.

Method

Research Design

A qualitative, single case-study approach was chosen to explore the facilitation of value-creating activities within an ecosystem of Arctic oil and gas field operations. It took as its point of departure an oil and gas field located on the Yamal Peninsula. This field has been developed by one of the world's largest oil companies (hereinafter, the focal company) under extremely natural conditions and a lack of infrastructure. The supply chain practice of this field was chosen for its role in the evolution of an ecosystem, including multiple actors, technologies and institutions, and in facilitating value-creation activities by absorbing and managing diverse operations.

This approach allowed us to investigate our phenomenon in its natural setting (Barratt et al., 2011), interpret the processes "in terms of the meanings people bring to them" (Denzin and Lincoln, 2005) and generate insights gained through the deep observation of real-life practice (Voss et al., 2002).

Data Collection

We used multiple data sources, as recommended in previous SCM research (Voss et al., 2002). Data were collected over a nine-month period in 2021 and 2022 using ten semi-structured and in-depth face-to-face interviews, eight telephone interviews and focus group discussions with key informants engaged in developing the Arctic oil and gas field, supply operations and the transportation of goods. Focus group participants and interviewees were selected through purposive sampling from different work positions – site and operator managers, equipment managers, terminal operations managers and representatives of Indigenous Peoples, as well as oil tanker administrators. They were chosen based on their long experience, practical knowledge and many years of involvement in developing oil and gas projects and ecosystem-related activities in the extremely harsh conditions of the Russian Arctic. This wide range of representatives of various professions allowed us to gain a comprehensive understanding of how ecosystems evolve around the development of Arctic oil and gas projects, and how value-creating activities are carried out, despite ecosystem members capturing value for limited resources and the associated profits.

The semi-structured interview method was chosen since it encouraged our interviewees to reflect and elaborate on the challenges and peculiarities of supply chain operations in extremely low temperatures and ice-infested waters and the discussed ongoing concerns, which led to deeper insights into the observed phenomenon. Lasting between two and three hours, these in-depth interviews were recorded on paper forms and as digital audio files with the consent of the interviewees, transcribed and validated with key informants in order to ensure the reliability of our findings. The interviews were conducted in Russian and then translated into English. When necessary, follow-up interviews with additional questions were conducted via email. The names of interviewees and companies were omitted to comply with ethical issues. The focus group discussions included a total of eight participants and were designed to follow up the preliminary outcomes obtained from the semi-structured interviews.

Our findings were supported by personal observations that enabled us to describe the real-life practice of supply ecosystems in the Russian Arctic. A certain amount of empirical data was collected during a trip onboard a container vessel of ice-class Arc7 (undertaken by the second author) on its regular voyage from Murmansk port to Dudinka port in the period 28 April to 6 May 2016. Personal observations were also made during a trip onboard the offshore service vessel (undertaken by the second author) on its regular voyage from the supply base to the offshore installations in the Norwegian Sea (between 4 and 6 March 2020). Although the waters of the Norwegian Sea are not ice-infested, this trip helped collect data on how service vessels participate in supporting oil field development and carry out loading/unloading operations in stormy winds and high waves. Further, our findings were supported by the working experience of the first author as an expert in supervising oil and gas activities in the Sea of Okhotsk, which is a so-called sub-Arctic area characterized by hurricanes, prolonged blizzards, severe storms, typhoons and harsh ice conditions. All the co-authors also made personal observations during several visits to the interviewees' offices. These data sources allowed the observation of the decision-making process by senior managers to witness their actual daily interaction in operational activity. Being careful observers and good listeners, we maintained a non-judgmental attitude and openness to the unexpected in what was learned.

Additionally, secondary data were primarily collected from the companies' documentation, press releases, internal archival materials and websites, as well as reports from relevant government authorities and independent agencies. Using different types of data sources allowed for data triangulation, thereby increasing the data's internal consistency and the validity of our research findings (Voss et al., 2002) and establishing a chain of evidence, as described by Yin (2009).

Data Analysis

One of the most crucial challenges behind data analysis in single case studies is demonstrating the objectivity of the process through which the empirical data and notes are developed into conclusions (Eisenhardt, 1989). In line with this, we employed thematic synthesis analysis, which allowed for greater flexibility in the coding process for identifying, analyzing and reporting patterns within our data. This method also describes the data set in rich detail and frequently interprets various aspects of the research topic. So, it was helpful to examine the experience, meanings and reality of case participants, as well as the ways in which events, realities, meanings, experience and other aspects affect the practice (Cruzes et al., 2015).

In the first stage, we provided a case description of supply chain operations within the Arctic oil and gas project and then delineated emerging constructs and their relationships related to value-creating activities and value-capture among the ecosystem members. Thus, we were able to move iteratively and abductively between previous research and the empirical material. This means that we kept revising and refining interview templates, informed by both insights from previous interviews and data obtained during personal observations, as well as by continuous reading of the literature (Braun and Clarke, 2006). In the second stage, we identified specific segments of interview transcripts and created a list of tentative themes. We also adopted themes from extant literature. Then, we reduced the overlap and translated the 12 codes into the following six themes: supply operations, maritime transportation, value-creating activities, value-capture, Indigenous People and food delivery. This allowed us to create a first-order coding scheme that continually changed. While our understanding of the empirical case grew, the coding scheme was revised and refined. In the last stage, we created a model of the final coding themes, in which we mapped the six themes into three higher-order themes: integration, adaptation and co-existence. The strength of the final coding scheme was based on the number of times mentioned by our interviewees.

Case Presentation: The Oil and Gas Ecosystem Affecting Reindeer Herders

Ecosystem-Building Mechanisms

Contextual Settings of the Russian Arctic as Prerequisites for Innovative Technologies

The focal company's oil and gas field is located in an extremely remote northern Russian area on the Yamal Peninsula. Recoverable reserves are estimated at over 250 million tons of oil and condensate and over 320 billion cubic meters of gas. However, the absence of transport infrastructure, coupled with the complex underlying geology and multiple technical issues, e.g., tectonic abnormalities leading to significant fragmentation of deposits, remain insurmountable obstacles to the field going into full-scale development.

Its location in the Russian Arctic implies serious contextual challenges, such as extreme remoteness, long distances, severe Arctic climate, polar night, sparse transportation networks and lack of transport infrastructure (Tsvetkova and Gammelgaard, 2018). The field lies 200 kilometers from the nearest railway line, more than 700 kilometers from the nearest road, 360 kilometers from the nearest town, and 30 kilometers from the Gulf of Ob. These challenges made the feasibility of this field project critically problematic to implement and meant the focal company was isolated from its customers, global markets and other regions. As a result, the focal company faced one of the most baffling and strenuous logistical undertakings in the entire history of the Russian oil and gas industry. As emphasized by a senior manager:

> *The field was discovered more than 50 years ago. But, unfortunately, the lack of technologies allowing us to develop such a complex field and – what is most important – the lack of a scheme for the export of finished oil from this field did not allow us to start its development.*

Thus, one of the most substantial challenges was the field's extreme remoteness from transport infrastructure. The focal company's main operational and strategic concern was finding a route for the shipment and transportation of crude oil from the field to the market in northwest Europe. Regular supply deliveries to the field and the shipping of oil from the field matter to the focal company's manufacturing operations and infrastructure.

Development of Transport Infrastructure

In 2012, full-scale development of the field began with the ensuing production of the first 6,000 tons of crude oil. As a senior manager stated:

> *In those days, when the project had just begun to be developed, there was nothing here, only an empty field ... Only endless tundra stretched thousands of kilometers, and here and there reindeer roamed. No roads, no paths. At first, living conditions were utterly harsh because, in these areas, the temperature drops to –60 degrees in winter, and everything is buried in snow for 245 days per year.*

The first oil shipments were carried out by trucks, using 200 kilometers of winter ice roads to the nearest railway station, and then they were transshipped into railway tanks to be transported about 800 kilometers to a refinery plant. A senior manager explained:

> *In such a way, we could transport only 12,000 tons of oil. It was an experimental scheme for us. We used it as it required the least investment. However, firstly, the throughput of this option was minimal. Secondly, the tundra becomes impassable in the summertime.*

Experts considered 20 options for oil delivery, which were mainly based on the construction of pipelines to the nearest railway or refinery plant and sea terminals located at a distance of several 250 to 500 kilometers. All these options meant a huge distance. Further, each of the 20 options had its own difficulties. So, over time, experts came up with the idea to transport oil by sea. In parallel, a pilot voyage of the Vaygach icebreaker was undertaken, in order to check the navigability of the Gulf of Ob during challenging ice conditions and confirm the possibility of transporting oil from the field by sea. Climatic conditions of the Gulf of Ob are characterized by harsh parameters, such as –25°C in February (with absolute lowest –56°C), ice depth of up to 2.5 meters and ice-free navigation for approximately 85 days per year. As emphasized by a senior engineer:

> *In the Gulf of Ob, fresh ice is stronger than sea ice. Nevertheless, the icebreaker successfully traversed the challenging ice conditions and thereby proved maritime transportation to be the most effective for oil shipping. This was the first experience of working with the state provider of icebreaker services, and it was positive.*

From the point of view of maritime logistics, the most attractive and convenient option was the terminal in Kharasavey, located more than 250 kilometers from the field. This terminal opened a route directly to the port of Murmansk. Thus, oil tankers would voyage for just two days, creating value for customers. However, this option could cause a social conflict of interest with Indigenous Peoples. As a senior manager explained:

> *We would have to build a pipeline with a length of more than 250 kilometers, and it would cross the entire Yamal Peninsula. This option would affect the roaming paths of reindeer and the Indigenous Peoples following them. For reindeer and Indigenous People to cross a pipeline is an unfeasible obstacle that could lead to hunger for the reindeer and their extinction. We would have to make numerous changes to the pipeline design, which is costly and a considerable challenge.*

Despite the seemingly high level of efficiency, the company had to abandon this option.

Indigenous People: Traditional Lifestyle at the Center of Business Ecosystem

The Nenets people are the keepers of the ancient culture, who obey the biorhythms of their reindeer herd. They have adapted to be able to live and travel in freezing temperatures. The annual reindeer migration sees over 650,000 reindeer and over 18,000 of the Nenets people who herd them traveling up to 1,000 kilometers across the Yamal Peninsula (see Figure 3.1). During the winter, when temperatures can plummet to –50°C, most Nenets graze their reindeer on moss and lichen pastures in the southern forests. Then, every spring, the Nenets move these enormous herds, which range from 500 to 7,000 reindeer, from winter pastures on the Russian mainland north to summer pastures over the Polar Circle to the shore of the Kara Sea. The northern pastures, rich in tasty lichen and saltwater, which are exceptionally useful for these animals, are waiting for them. Seasonal migrations are necessary, reindeer herders say, as they help prevent the depletion of reindeer pastures and let the animals gather strength before the long polar winter. This massive journey usually starts in

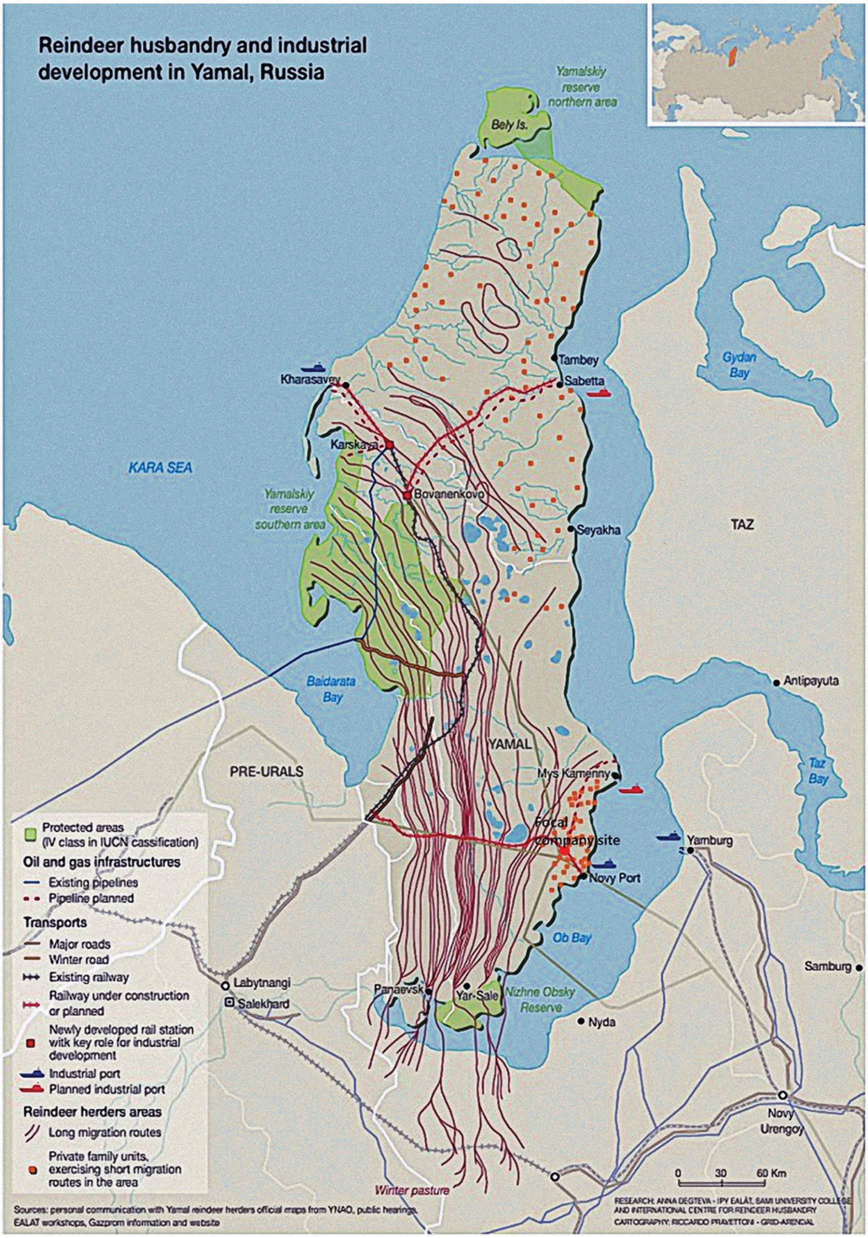

Figure 3.1 General migration routes of reindeer herds and major infrastructure on the Yamal peninsula (*Source*: Degteva and Nellemann, 2013).

mid-March, when temperatures are still freezing, because part of the journey involves crossing a vast expanse of the Ob River. It is worth adding that seasonal migration routes have not changed for centuries.

However, in the early 2000s, this land became the center of the strategic interests of the focal company. The extensive network of pipelines, roads and electrical lines has crisscrossed the Arctic tundra, a treeless expanse that became an insurmountable barrier for reindeer to travel across hundreds of kilometers. The question arises as to why it is impossible for reindeer to choose another way. At first glance, this does not seem to be a problem; after all, this industrial oasis is surrounded by untouched tundra. As clarified by one Indigenous representative:

> *The Nenets' livelihood is tied to the reindeer. There are other reindeer herders. If one family of reindeer herders is forced to change its centuries-old migration patterns, other herders have to leave their habitat. In this case, there will not be enough pastures. The Nenets' survival depends on reindeer migration in the tundra, and they cannot live without it. We often joke about who grazes whom – do people graze reindeer or, on the contrary, do reindeer graze people?*

Additionally, the Nenets' survival is threatened not only by the development of oil and gas fields but also by climate change. As temperatures rise and the tundra's permafrost thaws and releases greenhouse gases into the atmosphere, the ice melts earlier in spring and does not freeze until much later in autumn. The rising temperatures also affect the tundra's vegetation, the only source of food for the reindeer. Therefore, the Nenets have to struggle to survive due to climate change and industrialization of their land.

Ecosystem-Based Value-Capture Mechanisms: In Search of Innovative Logistics Solutions

The focal company's production sites are adjacent to the territories of the Nenets, who have been living on this land for many centuries. The construction of a vast pipeline system for oil shipping would set a barrier to reindeer migration by dividing the winter pastures into two. Further, the major facilities of the field have already affected migration patterns and transformed a fragile environmental community. As a senior manager reported:

> *We respect the traditions of Indigenous Peoples. Preserving the traditional lifestyle of these people of the North is among the fundamental principles of field development in the Yamal Peninsula.*

Although the option of the 250-kilometer pipeline construction to the terminal in Kharasavey and then maritime transportation directly to Murmansk port was the least costly option and allowed the time for the shipping of oil to customers to be minimized, the focal company decided to choose maritime transportation through the Gulf of Ob. This option was quite costly, arduous and carried numerous risks. It included the construction of a pipeline 100 kilometers long to the coast of the Gulf of Ob, where subsequent loading onto oil tankers would be fulfilled. The focal company faced numerous challenges, such as the Gulf of Ob being free of ice for less than three months, fresh ice being much stronger than sea ice (thickness up to 2.5 meters), constant alluvial currents, shallow waters of 12 meters' depth and sea tankers unable to come closer than 3.5 km from the coast. Due to these challenges, siting the terminal onshore proved impossible. However, one indisputable condition was that it had to operate all year round, although maritime logistics specialists doubted this was possible in principle.

During summer navigation 2014, the first shipment was made, aligned with the offloading of oil from the oil delivery and acceptance point to the river tanker with a low draft by hose, then transportation to a larger sea-going tanker and, finally, the "berth-to-berth" offloading of oil from the river tanker to the sea-going tanker to be delivered to Murmansk port. More than 101,000 tons were shipped under this scheme in 2014. Later, during winter navigation 2015, a temporary scheme was tested through the so-called ice pier, with the shipment of more than 112,000 tons of oil. Both options marked a breakthrough in the development of Arctic SCM practices. However, the volume of oil production grew in colossal proportions. As a senior manager reported:

> *Those temporary schemes based on offloading by hose and river tankers proved ineffective – first of all, because they could not be used in the offseason. Besides this, we could not claim that these logistics methods were safe and secure. There was a high risk of oil spills, which possibly needed to be prevented. We carefully tried to avoid every fault. From the very beginning, we made it a prerogative that ecology and safety were our priority in developing this field. Therefore, we put in a lot of effort and involved experts in finding an effective solution.*

Ultimately, in 2016, the focal company came up with an innovative decision to install a tower-type Arctic loading terminal as a single-point mooring at a distance of 3.5 km offshore, where large crude tankers could be loaded safely (see Figure 3.2). Oil from the production sites reached the central gathering point on the coast of the Gulf of Ob, through a pipeline more than 100 kilometers long and, subsequently, the terminal, through an underwater pipeline 3.5 km long. Transshipment capacity at the Arctic loading terminal allowed up to 8.5 million tonnes of oil per year. Further, the choice made in favor of the Arctic loading terminal ensured stringent environmental and industrial safety standards (Fadeev et al., 2021) and the application of "zero-emissions" technology that eliminated any risk of contaminants reaching the waters of the Gulf of Ob.

The focal company also invested in building its own icebreaker fleet to service the field project, including six Arc7-class tankers and two diesel-electric

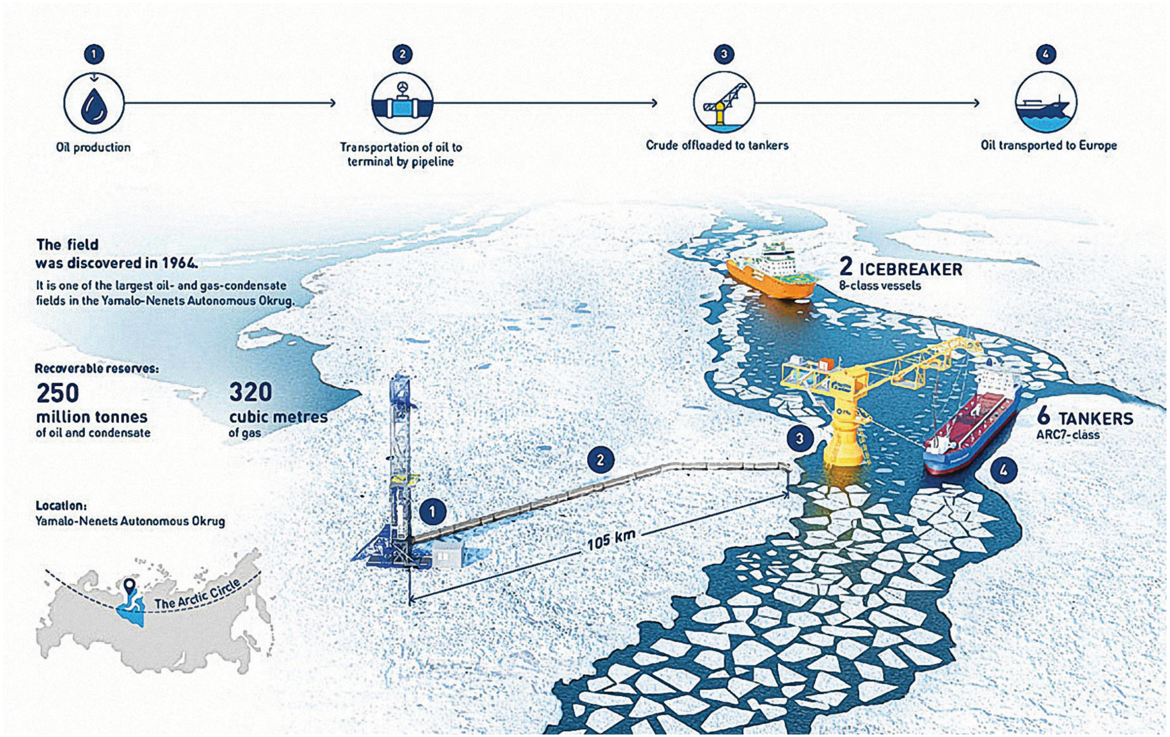

Figure 3.2 Oil offloading via the sea terminal in the Gulf of Ob (*Source:* “GazpromNeft-Supply” Ltd).

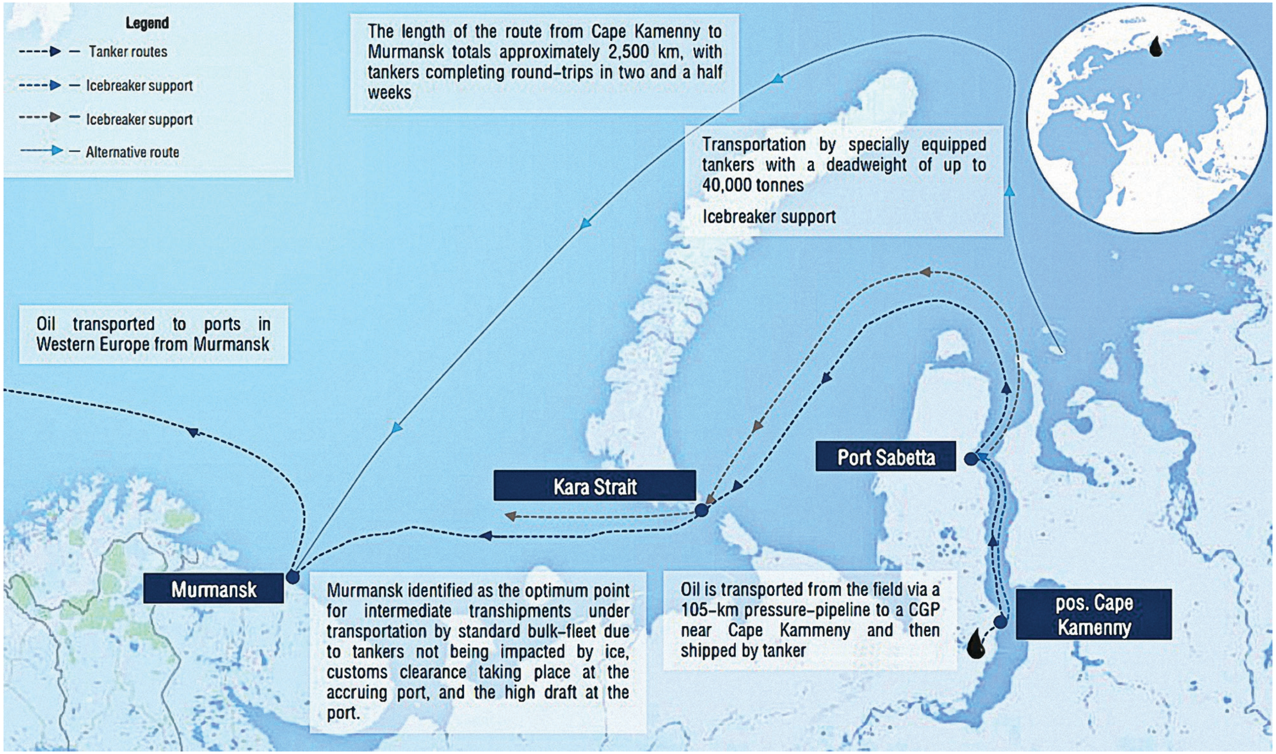

Figure 3.3 Oil transportation from the field to the customers (*Source:* "GazpromNeft-Supply" Ltd).

icebreakers. These tankers have a cargo-bearing capacity of 42,000 tonnes and a maximum draught of 9.5 meters, enabling them to operate at shallow depths in the freshwaters of the Gulf of Ob. Also, they can independently negotiate ice of 1.4–1.8 meters' thickness and are equipped with turret-type terminal crude bow-loading equipment. Both icebreakers are designed to support tankers, can operate independently for 40 days at temperatures as low as −50°C and can accelerate to up to 16 knots (30 kilometers per hour) in open waters. Moreover, thanks to their steerable propellers, they can complete a full turn within a minute, while their 22-MW propulsion power provides icebreaking capacity of up to two meters, comparable to that of nuclear icebreakers.

Thus, making concessions so as not to create additional obstacles, through the construction of a new pipeline, to the migration of Indigenous Peoples and reindeer, the focal company had to elaborate innovative logistics solutions that required colossal capital investments and technological breakthroughs (Fadeev, 2022). Despite the multiple challenges faced, it was, however, recognized that these technologies and solutions enabled eventual value-capture to ensure highly integrated competence. At the same time, it is worth noting that the focal company's choice was not helpful in utilizing shorter delivery times to create value for customers.

Ecosystem-Based Value-Creation and Adaptation Mechanisms: Reindeer Herders and Logistics Infrastructure

Finding a Balance of Interests

Close proximity to Indigenous Peoples, the so-called "masters" of the Arctic, made the focal company find a balance of interests. Therefore, it was decided to take into account the interests of both parties when equipping the field project. As an engineer told us:

> *At that place… [pointing to the side], for example, we overlanded the pipeline. Farther, there is a butanol pipeline, which goes underground at the place where reindeer herds cross it. This is important because reindeer are afraid of gas noise... [laughs]… reindeer are very capricious animals and react sensitively to many factors of artificial influence. Today, there are 22 crossings in total. But while the field is growing, there are discussions about organizing new crossings. So, "horned travelers" bring their own correctives to the field architecture. It turns out that we, oilmen and reindeer herders, are jointly protecting the Arctic's fragile ecosystem.*

So, industrial cables and pipelines that cross migration routes were laid in special U-shaped passages and underground if possible due to permafrost. Since then, oilmen and Indigenous People have met twice per year.

Preparations for reindeer migration are made in advance. The local commission, comprising representatives of the municipal reindeer herding enterprise, the Yamal public movement of the Indigenous minorities of the North, and the focal company's professionals, checks the condition of the existing crossings and defines the cooperation procedure. For the migration period, sections of motor roads are covered with a special geotextile fabric called dornit, which makes it possible for the sleds to glide easily without damaging the sled runners. The traffic is halted until reindeer herds and numerous loaded sleds finish the crossing. As a senior manager emphasized:

> *Ensuring safe conditions for the migration (passage) of reindeer herds through production sites is among the environmental targets successfully addressed by our company.*

Today, this solution makes it possible for reindeer to freely walk across the tundra toward the Kara Sea and back, using their traditional routes and, thereby, enhancing value-creation for Indigenous People.

Establishment of Trading Posts and Other Benefits of Industrial Supply Chains

The delivery of equipment, engineering facilities, building materials and food to the oil and gas field is carried out initially by rail to the station 200 kilometers away and then by road, which is possible only through winter roads. Winter roads must be built each year and function for a few months per year. In Russia, such connections (usually called "ice roads") often take the form of river ice crossings in the treeless tundra. In addition, these winter roads serve as a vital supply link for remote northern settlements located in close proximity to the field.

The focal company demands high standards regarding transport, technical means and drivers' experience. However, the 200 kilometers of the winter road are tough to maintain in good condition. Harsh natural conditions make their own adjustments. As a driver who has been working on this route for more than ten years stated:

> *The winter road is essentially the absence of a fully fledged road, a roadway. A special difference of a winter road in this area is the wind. I have never seen such a wind of 30 to 45 meters per second anywhere. Even though the winter road is cleaned from time to time, the weather conditions change very quickly – whether snow, wind or sun. The most frequent occurrence is an intense snowstorm when it sweeps over the tundra two meters high, and visibility is only up to two meters. Snowdrifts rule here... Trucks get stuck in fluffy snow. Have you ever seen how trucks trample the track in the snow? Here, particular skills are needed to make your way – awesome filigree work. The wind drives the snow, the drivers wave their shovels, and the cars barely move in an hour... Often, you can find trucks fallen into a swamp, river ice, or driven over to the side of*

> *the road. It's scary... especially when this happens every 10 minutes... Deadly factors are drivers' lack of sleep and fatigue, as well as weather conditions.*

At the same time, substantial and extremely heavy cargoes are delivered only by water during summer navigation, and their unloading is carried out in two nearby settlements.

Meanwhile, winter roads have made it possible to create 17 trading posts in this region, with the support of local authorities. Every year, about 22,000 people who roam with reindeer are served at trading posts, and an average of 1,500 tons of products from the traditional activities made by Indigenous Peoples of the North are harvested – fish, wild plants, reindeer antler products. Also, bread is baked directly at the trading posts. In addition to their primary functions, some trading posts provide social services and medical care, where the permanent work of paramedics is organized, and there are adapted premises for medical stations. As one of the tundra residents stated:

> *Our family always visits local merchants at trading posts. Typically, they stand on the deer migration routes, and there are slaughterhouses nearby, where we send deer for meat. So convenient! Here we buy mainly food products that end up in our raw-hide tent, also tarpaulin, colored cloth, lamps, reindeer harness equipment and other goods needed in the tundra. Generally, the generator often fails. So, we have to buy parts.*

However, delivering foodstuffs and all the necessary provisions for tundra residents is very challenging. As one of the local merchants told us:

> *Trucks usually drive along the winter road from seven up to twelve days. The problem is that food deliveries can happen once a year in winter. We listen to Indigenous People's wishes/orders and try to bring these new things that people want. It is pretty common for tundra residents to have no money to pay for food products. Here, almost like in a communal system… [laughs]... it is not monetary but often commodity settlements that are accepted. Reindeer herders bring fish, meat and deer antlers here – this is the hardest currency of the tundra, although local natives often complain that they are paid little for horns in contemporary times*.

Annually, reindeer herders can bring up to 1.5 tons of deer antlers to such a trading point. Trading posts are indeed a kind of saving oasis for the inhabitants of the Russian High North.

Another aspect of obtaining value was the railway, built primarily for the needs of the oil and gas industry on the Yamal Peninsula. All expenses for the construction of the railway were borne by the company, and the authorities provided administrative support for the project. Reindeer herders roaming the tundra on reindeer teams quite organically fit this road into their traditional way of life. The railway in all seasons has become an attraction for raw-hide tents – both nomadic and stationary. Often, when train carriages crawl through, you can see a picture of herds crossing the railway embankment against the backdrop of visible raw-hide tents. In some places, reindeer herders cross the railway, passing with reindeer under bridges. Further, reindeer herders and their families actively use the railway for daily needs. The railroad became a driver for the mobility of both the nomadic Indigenous Peoples and their belongings. Thanks to free transportation, some reindeer herders have organized food traffic from towns to the south, where prices are much lower. The luggage limit is 100 kilograms per person. Also, there is more convenient access to medical care, not dependent on reindeer, snowmobiles or helicopters. One of the most significant changes associated with building the railway is the increased mobility of women, children and also the elderly of the Indigenous Peoples of Yamal.

Surprisingly, reindeer herders often do not link the benefits of logistical infrastructure and the establishment of trading posts with the development of oil and gas fields on the Yamal Peninsula. On the contrary, there is a steady understanding among local reindeer herders that nothing good comes from the gas workers. Still, they respond very positively in relation to the railway. Further, this railroad also created a sense of inequality between the nomadic tundra inhabitants close to the new transport infrastructure and those whose reindeer migrated far away from it, closer to the focal oil and gas field. It is noteworthy that nomadic reindeer herders in conditions of extremely limited transport infrastructure, e.g., this railway, have a fairly low level of adaptability to the conditions of settlements and towns, as their communication skills are more deficient.

Discussion

According to Jacobides et al. (2018), a business ecosystem refers to a group of interacting entities that depend on each other's activities. So, this emphasizes the fact that the environment presents "common adaptive challenges to organisms" (O'Neill et al., 1986, p. 21), in which actors not only coordinate activities but also share these adaptive challenges with each other (Ketchen et al., 2014) and depend on each other for their mutual effectiveness and survival (Iansiti and Levien, 2004). Thus, organizations in such ecosystems have to adapt to contextual conditions that, in turn, can make them reconsider their core competencies, as well as the role of SCM practices (Tsvetkova and Gammelgaard, 2018).

Based on our empirical case study, we have discovered that actors within ecosystems, such as the focal oil and gas company and Indigenous reindeer herders, exhibit both independence and interdependence with one another. This relates to an essential characteristic of ecosystems: they help coordinate interrelated organizations with a large degree of autonomy. In line with this, they need to collaborate to create value and capture value, thereby creating "coopetition" (Ketchen et al., 2014; Hannah and Eisenhardt, 2018). Although each member's activity is related to the others' activity and the entire ecosystem as a whole, each member (in our case, the focal oil and gas company and Indigenous reindeer herders) has to compete for resources that can be extremely limited.

For the focal oil and gas company, consideration of reindeer migration paths undermined the company's value-capture capacity for itself. Reindeer migration paths appeared to be a bottleneck in the development of a transport system for exporting oil to the market. This finding is consistent with Ritala et al. (2013) that value-capture predominantly refers to individual actor-related activities; that is how actors strive to reach their own competitive advantages and reap benefits. However, within the framework of ecosystem interaction, the focal company managed to overcome this bottleneck by implementing innovative technologies and new logistics solutions. In this way, the company created value and ensured its growth for Indigenous herders, while capturing value and creating profits. So, we have observed so-called coopetition that implies a synergetic aspect of relationships, which in turn distinguishes ecosystems from ordinary networks (Ketchen et al., 2014). In the ecosystem studied, coopetition was seen as a prerequisite for ensuring a diverse set of value-creating activities for the actors involved. In this regard, this finding fills the gap in our understanding (still missing in literature) of how the leading company can disperse these bottlenecks by balancing competition for northern land on the Yamal Peninsula and cooperation to align synergies between other members of the ecosystem (see Hannah and Eisenhardt, 2018; Jacobides et al., 2018).

Ecosystems encompass more than just business networks; they comprise systems of actors, technologies and established practices that co-evolve through their interactions, joint contexts and shared purpose (Aarikka-Stenroos and Ritala, 2017). Not only can actors belong to multiple ecosystems simultaneously (Aarikka-Stenroos and Ritala, 2017), but they may also have distinct institutional effects and indirect butterfly effects on value-creation (see Lacoste, 2015). By tracing the goals and actions of the ecosystem's main actors (see Figure 3.4), we identified mechanisms for cooperation and value-creation, as well as mechanisms for competition and value-capture. Unlike previous studies (Adner and Kapoor, 2010; Pera et al., 2016; Meynhardt et al., 2016), we examined these mechanisms holistically, without segregating them. Our findings demonstrate that value-creation and value-capture are closely intertwined. The focal oil and gas company captures a portion of the value created by the ecosystem through its industrial expansion, the development of own transport infrastructure and enhanced expertise. In turn, the Indigenous reindeer herders capture a portion of the value created by the ecosystem by utilizing transportation services constructed by the oil and gas company for its own use, thereby ramping up their mobility and preserving their land and traditional ways of life. However, the interplay between value-creation and value-capture in the supply ecosystems is not always straightforward. Our

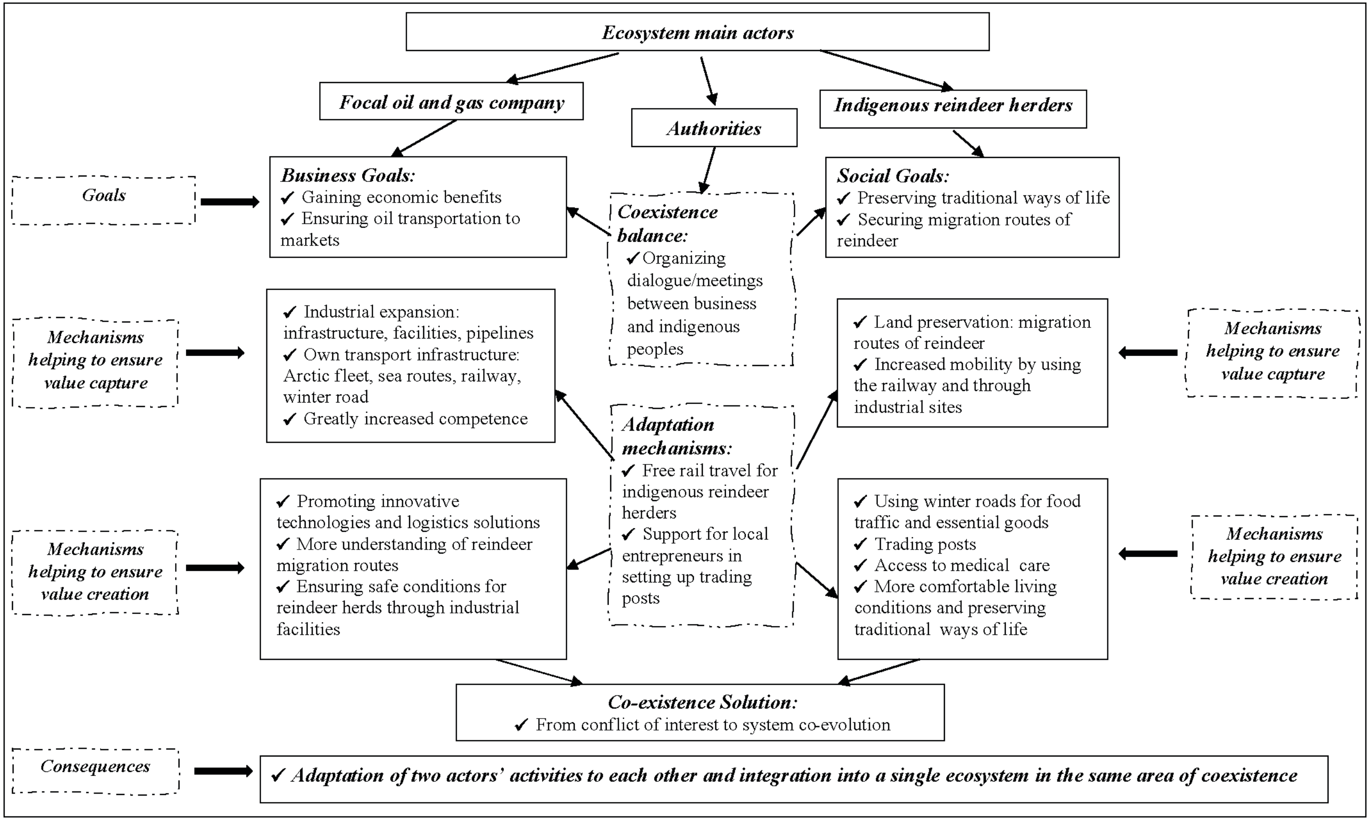

Figure 3.4 Ecosystem-building and management mechanisms (*Source*: the authors' elaboration).

empirical case reveals that the development of new transportation routes in the Arctic region can result in social contradictions and unforeseen consequences for Indigenous communities. Therefore, our findings indicate that the value created by the ecosystem may not be distributed fairly among the various actors, leading to tensions and conflicts.

Furthermore, it is worth noting the role of authorities in ensuring a balance between business and social objectives by implementing adaptation mechanisms for Indigenous reindeer herders. Notably, respondents from the business side highlighted the authorities' lack of influence and involvement, while representatives of Indigenous Peoples were more accepting and recognized the authorities' role as crucial. Nevertheless, the authorities' efforts contributed to the emergence of a new co-existence solution, which has permeated the societal fabric or, in other words, the entire ecosystem. The co-existence solution shifts the focus away from the conflict of interest between the main actors toward system co-evolution through interactions and joint contexts. This new phenomenon facilitates the fair and equitable distribution of value created within the ecosystem among all actors involved. Our findings have uncovered the integration of demand in supply ecosystem management and the development of social responsibility practices that take into account the needs and interests of all actors in the ecosystem.

While the SCM framework focuses more on value-capture and value delivery, the ecosystem-based approach allows the disclosure of value-creating and even innovative activities. Both primary actors in the ecosystem supported the envisioning of innovative supply chain practices, e.g., delivery by winter road supply to remote trading posts on the migration routes of reindeer herders. Ecosystem services have been harnessed as part of an overall strategic adaptation for contextual change in this extremely remote Arctic region. This allowed local communities, including both Indigenous and local people, to buffer against the adverse effect of industrial development and climatic change and receive the benefits of civilization. In line with this, our findings have disclosed value as something unique to an ecosystem and the context in which it emerges and the member for whom it emerges. So, the process of value-creation in an ecosystem has been viewed to extend beyond the focal company's ordinary operational activities. These findings support and further extend some recent discussions about the role of coopetition in value-creating activities (Ritala et al., 2013; Meynhardt et al., 2016).

Thus, an ecosystem-based approach allowed us to study the adaptation to contextual modifications associated with the emergence of a new main industrial actor that expanded industrial facilities on the land originally owned by Indigenous reindeer herders. The findings also illustrate that boundaries are elusive and open-ended at the ecosystem layer, further making supply chain practices dynamic and interdependent. That is consistent with Aarikka-Stenroos and Ritala's (2017) study.

Final Remarks

This in-depth study argues that the management of supply chains in an "ecosystem era" faces significant changes, through the development of value-creating and innovative activities in balance with competition and value-capture. Our findings indicate that supply chain practice requires a willingness to mutually understand each other's boundaries and challenges toward integrated co-existence and take into account the needs of weaker, vulnerable actors in a single ecosystem. This is especially important when supply chain practice becomes fragile due to confrontation between the competing goals of the main actors' actions and intentions. It is bilateral efforts that lead to a synergistic interaction between all levels of the ecosystem, including interdependence on markets and local social communities with other dimensions of civic life.

Thus, the ecosystem approach requires the recognition of the actors' embeddedness and interdependence within supply chain practice, where value-creation as something unique extends beyond the actors' ordinary operational activities and day-to-day routines. Our study, which is thus in line with current calls for a greater focus on the societal public value (see Tsvetkova, 2021) and social needs and responsibilities (see Tsvetkova, 2020b), explores an emergent phenomenon of the supply ecosystem. This phenomenon results in new forms of integration among the actors and potentially unexpected social consequences owing to the complex interplay of the collective interdependencies of co-existence. Further, our empirical case illustrates business boundaries and underlying mechanisms of value-creation and capture within and across ecosystems. So, our findings have implications for managers who are continuously engaged in the development of supply chain operations in new contexts and have to deal with an "unknown animal called society" (Meynhardt et al., 2016, p. 2988).

Limitations and Further Research Opportunities

The study includes some limitations related to its qualitative nature and a focus on local-level operations, in which a limited number of actors were involved in consideration of the SCM practice. It would, therefore, be beneficial for further research to survey a larger sample of practitioners and cover more actors within and across a single supply ecosystem to extend this study's findings.

While we discussed the supply ecosystem in the Russian Arctic, the findings may not apply in completely different settings. However, we believe that our study provides interesting and profound implications for further research about value-creation and value-capture in various operational and supply chain practices and settings.

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4 The Arctic Corridor and Questions Concerning Social Responsibility and Sustainability

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Introduction

Transport infrastructure and supply chain management (SCM) are intrinsically linked. As world markets become increasingly intertwined, global supply chains have had to develop and expand to meet demand and supply. In terms of SCM, globalization has led organizations to attempt to increase their competitive advantages and reduce costs via global sourcing (Shukla et al., 2011). Thus, the conflation of the need to optimize the efficiency of supply chains warrants building new infrastructure or expanding existing ones. This research applies a single-case study approach and aims to explore how developing global transportation routes and SCM practices creates social contradictions at the local, regional, and national levels.

The logistical corridor enabling the flow of people, cargo, and information between Finnish Lapland and the coast of the Barents Sea has a long and disputed history. For a century, the possibility of constructing a railway line there has been debated (Lilja, 2013). This discussion re-emerged, and concrete planning of the Arctic Corridor project intensified during the second half of the 2000s and culminated in decisions made in recent years. Supporters of the planned railway have emphasized its contribution to regional and national economies, global supply chains through the Arctic, and local logistical networks in the Barents Region. Yet, the project's social responsibility, cultural and environmental sustainability, and economic feasibility have been questioned by several actors. The extant research literature on the Arctic Corridor project is scarce and focuses on surveying Finnish media debates in the years 2016–2018

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(Taksami, 2018) and reports the most recent changes in the autumn of 2021 (Kähkönen and Nystén-Haarala, 2021).

We analyzed this collision of views and interests by using the lens of an institutional logics approach, which focuses on the contending logics of different societal sectors (Tsvetkova, 2020) and allowed us to expand on the three fundamental themes present in our qualitative empirical data: (i) the historical context that has led to different goals of stakeholders in the region, (ii) culture and cultural practices that have the power and agency to disrupt the institutional logics of markets, and (iii) the increasing environmental concerns of local, national, and international stakeholders that combine to upset the perceived needs of those who want to advance economic development. This approach allowed us to reveal the meanings and characteristics of different institutional logics affecting the debate concerning the Arctic Corridor and to place the planning and development of new supply chains in the Arctic in the context of history, community, and local sentiments.

This chapter consists of an introduction to the theoretical and conceptual framework we used, the presentation of a case study, our research methodology, data, and analysis, and a discussion and conclusion.

Sustainable and Socially Responsible SCM Approach Using Institutional Logics Theory

According to the United Nations' Brundtland Report (1987), sustainable development meets present needs without compromising the ability of future generations to meet their needs. The achievement of sustainable development enabling the well-being of individuals and societies is based on the harmonization of economic growth, social inclusion, and environmental protection. Sustainable SCM can be understood as an attempt to streamline supply chain operations to maximize profitability while minimizing environmental impacts and maximizing social well-being (Hassini, Surti and Searcy, 2012). Although questions concerning supply chains and sustainability have been addressed in an increasing number of research papers, the existing literature focuses on the environmental (and to some extent the economic) sphere of sustainability. Thus, attempts to minimize the environmental impacts of supply chain operations and increase energy (and cost-) efficiency are dominant discourses overshadowing the social sphere of sustainability (Tsvetkova, 2020).

Social responsibility is an ethical framework that proposes that individual actors should cooperate (often also compromise) and that their actions should benefit a community and/or society. As social responsibility is connected to the process of finding a balance between economic growth and the well-being of society and the environment, it is also closely tied to the concept of sustainability. Tsvetkova (2020) concluded in her study focused on Arctic marine operations that a supply chain becomes sustainable when it creates value not only for a focal company but also benefits local communities via economic support and capacity building. When social responsibility is discussed in the context of SCM, attention is often paid to enterprises and the concept of corporate social responsibility (Modak et al., 2020). Nevertheless, our research emphasizes that discussions concerning and demand for social responsibility in SCM-related decisions and actions are not limited to corporate actors but also involve public authorities who represent different levels of government and non-commercial interest groups ranging from indigenous organizations to political parties.

Rather than focusing on individual enterprises and their attempts to adapt and assume new practices in their supply chain operations, this study emphasizes a wider societal debate that circumscribes appropriate actions and policy options. Friedland and Alford (1991) argued that institutional logics may be described as "symbolic systems, ways of ordering reality, and thereby rendering the experience of time and space meaningful." Meanwhile, the definition provided by Thornton and Ocasio (1999) refers to the socially constructed historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social realities. When enterprises and other organizations try or are forced to integrate different spheres of sustainability into their supply chain operations and management practices, conditions for new logics replacing, competing, or complementing traditional market and financial logics may emerge. Following the vocabulary of Friedland (2018), Greenwood et al. (2010), and Friedland and Alford (1991), this means "non-market" institutions can influence the economic decisions of organizations.

Friedland (2018) also argued that emotion and affect should be considered when examining institutional logics and organizational decision-making. When referring to stakeholders and their agency, this study focuses on the capacity to act (including the right and/or opportunity to participate in a discussion), the experience of acting (including the experience of being heard), and the ability to influence decisions and utilize power. Alongside individual agency, we recognize the existence of collective agency and agency via intermediaries.

Research Methodology and Data

This research uses a qualitative single-case study approach that aims for an in-depth understanding that allows for meaningful and analytical generalizations. We chose this method to grasp the contextual settings affecting the debate concerning the Arctic Corridor and to determine the key players who possess agency. Careful contextualization of the phenomenon studied (that is, the debate and decisions concerning the Arctic Corridor) can make the identification of different institutional logics possible and enable the analysis of their interactions, collisions, and possible interconnections.

This study incorporates several forms of data and sources, including information such as written reports and documents produced by public and private actors. Our data and sources also include media material (e.g., printed newspapers and magazines, digital publications, and social media platforms) and data collected via semi-structured interviews (that is, face-to-face, online, and email interviews during 2017–2022) with public authorities and representatives of private enterprises. We also engaged in participatory observations of events in which the Arctic Corridor initiative was discussed. Consent from the informants, who had the right to withdraw from an interview whenever and for whatever reason, was obtained, and an utmost effort was made to ensure that the interviews conducted would not harm the interviewees' positions. Therefore, the interviews were anonymized. While critically evaluating the purposes and functional connections of different sources, this research benefited from investigator triangulation (that is, the cooperation of multiple observers with different backgrounds and expertise). It emphasizes the need to understand the historical roots of ongoing debates.

The Arctic Corridor Project: Case Presentation

Historical Background

Finland's national railway program started in the south in the early 1860s, and the railroad was extended to the town of Oulu in northern Finland in 1886. The network was extended further northward during the first years of the 20th century and reached Rovaniemi – an inland town near the Arctic Circle – in 1909 (Lilja 2013; Wiklund, 2016). Construction of the first railway in Norway between Christiania (now Oslo) and Eidsvold started in 1851, and the line was opened in 1854. The second line between Hamar and Grundset was completed in 1862, and the famous Iron Ore Line in the north was extended from Kiruna, Sweden to Narvik in 1902 (Stenersen, 2002; Norway Trains, 2021).

The first plans to build a railway to the Arctic Ocean through Finland were made in the 1890s. While early discussions in Finland concentrated on the possible source of funding, route, and the seaport that should be the final destination, a Norwegian initiative concerning a railway to Rovaniemi also appeared in the early 1910s. Interest in the railway flourished during World War I when water transport through the Danish Straits was blocked and a railway connecting Saint Petersburg and Murmansk was constructed in Russia (Lilja, 2013). When the resource-rich Petsamo (Pechenga District) became part of Finland after the Treaty of Tartu (1920), Finland extended its border to the Arctic Ocean. Although there was not even a road in the area, a debate concerning the railway ensued. Both the utilization of local natural resources (e.g., timber, minerals, and metals) and the transport of merchandise (e.g., fishery products) were recognized as economic opportunities that could be enhanced by a new railway connection (Uusi Aura, 1919; Wiklund, 2016; Kylli and Saunavaara, 2017). In the newly independent Finland, the railway was connected with the civilization process and nationalism (Pohjolan Sanomat, 1920; Rautatiehallitus, 1937).

Indigenous Sámi residents – who live in the northern parts of Fenno-Scandia and the Kola Peninsula of Russia – were not asked for their views on the construction of the railway. Compared to Norway and Sweden, where the Sámi people began ethnopolitical activities in the early decades of the 20th century, developments in Finland were delayed. The first association founded by the Sámi people, Samii Litto, was established in 1945. However, the Sámi had influence, e.g., in the Utsjoki municipal administration, which defended the Sámi livelihoods and opposed the construction of roads from the south to Utsjoki during the 1920s. Utsjoki was the only municipality in Finland where the Sámi were the majority (Kylli and Saunavaara, 2017; Lehtola, 2012).

Finland's planning of a railway connection to Petsamo started in 1921–23. Although none of the optional routes studied appeared economically feasible (Rautatiehallitus, 1937), discussions concerning the extension of the railway network north of Rovaniemi continued. Finally, the national parliament decided on the matter via the acceptance of a special law. Construction of the Rovaniemi–Kemijärvi railway was completed in 1934 (Lilja, 2013). Meanwhile, the first four decades of the 20th century witnessed the completion of many of Norway's main lines (Trondheim, 1921; Åndalsnes, 1924; Kristiansand, 1938) in the southern and central parts of the country (Stenersen, 2002).

Discussions in Finland concerning a connection to the Arctic Ocean were strongly affected by national security needs during World War II (see e.g., Suomen Kuvalehti, 1939). However, the Moscow Peace Treaty signed in 1940 at the end of the Winter War obliged Finland to construct a railway from northern Finland to the Soviet Union. The idea of a road and a railway connection to Norway did not disappear, and German troops planned to construct a railway between Rovaniemi and Petsamo during the Continuation War from 1941 to 1944. After the Moscow Armistice in 1944, Petsamo was handed to the Soviet Union, and the railway project was abandoned. During the postwar era, a new railway connection in Finnish Lapland between Tornio and Kolari was built in 1965. Although no new lines have been constructed since, the Arctic railway was proposed several times between 1970 and 2000 (Lilja, 2013). On the Norwegian side, the completion of the northern main line to Bodø (1962) stopped the northward expansion, although the possibility of extending the railway network to Tromsø has been discussed throughout the decades (Stenersen, 2002; Nikel, 2019).

Revival of the Project

Discussions about potential cargo flow through the Northern Sea Route (NSR) intensified at the end of the 2000s and the beginning of the 2010s. At the same time, growing international attention was paid to oil and gas

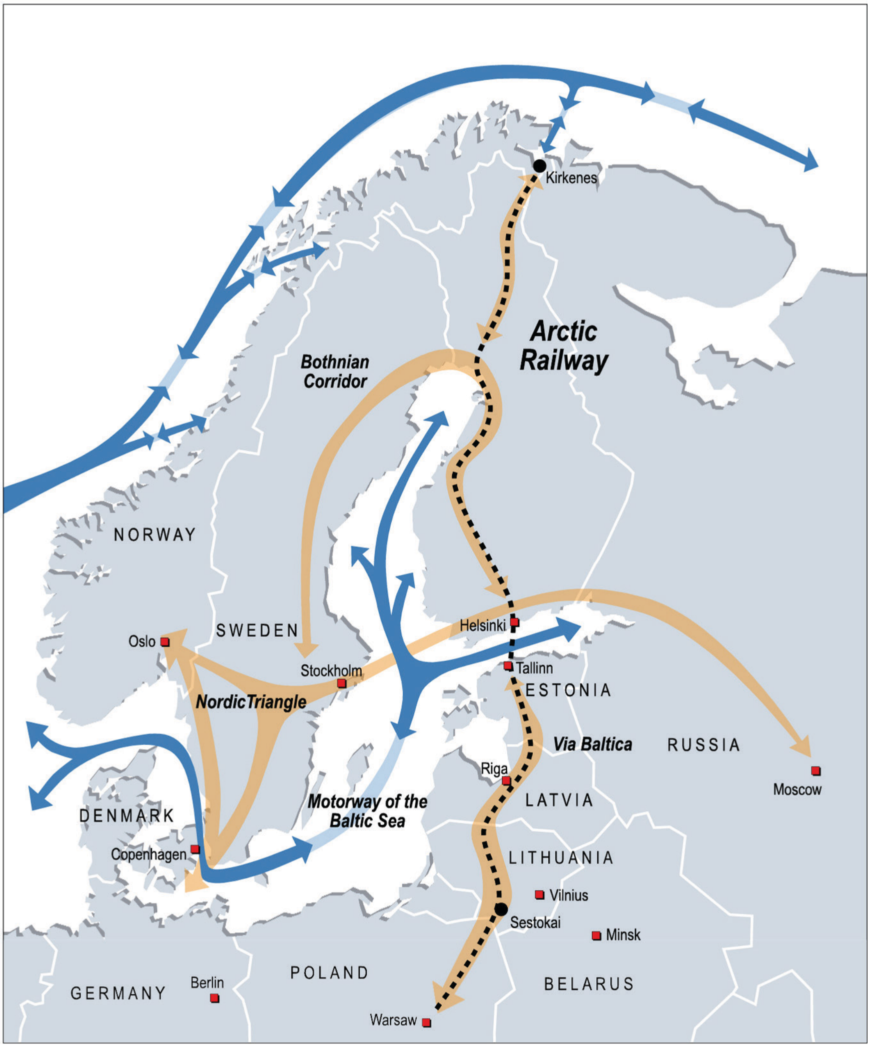

Figure 4.1 Map of Arctic railway (*Source*: Arctic Corridor 2019, https://arcticcorridor.fi/wp-content/uploads/etussivu-2.jpg).

reserves in the Barents Sea and the Arctic in general. The Finnish mining sector was in the spotlight due to the Mining Act being revised in 2011, and new mines were opened or planned in northern Finland (Arctic Corridor, 2019). This revitalized the planning of new railroad connections within the Barents Region. Early proposals envisioned a railroad from Nikel (Russia) to Kirkenes and even a wider regional system connecting Norwegian, Russian, and Finnish railways and the ports of Kirkenes, Murmansk, and Arkhangelsk.

While regional authorities in Murmansk remained skeptical about the project that might affect Murmansk's competitive position vis-à-vis the other Arctic harbors, attention gradually shifted to a possible railway connection between northern Finland and northern Norway (Sergunin, 2020).

In 2007, the port director of Kirkenes envisioned that a Rovaniemi–Kirkenes railway connection would open a unique European link to the Arctic Ocean, and planning intensified also in northern Finland (Staalesen, 2018c). The province of Lapland was preparing long- and mid-term regional development plans, and ideas concerning the railway connection to Kirkenes were introduced to provincial leaders in the spring of 2008. Reflecting the policies and terminologies of that time, the railway proposal was developed into the concept of the Arctic Corridor in 2009–2010. A corridor was understood as an economic and logistical region, and the railway to Kirkenes was the flagship project of this corridor. According to an informant (Interview, 18 May 2017), the early objective of actors in northern Finland was to increase public awareness concerning the project and upgrade it from a regional initiative to a national project. The first background studies concentrating on potential cargo volumes and types of cargo were also conducted (Pohjois-Lapin alueyhteistyön kuntayhtymä, 2010).

The provincial plan for Lapland announced in 2009 referred to the importance of the Arctic and Barents Region and the economic corridor but did not mention the railway. However, in 2011, the Lapland Regional Programme described the railway as a central part of the economic corridor from Finland to the Arctic Ocean. In the following Regional Programme, the Arctic railway was described as a long-term flagship project, and a comprehensive study was requested from the national government (Lapin Liitto, 2009, 2011, 2014). The Finnish Arctic strategy in 2013 referred to the transport needs of northern Finland and mentioned potential rail connections to the Arctic Ocean, Sweden, Norway, and Russia (Prime Minister's Office: Finland 2013). The wording of the strategy most likely reflected the competing Arctic railway plans in northern Finland. While stakeholders in the northern and eastern parts of Finnish Lapland promoted the Rovaniemi–Sodankylä–Kirkenes route or a connection through Russia, a railway connection either to Tromsø or Narvik was supported in the west (Interview, 18 May 2017).

In June 2017, the Ministry of Transport and Communications of Finland announced that the Finnish Transport Agency, in cooperation with Bane NOR (the Norwegian state-owned company responsible for national railway infrastructure), conducted a survey to explore potential cargo volumes, possible rail routes, business models, environmental impacts, and technical realizations (Ministry of Transport and Communication 2017a; Ministry of Transport and Communication 2017b). The background study commissioned by the Finnish Transport Agency and conducted by the consultancy company Ramboll (2018) provided a pessimistic evaluation concerning future container traffic through the Arctic and described the train transport between Kirkenes and Eastern Europe as an expensive and unrealistic option for future cargo flows, even if the tunnel between Helsinki and Tallinn were to be built. However, the main conclusions of the survey announced in the spring of 2018 were: all route options were technically possible, but the Rovaniemi–Kirkenes route would make the most significant improvements to Finland's logistical position and accessibility; the estimated costs for the infrastructure project would be up to €2.9 billion (including €0.9 billion for the Norwegian side); the earliest possible time to complete the railway would be by 2030; construction of the new railway connection should increase Finland's security of supply; the Ministry of Transport and Communications would conduct further studies concentrating on the Rovaniemi–Kirkenes line in cooperation with Norwegian partners (Heima, 2018; Ministry of Transport and Communication, 2018b).

The new Finnish–Norwegian Task Force established in May 2018 consisted of the Ministry of Transport and Communications, Ministry of Environment, Finnish Transport Agency, County of Lapland, and the Sámi Parliament (including Skolt Sámi representation) and paid attention to, e.g., questions concerning environmental impacts, reindeer herding, Sámi culture, potential funding, business models, regulations, and necessary permissions. The group's final report (Ministry of Transport and Communications, 2019), announced in February 2019, concluded that transport volume would have to be around 2.5 million tons per year to cover the railway's annual maintenance costs. According to the report, such volumes were not realistic without significant changes in business in the area or in the costs of different transport modes. The report presented no further measures for promoting the railway project and thus halted the government-level process (Ministry of Transport and Communications, 2019). Finland's prime minister at that time, Juha Sipilä, stated that it was impossible to support a project that was not economically feasible (Länsman, 2019).

Nevertheless, private actors continued to plan the railway. The Norwegian Sør-Varanger Utvikling company contacted Finest Bay Area Development Oy in 2018. In the spring of 2019, the companies signed a memorandum of understanding concerning the development of the Arctic railway (Finest Area Bay Development, 2019). Although the companies confirmed their intentions to consider stakeholders' views regarding the wider environmental, societal, and economic impacts of the railroad, their memorandum of understanding was strongly criticized. According to an informant (Interview, 10 December 2021), this surprised Finest Bay Area Development because, based on background discussions, the company believed their project was widely supported among local stakeholders in northern Finland. The emergence of Finest Bay Area Development, a company best known for its plan to build a railway tunnel between Helsinki and Tallinn into the Arctic, seems to have been a surprise for many, although the tight linkage between these two projects (that is, an Arctic railway and a railway tunnel to Tallinn) had been emphasized by Finland's state authorities (Salomaa, 2017; Karijord, 2017).

While the private project is still ongoing, the decision made by the Regional Council of Lapland in May 2021 strengthened the public sector's withdrawal from the project. The Regional Council rewrote the draft Regional Land-Use Plan for the period until 2040 and erased references to the Arctic railway line. A few months later, in mid-October 2021, the Regional Council announced a new railway proposal envisioning a connection between Kolari and Kemijärvi that would not enter the Sámi homeland but would support tourism, mining, and forestry (Kähkönen and Nystén-Haarala, 2021; Lapin Liitto, 2021a; Nilsen, 2021). A member of Finland's Parliament (representing the constituency of Lapland) proposed a railway connection to Tromsø in April 2022. This recommendation was made after Russia attacked Ukraine and emphasized the need to improve Finland's security of supply (Suomenmaa, 2022).

Key Stakeholders and Their Expectations, Hopes, and Fears

The debate about the Arctic Corridor project encompasses the interests of different stakeholders at the national, regional, and local levels. The Regional Council of Lapland, a statutory authority formed by the municipalities of Lapland (Lapin Liitto, 2021b), has been heavily involved in this discussion. As the Regional Council is responsible for strategic regional development and land-use planning, its involvement has not only been based on endogenous interests – such as the calculated direct and indirect employment to 20,500 people that the construction of the railways would provide (Lapin Liitto, 2018) – but also on legal duties. From the perspective of land-use planning, the Regional Council's position differs from the municipalities responsible for zoning in their respective areas. Regional-level planning is less detailed but covers larger areas and has a time horizon that covers not years but decades.

The region of Northern Lapland, a subregion including the municipalities of Inari, Sodankylä, and Utsjoki, has brought various local actors together and worked on behalf of the railway project. While the region of Northern Lapland championed the Rovaniemi–Kirkenes route, representatives of other municipalities within the Regional Council of Lapland have driven the cause of other routes. When the Council negotiated the new Lapland Regional Programme for 2018–2021, representatives of the municipalities of western Lapland wanted to change sentences in the text referring to the Arctic railway. They thought some expressions might be (mis)understood, so the Regional Council would support the route from Rovaniemi to Kirkenes (Rytkönen, 2017; Interview, 18 May 2017). At the same time, municipalities in eastern Lapland promoted building a railway to Murmansk through Salla and Kantalahti (Tynkkynen, 2017).

Even the municipalities forming the region of Northern Lapland have grown apart on this issue. When they commented on the Regional Land-Use Plan draft in 2020, Sodankylä was satisfied, Inari wanted to ensure that the planned route would go around Lake Inari from the south (not from the north), and Utsjoki recommended that the proposed railway line be removed from the plan because of the damage it would cause to the Sámi culture. Opinions within the individual municipalities have also been divided, and uncertainty concerning stations where trains would stop has caused concern. Arctic communities want to be nodes rather than areas through which different links in the supply chain network are built. As pointed out by the municipal mayor of Inari, traffic that goes through but does not stop would cause all the identified troubles and provide no benefits to the local community (Alajärvi and Linnea, 2018; Lapin Liitto, 2020).

Competitive arguments, even if fewer in number, have also been made on the Norwegian side of the border. Invoking conventional economic and market logics, interest in building the Arctic railway in Norway was bound to the Sør-Varanger Municipality's desire to develop its ports, coinciding with Chinese interests in regional investment. The emerging vision, supported enthusiastically by then-Mayor Rune Rafaelsen, led to mutual overtures between the municipality and Chinese stakeholders, various visits to China, and the signing of a friendship-city agreement with the Chinese city of Harbin (Sandø, 2019; Abarkach, 2019). When supporting the idea of developing Kirkenes into a major node in the international supply chain network connected to continental Europe by a railway connection to Finland, Rafaelsen has repeatedly maintained that

> *[W]e can not live only on agriculture, fishing, and reindeer husbandry. We have a population in Finnmark, and therefore we must have industry. We must work toward a green industry and to get there we must be willing to make some [environmental] footprints*
>
> *(Elnan and Belgaux, 2020)*

The hope of developing Kirkenes into an international logistics hub was supported by a 2018 study produced by the Kirkenes Business Park, the Sør-Varanger Development Company, and the Finnmark County Council (Trellevik and Klo 2017; Sør-Varanger Utvikling 2018). Meanwhile, representatives of the city of Tromsø have emphasized the superiority of the Kolari–Tromsø line even after the Rovaniemi–Kirkenes connection was mentioned in Norway's 2017 transport infrastructure plan (Det Kongelike Samferdseldepartement, 2017; Staalesen, 2017a; Staalesen, 2018a).

Although other ministers and ministries have been involved, discussions concerning the Arctic railway have centered on the Ministries of Transport and Communication at the national level. In Finland, the project became strongly associated with Minister Anne Berner. Her Norwegian counterpart was often Minister Kjetil Solvik-Olsen (Staalesen 2017b, Staalesen 2017d). Besides commissioning studies and reports that investigate local conditions, the ministers have also connected the planned railway to the transport of goods through the NSR and the development of new types of international logistical networks (Ministry of Transport and Communication 2018a; Staalesen 2018a; Staalesen 2018b; Staalesen, 2017b; Staalesen, 2017d). This kind of approach is understandable, as international comparisons elaborating the gross weight of goods handled in ports demonstrate Finland's high dependency on seaborne transport in international trade. While maritime export and import volumes per capita are even higher in the case of Norway (Österlund, 2019), the freezing of Bothnian Bay every winter causes significant costs and challenges to Finnish shipping and industry (Finnish Seafarers' Union, 2021).

The history of the Arctic railway project is long, and different political parties have commented on it both from the government and opposition. One informant recalled that representatives of all Finnish political parties have expressed their support for the project at one point or another (Interview, 18 May 2017). For example, in 2017, the Social Democratic Party (the opposition party at the time) criticized the government for its slowness in exploring the project's feasibility. However, representatives of the same party showed satisfaction when the project was erased from the Regional Land-Use Plan a few years later. Although differences between the party leadership and local chapters may explain many voices within one party, opinions among the members representing Lapland have also varied (Virtanen, 2017; Niemistö, 2017; Blomberg, 2019; Oja, 2021). When Yle Sámi studied the attitudes of different political parties in 2018, it concluded that the Green Party and the Left Alliance had the most critical stance toward the project (Länsman 2018). The lesser attention paid to the Arctic Corridor project by Norwegian parties and politicians may be due to two factors: investments on the Norwegian side of the border would be smaller, and the Norwegian discussion has recently focused on another project. Namely, a majority in the Norwegian Parliament overruled the Norwegian government in April 2021 and proceeded with the extension of the train line to Tromsø despite the opposition of Cabinet ministers (Berglund, 2021).

The Sámi Parliaments in Finland and Norway, the Sámi Council (a non-governmental organization, with Sámi member organizations in Finland, Russia, Norway, and Sweden), and the Skolt Sámi Village Committee have been the most visible collective entities representing Sámi interest in the debate concerning the Arctic Corridor (Aikio and Paltto, 2018; Nilsen, 2017; Nilsen, 2020a; HÆTTA, 2021). However, other groups, such as the Finnish Sámi Youth (a Sámi youth advocacy organization founded in 1991) and Suohpanterror (a Sámi art and activist group based in Finland), have also organized demonstrations to resist the project (Lakkala, 2018). Besides opposing the railway as a harmful project with negative impacts on reindeer herding (e.g., loss of pasture areas, obstacles that hinder reindeers' movements, ground-shaking, noise pollution, and accidents), culture, and traditional ways of life, these organizations criticized the process through which it was developed. Especially before the establishment of the Finnish–Norwegian Task Force in May 2018, they argued that the Finnish government failed to fulfill the rights of the Sámi to participate in decision-making concerning the railway. While opposing the idea that the railway would also have positive effects on the Sámi community, the Sámi Parliament referred to the lack of free, prior, and informed consent (FPIC) that is included in international agreements concerning the rights of Indigenous Peoples. They described the railway project as unconstitutional and emphasized that the project has had significant negative effects on the Sámi people's mental well-being (Lakkala, 2018; Lapin Liitto, 2020).

Although the current collective stance of the Sámi community in Finland appears to be rather united and entirely against the Arctic Corridor, this may not always have been the case. One (non-indigenous) informant closely involved in the project for years argued that the initiative faced hardly any resistance between 2008 and 2016, and Sámi municipal politicians joined the delegations that promoted the project both domestically and internationally. Articles and opinion pieces in local newspapers seem to support this argument (Seurujärvi, 2015; Peltomaa, 2015).

Industries in Finland have expressed support of the Arctic railway. Several Finnish industry and trade union leaders published a petition in 2017 to give the Arctic railway a central role when the Arctic infrastructure projects of the European Union were considered (Rakennusteollisuus, 2017). The Finnish branch of the Arctic Economic Council expressed its support for the project concurrently (Arctic Finland, 2017). Actors representing industries and businesses made positive remarks after the Finnish Transport Agency's report was published in March 2018 (Kauppakamari 2018; STT 2018; Ervasti 2018). When the Lapland Chamber of Commerce organized the Arctic Business Forum in the same spring, profitability calculations were based on an annual cargo of four million tons. Around the same time, local planners in Kirkenes described a potential supply chain for cargo. They argued that the new seaport with a railway connection could potentially handle up to 10% of container traffic between China and northern Europe. These grand visions included 550,000 containers per year and ten south-bound trains per day (Mainio, 2018; Staalesen, 2018a).

Private companies, which are the envisioned users and beneficiaries of the planned railway connection, have not actively participated in public discussions concerning the Arctic Corridor. It has been difficult (if not impossible) to find statements made by mining, shipping, or logistics companies that support the project. While companies have been careful not to become directly involved in a sensitive and politicized debate, both private citizens and most collective entities introduced above have been active in sharing their views on social media.

Although the railway project and its possible effects on Finland's position in global supply chains was first debated in online discussion fora, such as Suomi 24 (City Digital Group, 2021), Twitter has played a leading role as a discussion platform. The first tweet with '#jäämerenrata' (direct translation: railway to the Arctic Ocean [https://twitter.com/search?q=%23jäämerenrata&src=typed_query&f=live]) was published on 27 February 2013. After a steady increase in the number of tweets, the popularity of this hashtag on Twitter in Finland exploded in 2017. Although it is difficult to find positive comments concerning the planned project in the tweets made in the 2020s, early discussions were strongly polarized and consisted of arguments both for and against the project. These tensions may explain why a new Twitter account '@ArcticRailway' was launched in March 2018 with the self-stated purpose of providing a platform for appropriate information concerning the Arctic railway.

East Asian and European investors and potential users of the planned railway have formed a group of stakeholders that are often mentioned but rarely heard of. Although Japanese stakeholders in the mid-2010s expressed their interest in being involved in the project (Interview, 18 May 2017), and the seven-week transport time of timber products from a sawmill in Kemijärvi (northern Finland) to Japan through southern Finland, the Suez Canal, and the Malacca Strait has been used as an example of the benefits of the new Arctic route (Laukkanen and Heikkilä, 2016), China has been the most often mentioned non-Arctic actor. Actors in northern Finland and Norway have prepared material in the Chinese language and envisioned a connection between the Arctic Corridor and the Belt and Road initiative (the Polar Silk Road). Chinese capital and potential investments have also been discussed in the case of a private railway initiative (Devonshire-Ellis, 2017; Arctic Corridor, 2019; Mainio, 2019).

The east has not been the only direction where support for the project has been sought. Paavo Lipponen (2015), the former Prime Minister of Finland, proposed in his 2015 memorandum to European Commission President Jean-Claude Juncker that the EU should secure logistical access to the Arctic Ocean by launching a project for a railroad connection from Southern Finland to Kirkenes. Taksami (2018) concluded in her survey of Finnish media debates that discussion and interest (in years 2016–2018) were transforming from Chinese toward possible EU investments. However, these initiatives have not proceeded to the point where the Arctic Corridor is included in the Trans-European Transport Network policy.

Analysis and Discussion

This study emphasizes the presence of conflicting interests and local actors' capabilities to drive their causes either independently or in cooperation with like-minded agents. It introduces a case in which contradictions and competition between different logics resulted in a situation in which space for sustainable and socially responsible supply chain practices could not be found. Thus, those engaged in or supporting the development of the Arctic Corridor have found themselves in a situation in which it is difficult or impossible to advance this project, which could open opportunities for new types of supply chain operations in the Arctic.

The connection between transport infrastructure, resource extraction, and economic growth has been strong in the Arctic. Building transport infrastructure has a significant impact on landscapes, ecosystems, and land-use patterns, and they often stimulate debates concerning social responsibility and inequality (Kylli and Saunavaara 2017). Unsurprisingly, statements reflecting the environmental, economic, and social spheres of sustainability have been made both for and against the Arctic Corridor project. Although some of these arguments have a long history, contemporary discussions have also emphasized issues missing or much less present in debates that took place in the 20th century. A holistic approach that pays attention to historical development has revealed that questions concerning the railway's direct impacts on nature are an example of issues that have become widely addressed only recently.

The impact of the environmental-concern logic in discussions on Arctic railways should not be oversimplified. As described in Table 4.1, railways have been described as an environmentally friendly mode of transport. Norway's largest environmental conservation organization, when commenting on the planned Fauske-Tromsø line, referred to the positive climatic effects achieved if goods are transported by rail instead of roads (Aas, 2017; Nikel, 2019). In the context of the Arctic Corridor, low levels of carbon dioxide emissions, when compared to other forms of traffic, have also been mentioned (Lapin Liitto, 2018; Sitowise, 2018b). Nevertheless, most comments concerning environmental sustainability have emphasized the railway's harmful effects on nature conservation areas and natural assets (Sitowise, 2018a; Lakkala, 2018; Länsman, 2018). Besides direct impacts, some people have suggested that railways also have indirect harmful effects on the environment. In other words, the construction of the Arctic railway would make transporting local resources (e.g., minerals, forests, etc.) easier, attract new business activity, and cause damage to the environment (Aikio and Paltto, 2018).

Economic growth, industrial diversification, and employment are at the core of discussions concerning economic sustainability, and the Arctic Corridor project is no exception. While long-term employment may be significantly lower than what would be required in the short-term construction phase, both the maintenance of infrastructure and the operation of train traffic would have positive direct effects on employment. The possible long-lasting indirect contribution to employment and economic growth would come through industrial development that might gain new momentum advanced by the railway and through the ripple effects of support industries. However, constructing a railway could also have negative effects on local industries. While the impacts on reindeer herding have constantly been described as negative, discussions concerning the tourism industry have been more complex, as the planned railway has been described as a pull factor bringing more tourists and a negative development affecting nature and landscapes (Mainio, 2019; Ruokangas and Mäntykenttä, 2019; Ministry of Transport and Communications, 2019).

The history of SCM in Finnish Lapland involves many instances in which local people have criticized the central government, either because of a lack of sufficient interest and investment or because of pressure to develop transport infrastructure that is neither needed nor desirable. Although local communities, both indigenous and non-indigenous, have often been divided, and there

Table 4.1 Institutional logics and disputable reflections on the Arctic Corridor project

Type of Logic	*Supportive Argument*	*Opposing Argument*
Economy/market logic	• More efficient and diverse supply chains • New direct employment and tax revenue • Engine of growth/positive impacts on other (existing or new) industries	• Not feasible (lack of competitiveness against other transport routes) • Not feasible (lack of cargo through the NSR) • Negative effects on other economic activities
Environmental logic	• Rail is a green form of transportation • Can support traffic through the NSR (e.g., a shorter route, less fuel consumption, etc.)	• Harmful effects on the (local) environment and (indigenous and non-indigenous) livelihoods • Can support industries that have a great environmental footprint • Feasibility depends on climate change and the melting of sea ice in the Arctic
Social responsibility logic	• Workplaces and economic activities keep an area attractive and occupied (enable public and private services) • Improved traffic connections	• Destructive effects on Sámi culture. • Illegal process • Continuation of the injustices suffered by the Sámi
Regional development and integration logic	• Possibility to increase cross-border mobility • Strengthen cooperative relationships within the Barents Region (Prior to Russian invasion of Ukraine in 2022) • Increasing awareness of the Arctic	• Increased pressure on Sámi culture (sentiments that Sámi land and culture are being colonized by majority populations) • Overuse of the natural environment with an increasing number of tourists and newcomers
Security-of-supply logic	• Increased security of supply via diversity/existence of alternative routes	• Closeness to the Russian border is a problem • Economic feasibility (transshipment from Asia to Europe through the NSR) relies heavily on ice melt (that is, global warming)

are examples of northern indigenous communities lobbying for the construction of new transport infrastructure, concern about the damage that infrastructure could cause to the Sámi culture and traditional livelihoods has been a re-emerging theme (Kylli and Saunavaara, 2017). Therefore, the fact that the Arctic Corridor's harmful impacts on Sámi communities have been the dominating discourse in recent debates concerning the social responsibility and sustainability of the project is not surprising.

We argue that emotion and affect are sharply heightened by culture and history, which has manifested in Sámi leaders in Finland (to a lesser extent, Norway), who are voicing their opposition to the Arctic railroad (Nilsen, 2017). However, it must be emphasized that the Norwegian Sámi Parliament was in full support of the Sámi in Finland that the railway should not be built (Lægland 2021). As Greenwood et al. (2010) argued, such non-economic logics also play a part in decision-making. They identified three overriding elements that lead organizations to make non-market decisions: state and family, renewed interest in the role of geographical communities, and the importance of history for any understanding of the relationship between organizations and institutions. We argue that all three of these elements have been present in decisions concerning the building of the railroad between Rovaniemi and Kirkenes if we designate that the indigenous Sámi interests can be characterized as what Greenwood et al. termed "family." Indeed, the Sámi's arguments of traditional livelihoods tied to the land and its rootedness in history have strengthened Finnish Sámi's arguments and standpoints.

Although Taksami (2018) concluded that state officials, regional authorities, and the Sámi population have been inflexible in their perceptions, there are examples showing that attitudes have evolved. The relative importance of factors affecting the process in which the pros and cons of the railway are weighed have varied. The current situation speaks to the strengths of social and environmental sustainability discourses. However, it can be speculated whether non-market institutions and logics would have been strong enough to halt the railway project should the evaluations concerning economic feasibility be more positive. One informant criticized the Ramboll and Sitowise studies and argued that they were tendentious and written to make the Arctic railway project look unattractive. Taking no stance on the criticism of the reports, it can be considered whether pressure based on non-market logics affected the drafting of these assessments. The fact that these studies found the project economically unfeasible affected evaluations concerning overall sustainability and social responsibility, and this made it easier for political decision-makers to withdraw from the project.

The railway initiative can also be analyzed as a part of a wider discussion concerning the sustainable and responsible development of the Arctic. Finland's new Arctic Strategy adopted in 2021 strongly emphasizes climate actions, the carrying capacity of natural environments, and respect for the rights of indigenous populations. Space dedicated to the economic potential and infrastructural development of the Arctic seems less than in the previous strategy (Finnish Government, 2021). The Arctic railway is not mentioned in the Finnish presidency program for the Barents Euro-Arctic Council 2021–2023 (Ministry for Foreign Affairs of Finland, 2021). When the new Arctic Strategy mentions transport services and cross-border connections in northern parts of Finland, Norway, and Sweden, it refers to the possibility of connecting Finland to the Arctic Ocean and East Asia via the port of Narvik. While the desire to recognize Finland as a part of global supply chains through the Arctic is still present, the document does not comment on the current or expected future traffic conditions in the so-called Iron Ore Line.

As for Norway's Arctic Strategy 2021, there is no mention of an Arctic railway or references to local visions of building a railway connection from Rovaniemi to Kirkenes. However, in a speech on 3 February 2022, the newly elected prime minister of Norway, Jonas Gahr Støre, revived the focus on the High North and Arctic while citing the importance of a possible North Norway railway that would connect the country more tightly from east to west and not just from north to south. Støre underscored this will be a major focus of his government's forthcoming transport plan (Støre 2022).

Conclusion

The Arctic Corridor exemplifies a project in which discussions concerning international and global supply chains and their sustainability meet various conflicting interests and views at the local, regional, and national levels. Our findings reveal a dynamic range of different institutional logics involved in and guiding argumentation (either on behalf or against) concerning the project. The most influential are those that focus on (1) economic benefits, (2) rights of the Sámi people and their traditional ways of living, and (3) protection of the fragile Arctic environment. Due to the collisions and incompatibility of these logics, leading to the lack of SCM practices broadly considered responsible and sustainable, the Arctic Corridor project has become a new chapter in the long history of failed attempts to construct a railway line between northern Finland and an Arctic port town. The current study contributes to the SCM literature on social responsibility and sustainability by underlining the heterogeneity and conflicting interests within Arctic local communities. The lack of understanding or dismissal of local collisions can challenge the development of supply chains that might have global significance.

Finally, it is worth pointing out that the Arctic Corridor is not the only Arctic railway project recently described as a missing link in the global supply chain. The Belkomur project, a railroad connection designed to link Perm in the Ural Mountains with the Arctic port city of Arkhangelsk, also has a history that dates back to the beginning of the 20th century. Like the Arctic Corridor, this project has also been revitalized during past decades as part of discussions concerning the NSR and new global supply chains (Belkomur, 2007; Sukhankin, 2019). Therefore, comparative research on the different

Arctic railway projects (possibly including a plan to build a railway to Indiga on the coast of the Barents Sea (Nilsen, 2020b) or some case studies from North America) could provide an interesting analysis that elaborates on national and regional differences in the relationship between SCM practices, transport infrastructure, and sustainable development in the Arctic.

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5 Social Sustainability and Supply Chain Management in Tourism

The Case of Iceland

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Introduction

Supply chain management in tourism is complex. The tourist is a consumer of a variety of products from a range of suppliers that may or may not be coordinating their management of supply. The producers contributing to the supply chain may even have conflicting short-term interests. For example, an airline is interested in selling as many seats as possible while a destination developer may wish to control visitor numbers to sustainably manage their product development. Mismanagement of the tourism supply chain can lead to negative impacts on the environment due to high visitation and can also be socially and culturally disruptive. Conversely, mismanagement may also have negative economic impacts, such as many vacant beds and unsold meals at a destination.

This threatens the sustainability of the tourism supply chain in many ways; one of the consequences has been identified as overtourism. Iceland has been

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named as a destination suffering overtourism as the number of tourists exceeds the tolerance limits of residents, causing damage to nature and stress on the national infrastructure (Sæþórsdóttir et al., 2020). These concerns arose in the wake of an exponential growth rate of visitation after the finance crisis of 2008 when international arrivals rose from 480,000 in 2010 to 2.3 million in 2018 (Icelandic Tourist Board, n.d.). The Icelandic Tourism Board launched a nationwide survey of resident attitudes toward tourists and tourism in the year 2014 (Huijbens and Bjarnadóttir, 2015). This was the beginning of a longitudinal research program on residents' attitudes to and experiences with tourism and tourism development. The data from this longitudinal study forms the basis of this chapter.

Traditionally supply chain management (SCM) focuses on business, particularly business-to-business (B2B) relations. Due to the complexities incumbent in supply chain activities, which typically stem from the large numbers of actors involved in the network, as well as issues related to interdependencies, coordinating the activities along the chain is usually quite difficult to achieve (Holmberg, 2000). Much research effort has been directed toward business relationships in recent years, particularly with long-term collaboration between customers and suppliers in the supply chain (Guinipero et al., 2008). In the case of service supply chains, the matching and management of processes, information flow, service performance, and capacity are among the issues that make the network difficult to coordinate and, in the case of tourism, can lead to overtourism (Ellram et al., 2007). The chain metaphor refers to companies that are engaged in multiple business-to-business and customer relationships that form a network through which goods and services flow (Lambert and Cooper, 2000). This is, however, reductive as it leaves out the social context of the communities in which these chains operate. The social aspect is one of the dimensions of sustainability, but it has been overshadowed by environmental and economic perspectives (Mota et al., 2015).

Thus, there is a gap in our understanding of how SCM is perceived and experienced by residents, which is an important indicator of social sustainability in the supply chain. This study addresses this gap through describing what residents in different tourism destinations in Iceland have to say about the tourism businesses, tourism management, and tourism flows in their daily environment and analyzing it from an SCM perspective.

The chapter opens with a brief discussion of the SCM concept and social sustainability specifically before moving on to how this applies to tourism. The case of Iceland as a destination is presented with a focus on the results of a longitudinal research project on the social sustainability of tourism. This is followed by a discussion on how effective management of the supply chain relates to social sustainability of tourism in Iceland. In conclusion, implications are drawn about the usefulness of sustainable supply chain management to address problems such as overtourism and undertourism, and seasonality in demand for the destination Iceland.

Supply Chain Management

Over time, the focus of business managers has shifted from the individual business or enterprise to the external environment in respective industries. This refers to business-to-business (B2B) relations such as supply chains (Towers and Ashford, 2001). Business managers came to understand that being autonomous or self-sufficient was costly in terms of raw material production and inefficient for satisfying individual customer needs (Starbuck, 1992). It has now become clear that different suppliers should be considered integral to delivering quality for a business; that is, being able to give the best to your customers at the right place and at the right time. Firms have thus worked together as integral parts of a whole product rather than as autonomous components.

The term supply chain could suggest that only the acquisition of items from the supplier's side needed attention to make the chain effective. However, the concept refers to a flow that involves a focal company; suppliers to that focal company that can be described as upstream of it; and the customers of the company who are downstream. The supply chain involves both production and consumption, and, in a global market, the various links in that chain can take place in diverse corners of the world (Seuring and Müller, 2008a). Managing supply chains entails supervision of all the relevant actors: from the suppliers of goods and services, through the focal company that provides these goods and activities to the final consumers. This is encapsulated in a popular definition by Lambert and Cooper (2000, p. 66): "supply chain management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders". Towers and Ashford (2001) took a marketing approach to defining SCM, emphasizing the sustainable and long-term relationships and partnerships between producer, supplier, and customer that result from SCM. In their words, SCM is the strategic management of "procurement, movement and storage of materials, parts and finished inventory (and their related information flows) through the organization and its marketing channels in such a way that current and future profitability are maximized through cost-effective fulfillment of orders" (Towers and Ashford, 2001, p. 1).

These traditional definitions focus on economic sustainability, that is, the efficiency and profitability of supply chains but do not explicitly address sustainability in the SCM. Although considerable research now exists on sustainability in supply chains, mainly on environmental and economic aspects, few studies have addressed the social aspect of sustainability (D'Esunanio et al., 2019; Tsvetkova, 2020).

Sustainable Supply Chain Management

Firms increasingly incorporate the concept and measures of sustainability in their supply chains. This is both due to internal motivation to meet customer demand for sustainable products and services, and to meet external demands such as law and regulation of various aspects ranging from CO_2 emissions to labor rights. Sustainable supply chain management (SSCM) adds the criterion of sustainability to the processes that already exist in the supply chain by taking into consideration the impact that activities of individual actors in the chain have on the environment, society, and the economy in which they operate (Font et al., 2008). A growing body of research has addressed the issues and challenges that sustainable management seeks to attain in the supply chain (Tsvetkova, 2020).

The efficiency of the supply chain depends on a balance of supply and demand. The longer the chain and the wider the network of suppliers and consumers, the greater the risk of inefficiency due to a mismatch between supply and demand. Sustainability in SCM requires accountability on a wide range of parameters throughout the length of the chain. Seuring and Müller (2008b, p. 1700) define sustainability and supply chain management by introducing the interests of stakeholders in their definition as:

> *[…] the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all dimensions of sustainable development i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements.*

This definition gives a clear overview of both the upstream, which includes the actors on the supply chain from whom materials flow, and the downstream, which includes the actors to whom materials and information flow. It also captures the three dimensions of sustainability stated above, and emphasizes corporate governance (Beske, 2012, p. 374).

Seuring and Müller (2008a) composed an integration framework of the supply chain, where two orientations supplement each other; process orientation of managing for risk and performance, and product orientation of SCM for sustainable products. In this study, we consider SCM in tourism as a network of different actors. Previous research often focuses on the focal company's responsibilities in ensuring sustainability (e.g., Seuring and Müller, 2008b), and a theoretical gap emerges regarding the importance of other actors, particularly the residents of a destination who are understudied in this context. To truly assess sustainability, SCM needs to be considered through the three aspects of environment, economy, and community.

Environmental impacts of economic activity were a primary concern in the development of the concept of sustainability and measures to achieve it (Caradonna, 2017). In being seen as responsible for the sustainability of the entire supply chain (Seuring and Müller, 2008b), the focal company is usually charged with determining whether the actors in its supply network have measures in place to reduce environmental impacts, such as the reduction of waste products (Budeanu, 2009; Babu et al., 2016; Mani et al., 2016).

Most of the literature on supply chain social sustainability focuses on developing countries where equity, philanthropy, safety, health and welfare, ethics, and human rights are of primary concern (Mani et al., 2016). In developed countries, by comparison (Golicic et al., 2020), there is more faith in market forces adopting socially sustainable practices due to consumer pressure, but, at the same time, there are calls for government responsibility in the form of interventions to create incentives and framework to support such practices.

Beske (2012) claims that when firms identify their capabilities and cooperate through aligning their goals to make their supply chain sustainable, they gain a competitive advantage, and it is usually these firms who perform well on social and environmental indicators. Further studies are needed specifically to confirm this in terms of social sustainability, particularly in developing countries, and there is a call for the businesses to consider the interests of stakeholders who are not direct partners in the supply chain, such as the community in which the business operates (Golicic et al., 2020; Mani et al., 2016). Ahi and Searcy (2015) also emphasize the importance of identifying and addressing safety, welfare, and community related issues in sustainable supply chain.

Supply Chain Management in Tourism

Tourism is a multi-segmented service industry based on provision of experiences for the tourist consumer. In this industry, the flow of foreign currency into a country's economy is part of international trade and highly competitive, while lacking reliance on the export of goods (Minciu, 2008). An effective tourism industry requires the cooperation and commitment of many stakeholders to manage its supply chain. Although the term SCM has not been widely used in tourism research, it is implicit in conceptualization of the tourism system, which is more commonly used as a framework in tourism research and education (Morrison, 2018). To supply the required goods and services to tourist consumers, these stakeholders take the form of links in the supply chain which must be flexible to respond to increases and changes in customer demands. The well-known issue of seasonality in tourism destinations, that is the difference in demand between high and low seasons, can be addressed with the SCM concept. The seasonal fluctuation in demand reduces the economic sustainability of the tourism supply chain as the lack of demand in a long low season reduces the return on investment in tourism infrastructure, such as accommodation (Rantala et al., 2019).

The supply chain in manufacturing industries is conceived of, in a linear fashion, as a single stream flowing down a chain. This does not adequately describe the tourism supply chain (TSC). A critical difference is that it involves a network of tourism organizations as stakeholders involved in a series of diverse activities (Zhang et al., 2009). This network is wide and diverse, ranging from those organizations responsible for marketing, provision of flights and accommodation, to those that deploy local products and tours. It also involves stakeholders in public and private sectors, ranging from governments and large organizations to small businesses and individuals. Development and management of tourist destinations is based on this view of a tourism system where community relations, stakeholder collaboration, and conflict resolution are central (Morrison, 2018). The tourism supply chain management (TSCM) is, therefore, a very complex system, which increases the risk of a mismatch between supply and demand along the supply chains.

In tourism, the supply chain products are the goods and services consumed by tourists. Mirroring all supply chains, successful delivery of products relies on cooperation between stakeholders who have different duties and may also have differing objectives. An effective TSC supports sustainability of the industry, which is also important for financial advantage in a highly competitive commercial environment (Chen, 2009; Song, 2012; Szpilko, 2017). There is also a need to be mindful of the entire supply chain network, taking a holistic view of its management. This will always be challenging, especially given the "heterogeneous nature and fragmentations that exists within the tourism industry" (Sifolo, 2020, p. 129).

Sustainable Supply Chain Management in Tourism

As discussed, prioritization of sustainability in SCM initially followed a triple bottom line approach, adding consideration of "environmental, social and economic impacts of business activities" to the processes of supply change management (Font et al., 2008, p. 260). In the tourism literature, research encompassing sustainability and SCM theory has focused on the economic and environmental issues; more on manufacturing, such as the environmental aspects of manufacturing (Font et al., 2008), less on the service sector, and even less on the social, and particularly resident, aspects. This focus, until the last decade, prioritized distribution and marketing activities "without fully considering the whole range of different suppliers involved in the provision and consumption of tourism products" (Zhang et al., 2009, p. 345). In more recent shifts, SCM has been recognized as a sustainability-driven approach (Soratana et al., 2021), and its success in other sectors gives rise to optimism for its use in the tourism sector (Zhang et al., 2009).

As with the literature on SCM in other sectors, social, and particularly resident, sustainability is yet to be comprehensively addressed in the field of tourism. As discussed, achieving sustainability in products and services leads to customer satisfaction (Seuring, 2011). In tourism, the customer is the tourist, and the importance of understanding their satisfaction in SCM is addressed in some literature (e.g., Ghaderi et al., 2018). However, the resident is a stakeholder in TSCM as well, and their role in the sustainability of it remains understudied.

The prevalent focus on material goods in SCM may have blinded tourism researchers to how the concept can be applied to a glaring case of unsustainable tourism, that is, overtourism. An applied focus, such as through SCM, may bridge a gap between theoretical discourses on the subject and the operationalization of research and practice to address overtourism. This would answer calls for application of the critical turn in tourism studies (Bianchi, 2009; Bramwell and Lane, 2014), particularly regarding research on tourism sustainability (Moyle et al., 2021).

Social sustainability of tourism is multifaceted. Using Iceland as a case study, here we focus on the tourism industry's use of public goods and services created and maintained by taxpayers, such as road infrastructure, law enforcement and health care, as well as other natural and cultural resources. This can lead to the negative perception that tourism takes more than it provides, thus creating discord with residents and a mismatch between the demand for and availability of resources (Andereck and Nyaupane, 2011; Helgadóttir et al., 2019).

Tourism Management in Iceland

Tourism became the most important export industry in Iceland after the financial crash in 2008 (Icelandic Tourist Board, 2018). In 2018, Iceland ranked in third place of all the Organization for Economic Co-operation and Development (OECD) countries, after Mexico and Spain, in the proportion of tourism contribution to the total GDP of the country (OECD, 2020). International tourist numbers rose from half a million in 2010 to 2.3 million in 2018 (Icelandic Tourist Board, n.d.), with an annual increase between 19% and 39%. Tourism became the main economic activity and by 2018, the percentage of people working in tourism in Iceland compared to the whole economy was the highest of all OECD countries (OECD 2020). In Iceland, the short summer season, June–August, is traditionally the high season and the geographical spread of tourists is uneven, with the vast majority visiting in the South and South-West region (Sæþórsdóttir et al., 2019; Þórhallsdóttir and Ólafsson, 2017).

Despite economic optimism, the exponential growth rate of visitation in the decade after the financial crisis led to increasing media reports of alleged negative impacts of tourism on Icelandic nature and society (Helgadóttir et al., 2019). Iceland increasingly became associated with overtourism; that is, when the number of tourists exceeds the tolerance limits of residents and causes damage to nature and stress on the national infrastructure (Sæþórsdóttir et al., 2020).

The Icelandic government reacted by developing a high-level tourism task force composed of ministers responsible for tourism, finance, environment, and interior, in addition to the Icelandic Tourism Association and Icelandic Association of Local Authorities (OECD, 2017). The task force addressed the consequences of tourism on nature conservation, improved skills and quality of tourism services, and provided a foundation for managing tourism development more effectively (Ministry of Industry and Innovation and SAF, 2015). Since then, various programs have been launched to better manage the increased tourism numbers. The most prominent ones are the National Infrastructure Plan and the Tourist Site Protection Fund, both with a focus on infrastructure development (OECD, 2021). Most recently, the Ministry of Tourism launched a program labelled *Varða – Sites of Merit* that aims to promote and facilitate an integrated approach to destination management. The three main goals of the program address the triple bottom line of sustainability: conservation of nature and culture, high-quality service, and respect for residents (Ministry of Industry and Innovation, 2021).

Although these initiatives were initially largely concerned with environmental sustainability, they have also increased the focus on the social impacts of tourism and the increased presence of tourism in Icelandic communities. The Icelandic government's vision for 2030 is that tourism will have a positive effect on the local community and increase the quality of life of local people (Government of Iceland, n.d.).

Method

Our study is part of a longitudinal research program initiated by the Icelandic Tourist Board, which we have been engaged in via the Icelandic Tourism Research Centre and Hólar University. Resident attitudes toward tourism impacts and tourists in Iceland have been monitored since 2014 through national and local surveys as well as through interviews with randomly selected residents. The longitudinal research aims to monitor changes in attitudes and indications of pressure on residents and communities due to tourists and tourism in their local area. In its research agenda, the Icelandic Tourist Board measures how content the residents are about tourism in Iceland through national surveys and interviews (Icelandic Tourist Board, 2021). This longitudinal study provides an opportunity to build a timeline of resident attitudes, which is an important indicator of the social sustainability of tourism. The selection of communities for this study reflects both geographical spread in Iceland and different characteristics of tourism. Thus, some of the communities studied dealt with mass tourism, while others had to battle remoteness and lack of infrastructure.

The interviews were semi-structured, and the sample was randomly selected from residents who were 18 years or older and not employed in the tourism sector. The interview schedule included both items on attitudes to and experiences with tourists in the respondents' daily environment. The schedule also included items about the tourism industry and governance, covering private and public sector roles in tourism development.

In total, 108 interviews and three focus group sessions were conducted every second year from 2015 to 2021 in 11 communities (Bjarnadóttir, 2022; 2021a; 2021b; 2021c; 2021d; 2019a; 2019b; Helgadóttir et al., 2019; Bjarnadóttir et al., 2016). In reporting findings, the respondents are anonymized and only referred to by their place of residence, interview number, and year. The interviews were carried out in respondents' place of choice, except the interviews and focus groups conducted in 2020–2021, which were conducted online due to COVID-19 restrictions. The mean length of the interviews was an hour, all interviews were recorded and transcribed. They were analyzed independently based on content. First, the categories inherent in the interview schedule were considered and then new categories were formed through content provided by respondents in addition to what was in the interview schedule. Interviewer's notes and recordings were also used to gauge the affective content; that is, what emotions respondents expressed. This was taken as evidence of both attitudes and the relative importance respondents attach to items.

The national and local surveys were based upon structured questionnaires combining a variety of question formats and administered by telephone interviews to a randomly selected sample of residents 18 years and older. Descriptive statistics were used to summarize responses and compare attitudes to tourism impacts between different communities and regions, by demographics and stakeholders (Bjarnadóttir, 2020a). The survey instrument monitors changes in the residents' assessment of quality of life and their local way of life due to tourism in the prevailing tradition of social impact research.

Main Findings

Here we present the main findings from our longitudinal study that have bearing upon sustainability in the TSC. Figure 5.1 shows results on items from the national survey on resident attitudes that reflect residents' attitudes to the number of tourists in their daily environment. It clearly shows that across the years, and in both seasons (summer and winter), residents were overwhelmingly positive about the number of tourists with many thinking that the number was too low, particularly in winter.

Table 5.1 shows survey items that are of most relevance to SCM, addressing how tourism impacts issues such as access to services, traffic infrastructure, retail, housing, public space, and jobs. Respondents were asked to rate their level of agreement using a 5-point Likert-type scale (1 = strongly disagree to 5 = strongly agree). On a national scale, the surveys indicate that residents have positive attitudes toward tourists and tourism. Most Icelanders are satisfied with tourism in their community. Their opinions about the positive aspects of tourism have been consistent over time, and the economic perspectives inherent in opportunities for income generation, employment, and improved quality of life are prominent.

Resident satisfaction with increased provision of services such as more restaurants and cafés as well as events and attractions is linked with improvement in quality of life (Vogt et al., 2020). This is borne out by resident statements such as:

		Too many	Rather many	Moderate	Rather few	Too few
Attitudes to tourist numbers: summer	Iceland 2014	8%	21%	65%	5%	1%
	Iceland 2017	8%	19%	61%	10%	2%
	Iceland 2019	6%	13%	67%	13%	2%
	Iceland 2021	4%	11%	65%	16%	4%
Attitudes to tourist numbers: winter	Iceland 2014	1%	2%	48%	40%	9%
	Iceland 2017	2%	4%	49%	30%	14%
	Iceland 2019	1%	3%	52%	30%	13%
	Iceland 2021	1%	2%	39%	37%	21%

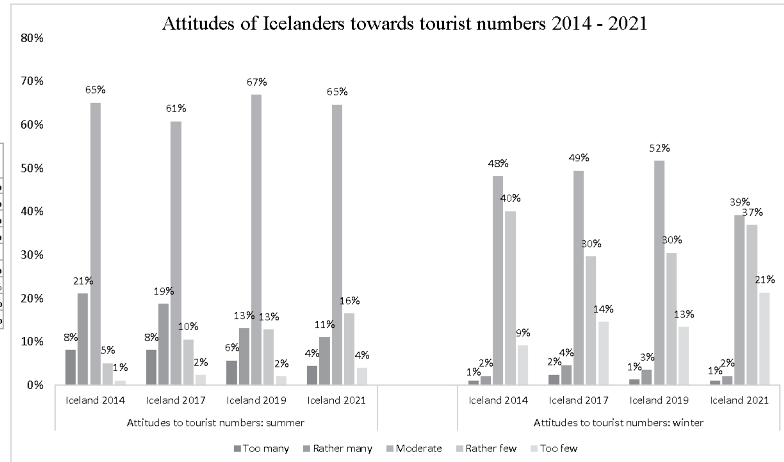

Figure 5.1 Attitudes of Icelanders toward tourist numbers during summer and winter seasons 2014–2021 (Based on sources: Bjarnadóttir, 2020a and Ministry of Industry and Innovation, n.d.).

Table 5.1 Selected items from the 2019 national survey of attitudes of Icelanders towards tourism and tourists in Iceland

Selected statements from 2019 survey	*Likert scale (1 = strongly disagree to 5 = strongly agree)*						
	1	*2*	*3*	*4*	*5*	*N*	*Mean*
Tourism has led to more diverse service in my community that I have used	8%	22%	12%	34%	24%	2.565	3,4
Tourists boost trade in my community	4%	12%	7%	42%	35%	2.566	3,9
Tourism increases job diversity in my community	2%	7%	7%	47%	37%	2.558	4,1
Tourists limit other people's access to service in my community	37%	43%	8%	9%	3%	2.568	2,0
I try to avoid certain places around the country that I know many tourists are to be encountered	20%	26%	10%	28%	16%	2.576	2,9
I am more afraid now than before to drive on the highway due to increased tourist traffic	12%	21%	10%	36%	21%	2.575	3,3
The tourism industry has limited the possibility for residents to acquire housing in my community	21%	37%	11%	23%	8%	2.398	2,6
Other industries in my community suffer for people being employed in tourism	28%	49%	11%	9%	2%	2.418	2,1
I think it is positive that people in my community can rent out their properties to tourists	8%	15%	17%	44%	16%	2.480	3,5

Source: Bjarnadóttir (2020a).

> *The biggest change is that we have a greater level of service here. We get more services and more choices because of the tourists. I think people forget that sometimes.*
>
> *(Husavik-04-2018)*

> *The community here is so small, we would never be able to have all this service if it wasn't for the tourists.*
>
> *(Akureyri-03-2021)*

> *In the past, local companies commonly closed down during the winter season and some probably still do that. […] But we get to act like the community is considerably bigger than it really is because of the tourists.*
>
> *(Egilsstadir-04-2018)*

A common thread in national surveys is that the most negative attitudes toward tourists and tourism are likely to be found among those who claim that tourist numbers are too high (Bjarnadóttir, 2020a). Those residents are also more negative in their attitudes to the impacts of tourism on the housing and labor market and daily life in their environment. The number of customers in local stores rises considerably during the high tourism season and, in some locations, residents expressed concerns about the strain of this on the stores and on themselves.

> *The grocery store is so small, it's often completely full and the parking lot is often full too. It's just awful. This is what irritates the locals the most. They are not necessarily annoyed by the people; the space is just so small that it does not carry this kind of traffic.*
>
> *(Myvatn-01-2016)*

In some cases, however, especially in very small communities, the economic viability of operating a grocery store or cafe in the countryside is dependent on tourist business, and residents recognize this. For some, this became particularly apparent during the COVID-19 pandemic when tourist numbers to Iceland were reduced by 75% (Icelandic Tourist Board, n.d.):

> *In a small community such as by lake Myvatn, the locals now understand that the tourist traffic has sustained the grocery store. As soon as the tourist traffic decreased, so did the service.*
>
> *(Myvatn-04-2021)*

Nevertheless, long queues on crowded summer days are still described by residents as a problem. Additionally, the residents point out that the retailers lack the flexibility to accommodate large numbers of customers during the peak tourism season and far fewer at other times in the year (Bjarnadóttir, 2021a).

> *When the grocery store here was built at the time, the question was, are we building this for the tourist traffic in the summer or the local community in the winter?*
>
> *(Myvatn-06-2021)*

> *A bus of 30 people comes to the supermarket and all bread, vegetables and all kinds of products disappear from the shelves. […] Of course, I'm sad that there's no more bread when I come to buy groceries, but in my opinion, the tourists are not to blame, it is rather the grocery store that is to blame.*
>
> *(Husavik-05-2018)*

Problems perceived by residents in the housing market have mainly been in connection with increases in short-term rental accommodation for tourists. This is linked to a shortage of housing for tourism workers and issues with tourist accommodation which, within the shared economy, moved closer to the residents than they previously experienced. The flip side of that coin was what residents referred to as a lack of "*real neighbours, people that you know" (Ísafjörður -02-2015)*, that is the social fabric of the community wears thin when residency is only short-term.

> *The sharing economy has raised the rental prices, which has led to that we have lost a lot of young people from the city centre to other parts of the city*
>
> *(101-Reykjavik-01-2021)*

> *It's annoying and disturbs the social pattern that there should only be guests in some of the houses in our neighbourhood, not families and kids.*
>
> *(Höfn-01-2016)*

> *I found out the hard way that it can be very difficult to get and keep a long-term rental apartment. It can be quite easy from 1st of October until 1st of March, but after that you might be thrown out because the apartment is turned into a short-term rental only over the summer.*
>
> *(Egilsstadir-01-2018)*

In some communities, problems have risen where residents have felt that tourism has become overwhelming. Some residents in heavily visited destinations experienced negative communication with tourism workers. For example, when a guide pointed to a resident as an example of an aspect of Icelandic culture and society the reaction was:

> *I don't want to be a prop for some guide who takes 15 people for a walk in my neighbourhood.*
>
> *(Reykjavik-02-2015)*

Another example was given of a guided group who blocked the street for other pedestrians and when a resident asked them to move, the group leader responded impolitely *(Ísafjörður 02-2015)*. In Reykjavík, a bus driver reacted negatively to the frustration of other drivers to his blocking of a residential street while letting passengers off the bus *(Reykjavík-04-2015)*. In some cases, complaints from residents with (repeated) bad experiences have led to improvements, which have reduced some of the pressure caused by tourism on residents. One such example is from Reykjavík city centre where bus traffic was restricted significantly in 2017 after opposition from the residents (Reykjavík, n.d.). As described by one resident:

> *These new regulations that banned the big buses from certain streets downtown made a huge difference in my neighbourhood. I'm very happy with the*

> *new arrangement. This thought had begun that there must be room for the locals as well the tourists.*
>
> *(Reykjavik-05-2021)*

In response to complaints from residents in Ísafjörður who shared their experience of wandering cruise tourists blocking traffic on the streets or looking through windows into people's homes, the municipality undertook a walking-path construction along the seaside. This construction raised hopes that pedestrian traffic would move off the streets and thereby reduce pressure on the locals.

> *There was great resentment amongst the residents. [...] But these paths were constructed, and I think the locals did have an impact. Our experience from living with this became revealed.*
>
> *(Ísafjörður-01-2021)*

On the other hand, the residents often reported taking the initiative to interact with tourists, both to offer help and advice and to socialize – although the willingness to do so declines when they experience their daily environment dominated by tourism.

> *You don't have to talk to tourists unless you want to. [...] Mostly you get asked for directions. [...] It doesn't happen very often.*
>
> *(Egilsstadir 01-2018)*

While resident attitudes toward economic and social impacts are mostly positive, they are less positive toward the increased pressure on nature and infrastructure such as the road system, public lavatories, the health care system, and the local housing market. In other words, increased tourist numbers resulted quickly in increased pressure on shared spaces.

The road system is one of the clearest examples of infrastructure shared by tourists and locals in Iceland. Residents expressed concern about drivers who lacked experience with road conditions in Iceland as well as their lack of consideration for other drivers. They also identified a need for increased maintenance and improvements of the road system due to increased traffic. In North Iceland, for example, the perceived lack of tourism infrastructure in a popular nature destination has been a cause of concern for the residents who doubt that the infrastructure can handle the current tourism traffic (Bjarnadóttir, 2021a).

> *There is no infrastructure to accommodate all of this [car] traffic. There are not enough lay-by parking areas along the main road so people stop wherever they see something [interesting]... The area is not ready to receive all these cars.*
>
> *(Myvatn 05-2021)*

South Iceland is one of the most visited regions in Iceland (Ólafsson and Þórhallsdóttir, 2018) and residents there expressed the need to deal with the traffic intensity and to make the roads safer. They emphasized that traffic safety should be a priority in the planning and infrastructure of the area, as improvements would significantly increase the satisfaction of residents in the area (Bjarnadóttir, 2021b; 2020b; 2018; Árnason and Kolbrúnardóttir, 2019).

> *There's heavy traffic [on the main road]. There are rental cars everywhere [...]. Cars pulling over on the side of the road, constantly slowing down by single-lane bridges or dangling on behind many cars in a row. Drivers staring at the glaciers out the car windows. [...] This is extremely dangerous.*
>
> *(Höfn-07-2021)*

Local dissatisfaction is also reflected in comments about what the residents feel needs improving in tourism management. Apart from comments on insufficient infrastructure, this was evident in references to tourism policy, strategy, and management. Residents perceive that the tourism industry and the public sector are not sufficiently prepared for the large influx of tourists; that tourism providers need to work even harder; and municipalities and the government must better prepare for the arrival of tourists, traffic management, and provision of information to tourists. This lack of preparation was perceived across many stakeholder links in the tourism supply chain in Iceland.

> *Everyone here wants to get the tourists to our town, and be busy working in tourism, but the tourist traffic does have side-effects. The local government has not focused enough on management. They are always responding to the predictable developments instead of being proactive, planning ahead and preparing before it was inevitable.*
>
> *(Husavik-01-2018)*

> *I've never liked this emphasis on cheap flights and mass tourism. It's not good for the environment, our little nation, our fragile land and nature. I think it is a symptom of greed to keep injecting people into the country.*
>
> *(101-Reykjavik-12-2021)*

> *There has been a bit of friction between locals and tourists, mainly because the infrastructure is not good enough. Tourists are stopping in the middle of the road and doing all kinds of unnecessary things because the infrastructure is not good enough. For example, The Icelandic Road Administration and signage. It should be so easy to prepare some instructions for people so that they already know enters the area how to behave. I think it was missing a bit up to it. The cause of friction is when people are not behaving the way they should.*
>
> *(Myvatn-09-2021)*

The findings of the longitudinal research undertaken in Iceland do not necessarily indicate a call from residents for fewer tourists, despite claims of Iceland as a prime example of overtourism (Sæþórsdóttir et al., 2020). Instead, they call for stronger tourism infrastructure to accommodate the visitor numbers and stronger destination management in terms of access to goods and services, as negative attitudes are connected to perceptions of the state of the infrastructure and tourism management (Helgadóttir et al., 2019; Bjarnadóttir, 2020a). Indeed, authorities and the tourism industry are strongly encouraged to take the initiative in organizing tourism infrastructure so that residents can be proud of the hospitality they see extended to the tourists visiting their communities (Helgadóttir et al., 2019; Bjarnadóttir, 2020a).

Analysis and Discussion

Mention of supply chains in relation to tourism in Iceland, either in practical or academic-based literature, is sparse and, where it does exist, discussion occurs in a rather ad hoc manner (e.g., Cook and Jóhannsdóttir, 2021). Discourse that directly, or comprehensively, addresses tourism in Iceland in terms of SCM theory is missing. This paucity of engagement invites further investigation to assist with sustainability of the tourism industry in Iceland generally, but here we employed it specifically with regards to social sustainability.

Our work contributes to the body of literature on social sustainability of tourism by foregrounding the role and satisfaction of residents in a destination where the supply chains are under pressure through overtourism, that is in Iceland. They reveal both resident concerns as well as the aspects of tourism with which they are satisfied. As we have seen, concerns arise about overcrowding at certain places and times, and there is a market difference between satisfaction with tourist numbers in high and low season, as shown in Figure 5.1. These issues point to a breakdown in supply chain management, which may be difficult to coordinate due to differing interests among stakeholders.

Residents are not normally considered consumers of tourism services. Indeed, as the definition of a tourist is someone who stays away from their daily environment for at least a night and up to a year (UNWTO, n.d.). In contrast, our findings have revealed that residents are also consumers of tourism products and services in, for example, sharing and/or competing for access to infrastructure such as roads, public facilities, and retail venues with tourists (Andereck and Nyaupane, 2011; Helgadóttir et al., 2019).

The case of tourism social sustainability in Iceland illustrates the following issues and topics in SCM that need attention: Tourism takes place in residents' daily environment, which means that their homes and even themselves can become an object of the tourist gaze. The longitudinal interview data indicate that tourism operators and workers, such as guides, need to pay more attention to how they represent the residents, as those may not feel comfortable as part of a tourism product supply. Related to this is that there were reports of conflict and negative encounters with tourism workers. It is the responsibility of the industry to ensure that their provision of services to tourists causes minimal disturbance to daily life for residents (Font et al., 2008).

Resolving infrastructure issues requires collaboration between public and private sectors for a more sustainable tourism supply chain. The residents' complaints about traffic congestion and housing shortage due to tourism traffic have in some cases resulted in improvements, as local authorities, who are responsible for planning and permitting business activities as well as regulating traffic, have addressed the problem. While many of the issues require private and public sector coordination to resolve, some are clearly the responsibility of the private sector supply chain. Shortage of goods in retail that residents in highly visited rural areas had experienced in high tourism season shows poor supply chain management, which leads to dissatisfaction for tourists and residents alike. Increased access to services and attractions such as restaurants, cafés, and attractions through tourism development does, however, increase resident quality of life with a lively and attractive daily environment. The tourism supply chain is therefore important for resident satisfaction.

While resident dissatisfaction often stems from the competition with tourists for goods and services, the interviews revealed that another reason was the concern for the safety and well-being of the tourists. Residents contribute informally to the hosting of tourists in their daily environment as a destination. Interaction with tourists, welcoming and assisting tourists, positively acknowledging their presence, is an intangible and invaluable contribution to the tourism supply chain. Our study shows that residents have strong opinions and are well informed about tourism in their daily environment and are willing to contribute to tourist well-being both directly and indirectly through demands to public authorities and businesses for better tourism management.

Conclusions, Limitations, and Future Research Suggestions

The implications of this study are numerous across sectors of research, industry, government, and community – all of which are important links in the network of tourism supply chain management (TSCM). As to previous research, we have identified a lack of studies and, consequently, of literature and understanding on TSCM in Iceland, and of the relationship between social sustainability and SCM more broadly. Similarly, greater understanding of these relationships in developed countries is needed, and thus our study contributes to this literature.

Practically, our findings are of importance to the tourism industry, government, and community. As we have identified, residents have an ambiguous placement in the supply chain network of the tourism industry, where they can be suppliers of goods and services for tourists but also share services such as road and shopping infrastructure with tourists. Their satisfaction with these services is important for the sustainability of the chain, and thus their varying placement along the chain needs to be taken into account.

Where dissatisfaction occurs, residents look to the industry and governments to address the issue. This highlights the need for the government to be positioned as a vital component of the TSC, and the need for it to work effectively with other stakeholders as links in the chain. In recent years, faced with rapid tourism growth, the government in Iceland has increasingly paid attention to tourism and developed new tools for assessing tourism impacts. This development needs to continue and to further include the vital role of residents. Finally, the study has implications for the local community, composed of the residents in a tourism destination, for whom tourism can affect their quality of life, by highlighting that they actually have a role in the supply chain of this industry.

Our study is the tip of the iceberg in terms of exploring the relationship between social sustainability and TSCM in Iceland. Globally, this tip is only slightly bigger. Most importantly, we can see that SCM theory is very relevant but seldom applied to analyze tourism sustainability. The limitation of this study for TSCM theory is that it focused broadly on social sustainability of tourism, but the value is that it shows how future SCM research can reveal issues that should be addressed for more socially sustainable tourism.

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6 Social Responsiveness within the Russian Arctic Supply Chains

Evidence from Isolated Communities through the Anthropological View

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> *These people who live on the island and coastal territories of the North...we don't know anything about them at all. When you start talking to them, it turns out that this is a completely different universe; even if they have a little something to do with Arkhangelsk, everything is different there.*
> Representative of the Arkhangelsk River Port

Introduction

Research on responsible supply chain management (SCM) has gained considerable attention recently. Being socially responsible means that an individual or social entity complies with not only economic but also moral duties, ethical and social standards, which are partially determined by stakeholder demands (Maignan and Ferrell, 2001; David et al., 2005). Active means of social responsibility and a way to manage and respond to societal needs and stakeholder demands (Crampton and Patten, 2008) can be identified as so-called social responsiveness, which is often referred to as "social responsibility". In the broad sense of the term, responsiveness means that an individual or entity should take explicit and proactive actions to respond to and deal with stakeholders and social issues (Waddock, 2004). Klassen and Vereecke (2012, p.103) define social issues in supply chains as "product- or process-related aspects of operations that affect human safety, welfare and community development". So, social responsiveness seems to contribute to activities that focus on responding to societal needs in a way that improves the quality of life and environment for those around them.

Within SCM studies, much has been written about the variety of relationships – but often from a restrained and technical viewpoint (Price,

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1996). Further, most studies on social responsibility in SCM have focused on purchasing decisions due to suppliers' incorrect behavior, including ethics and safety conditions, thereby emphasizing supplier relationships and supply management practices as a challenge to enhancing social performance and sustainability (Carter and Jennings, 2002; Boyd et al., 2007; Ciliberti et al., 2008). In this study, we suggest that the most fundamental challenges are social rather than technical. Groups of people can deal with a number of challenges regarding communication, cooperation, and competition by developing detached cultures. Within these cultures, roles and relationships evolve to maintain the structure and function of an entity or whole community. At the same time, individuals or groups of people in a particular cultural context are inevitably influenced by the cultural atmosphere they live in. Thus, our study's main motive is to analyze social responsiveness initiatives in SCM and *explore how local residents in isolated northern settlements of the White Sea respond to social needs and develop socially responsible supply chains in Arctic local communities.*

In doing so, this study represents an empirical case of the evolvement of social responsiveness initiatives in the existing SCM practice in two different groups of rural, remote settings in the Russian Arctic: island and coastal settlements of the White Sea. This qualitative exploratory study utilizes the anthropological approach of observing the behavior of local residents who assume the role of supply chain managers in these rural remote settings. This approach is proposed to better understand the cultural context of the day-to-day lives, activities and motivations of local residents who make supply chains work and of locals who rely on them.

The remainder of this study is organized as follows. The following section provides an overview of the extant literature on social responsibility within SCM and the anthropological view. We then present our methodology and the data collection process, followed by an analysis of data and findings. Next, the findings are discussed in light of our conceptual framework and anthropological approach. Finally, the study concludes with theoretical and practical implications and provides insights for future research.

Social Responsibility and Social Responsiveness in SCM Literature

Social responsibility issues are commonly considered through the core characteristics of corporate social responsibility (CSR). An early definition of organizations' social responsibility dates back to Bowen (1953, p.6), who defined it as the obligation to

> *pursue those policies, to make those decisions or to follow those lines of actions that are desirable in terms of the objectives and values of our society.*

Later, Davis (1973, p. 312) defined CSR as

> *the firm's consideration of and response to issues beyond the narrow economic, technical and legal requirements of the firm which results in accomplishing social benefits along with the traditional economic gains which the firm seeks.*

Much of the literature deals with socially responsible practices adopted by individual firms to enhance and ensure social, environmental, and economic attitudes and behaviors (Ciliberti et al., 2008). However, SCM practice links various organizations from different fields of business with multiple goals and ways of managing, and CSR initiatives should be transferred beyond the individual firm to act "as a multiplier effect for social responsibility" (Preuss, 2000, p.143). Along the whole supply chain, a common understanding of social responsibility and social issues becomes a significant challenge for all supply chain partners, including suppliers, manufacturers, customers, and society or local communities. Thus, the social aspect concerns fair opportunities and involvement inside and outside the community, not only the boundaries of an individual organization. However, the incorporation of CSR-related parameters in the SCM field struggles to measure the social efforts of supply chain agents and members (Slaper and Hall, 2011; Servaes and Tamayo, 2013) due to the lack of comprehensive indicators (Yawar and Seuring, 2017).

Further, Yawar and Seuring (2017) proposed that responsible supply chain actions initiated by stakeholders and accepted by other supply chain members to address social issues can be grouped into communication, compliance, and supplier development strategies. The challenge is that what constitutes social issues differs significantly among different stakeholders because they constantly adjust and depend on the conditions in which a firm operates (Klassen and Vereecke, 2012; Hoejmose et al., 2014). Moreover, SCM's integrative and cooperative nature can suggest a particular influence on socially responsible activities, which may not be reflected in the more traditional private sector (Spence and Bourlakis, 2009), especially concerning society's needs (Tsvetkova, 2020). The shift to supply chain responsibility requires that all supply chain members not only strive to achieve social and environmental benefits besides economic gains but also acknowledge different approaches to ethics by various organizational forms within the supply chain (De Vlieger, 2006; Spence and Bourlakis, 2009).

These social issues can be understood through another concept of social responsiveness closely related to social responsibility. Social responsiveness is defined as stakeholders' intention to contribute to society's welfare and betterment. While social responsibility refers to the ethical/moral obligation and duty of an individual or entity toward society, social responsiveness is the manner in which an individual or entity responds to social needs. Social responsibility and social responsiveness are two factors enabling an individual and/or group of people to benefit society's development. Thereby, social responsiveness reflects on the social or human dimension issues, which have received scarce attention in SCM literature (see Tsvetkova, 2021). In this light, SCM practice is also viewed as consistent patterns of human actions that perform ongoing operations, produce outcomes in day-to-day endeavors, and envision new forms of collaboration among supply chain members (Tsvetkova, 2021). Despite both topics – SCM and CSR – having been increasingly observed in the literature, little attention has been paid to understanding the possible effects of integrating SCM and social responsibility in local communities and the needs of society (Pagell and Shevchenko, 2014; Tsvetkova, 2020).

This study addresses the above-mentioned shortcomings in the literature on incorporating social responsibility in SCM practice and its influence on supply chain integration problems, by applying an anthropological view, as outlined in the subsequent section.

Cultural Settings of Supply Chain Management: The Anthropological View

From the anthropologic perspective, this study deals with the cultural aspects of social action to gain a better understanding of praxis and conscious action by local residents who develop and maintain food supply chains and of those who rely on them.

Culture is an essential part of SCM, as supply chain members operate in cross-cultural contexts (Murphy et al., 2019). Further, relationship issues, in terms of both structure and communication and other problems related to integration efforts, can be attributed to cultural differences (Klaus et al., 1993). Culture can be defined as a common set of shared values, beliefs, attitudes, and norms that characterize a group of people (Hofstede et al., 2010). This means that culture embraces all aspects of society and thus affects the behavioral aspects of how people act and think in everyday life.

Culture can be seen as a separate system of ideas or "an ordered system of meaning". Geertz (1973, p. 145) argued that culture becomes "the fabric of meaning in terms of which human beings interpret their experience and guide their action". Foster (1994, pp. 370–371) added that "cultures are systems of symbolic meaning which can not be separated from the process of social interaction". This suggests that the meaning of culture can barely be separated from the person and his/her intentions. Most anthropologists agree that "finding meaning" is vital in cultural analysis.

Most frameworks adopted in current research on organizational culture have been based on the competing value framework of Cameron and Quinn (2006), cultural intelligence, and other operationalized frameworks for SCM research (El Baz et al., 2022). However, such cultural frameworks insufficiently delineate motives, roles, and interactions between the organization's members (Marshall et al., 2016), as they oversimplify culture. For anthropologists, culture cannot be divided into several elements or different values to be measured and quantified. In contrast, cultural context concerns the diversity of values, roles, and relationships that emerge to maintain the organization's structure and function through symbols and meanings in an integrated manner (Baskerville, 2003). According to Price (1996) and El Baz et al. (2022), SCM research can extend its scope by learning from cultural anthropology.

Method

Research Design

A qualitative in-depth single case was chosen to explore social responsibility practices in SCM within the Russian Arctic. Case study research is an appropriate approach, as it represents the interchange of theory, structures, and events. Moreover, it allows the investigation of a specific phenomenon within its specific contextual settings through different sources of knowledge (Seuring, 2008), interpreting them "in terms of meanings people bring to them" (Denzin and Lincoln, 2005).

The case represents two groups of rural, remote settings in the Russian Arctic: island settlements (see Figure 6.1) and coastal settlements (see Figure 6.2) of Primorskiy district in the Arkhangelsk region. The geography of these settlements includes islands in the lower course of the Northern Dvina River and the White Sea coast around Dvina Bay, namely the Onega Peninsula.

Data Collection

We used multiple data sources, including field research and observations, 50 semi-structured, in-depth face-to-face interviews with local residents and authorities of 13 rural settlements, as well as archival materials.

Anthropological data were acquired via field studies performed by the second author, who resided in the respective rural settlements for several weeks and days in 2019 and 2021. Field studies on the settlements on the Northern Dvina delta islands (see Figure 6.1) were conducted during four trips in the period June–July 2019. Each trip's duration was two to three days and "tied" to the main local river passenger transport schedule. Further, field studies on settlements on the White Sea coast (the Onega Peninsula) (see Figure 6.2) were conducted as part of the scientific expedition in August–September 2021. Data collection was challenged by problems due to the difficult and scarce transport accessibility of these areas (see Figure 6.2 and Picture 6.1). Consequently, field research on these remote northern territories in the Arkhangelsk region has not been conducted for the last 20 years (Batyanova, 2013).

To conduct this field study, the second author joined a group of pilgrims from the Arkhangelsk diocese who visited rural settlements, performed divine

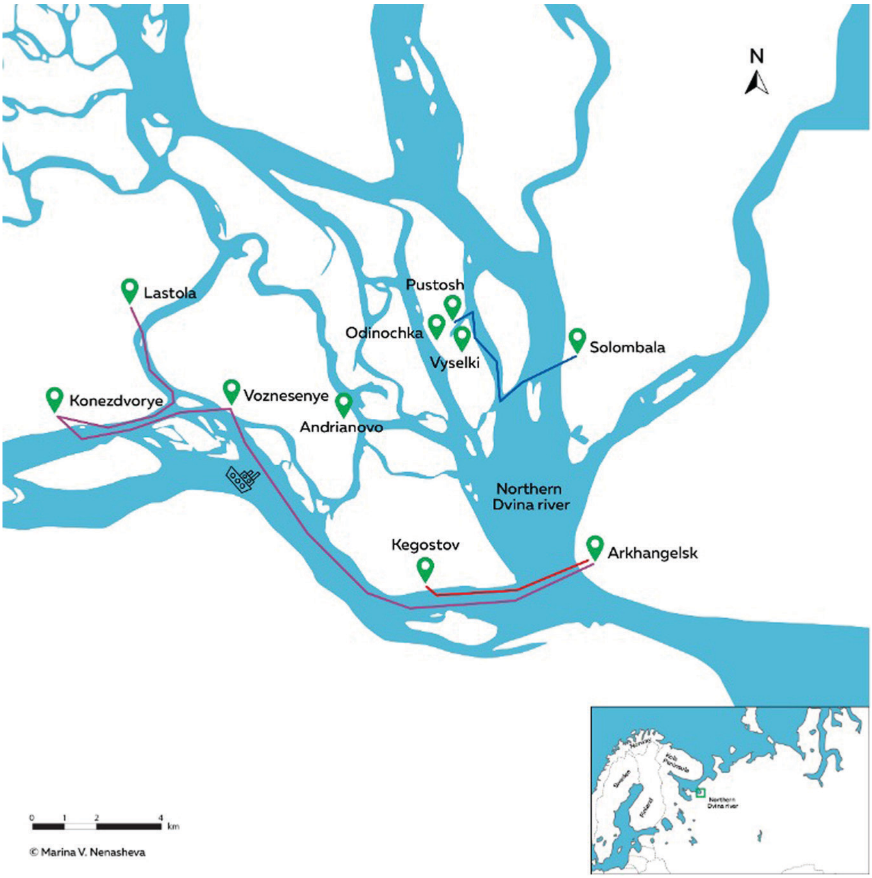

Figure 6.1 Map of settlements located on the Northern Dvina delta islands (*Source*: the second author's elaboration).

services in remote villages, and examined the technical condition of religious monuments. In most cases, the locals helped move between the villages on their boats, e.g., as shown in Picture 6.1, the journey from Pushlakhta to Letnyaya Zolotitsa on a small motorboat took about three hours. The purpose of both field studies was to investigate and collect data on the day-to-day lifestyle, economic and social activities, and motivations of locals who keep food supply chains moving and those who rely on them.

This primary observation data of residents who organized and maintained food supply chains and of locals who rely on them was combined with insights from the anthropological approach to explore the cultural context of local food supply chains. This made it possible to identify and describe individual and collective features of their lives, social perceptions, and expectations regarding needs, prospects, and acceptable means of rural existence in response to several

Picture 6.1 Motorboat used for traveling from Pushlakhta to Letnyaya Zolotitsa (Photo taken by the second author).

economic and social challenges. Further, field research was conducted in real-world and natural settings, so we could gain a deep understanding of the research phenomenon, due to the proximity to it. Hence, our study is extensive, thorough, and accurate.

Due to the small size of the local population and the region's limited accessibility, the selection of respondents and the interview process were carried out by the "snowball" method. This meant respondents being selected at random (on the streets, in grocery shops, at the post office, in the local administration) and then suggesting other potential candidates for interview. Consequently, 50 residents, aged 25–82 years, were interviewed during field research. Of particular interest were respondents involved in developing and maintaining local food supply chains and the evolution of social responsibility practices. All 50 interviews (performed by the second author) were hand-written and recorded with the consent of each respondent to be transcribed later. Interviews were conducted in Russian and translated into English. Interview data mainly included stories about residents' lives in the Soviet and post-Soviet periods, the history of the respective rural settlements, food delivery and procurement, climate change, and challenges for survival in the North. To ensure

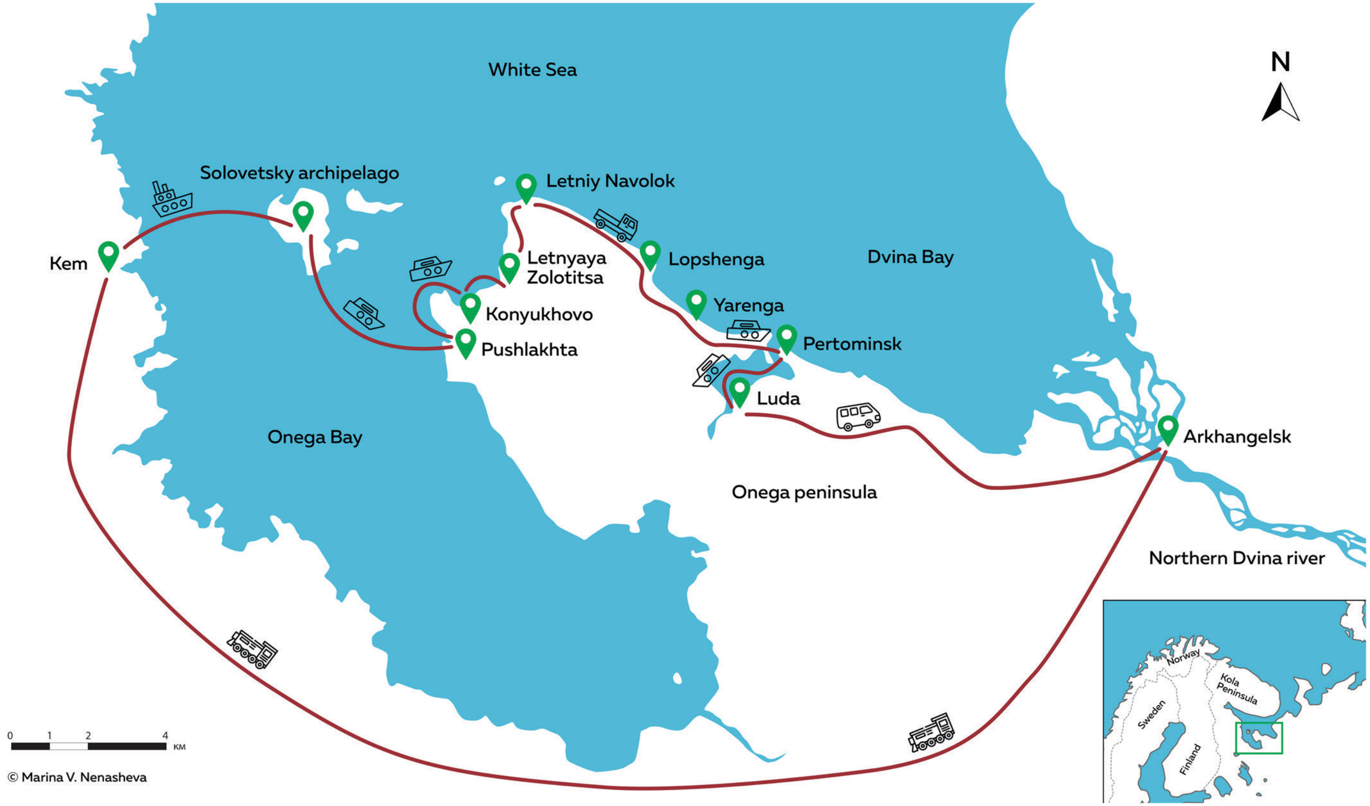

Figure 6.2 Map of settlements located on the White Sea coast, the Onega Peninsula (S*ource*: the second author's elaboration).

Table 6.1 Data on rural localities, including economic infrastructure, population, and interview numbers in each locality

#	*Islands and coastal settlements in the Arkhangelsk region*	*Economic infrastructure before the 1990s*	*Distance from Arkhangelsk (km)*	*Permanent population as of 1 January 2021*	*Current economic status*	*Interview numbers*
Island settlements in the Northern Dvina delta						
1	Pustosh	Agriculture	4.4	221	Subsistence economy, tourism, museums	R1, R2
2	Vyselki	Agriculture	6	25	Subsistence economy	R3, R4
3	Odinochka	Agriculture	6.5	30	Subsistence economy	R5, R6
4	Voznesenye	Agriculture	12,8	412	Municipality, museum, agriculture, subsistence economy, tourism	R7, R8, R9, R10, R11, R12, R13, R14
5	Andrianovo	Agriculture	11	23	Agriculture, subsistence economy	R15
6	Lastola	Agriculture	38	432	Subsistence economy, tourism, museums	R16, R17, R18, R19
7	Konezdvorye	Agriculture	33	31	Subsistence economy, tourism	R20, R21, R22
Coastal settlements in the Onega Peninsula (the White Sea)						
8	Pushlakhta	Agriculture, fish farm	191	31	Agriculture, subsistence economy	R23, R24, R25, R26, R27, R28, R29
9	Letnyaya Zolotitsa	Agriculture, fish farms, airport	310	102	Agriculture, extraction of White Sea algae, sea seal hunting (up to 2010), tourism, subsistence economy	R30, R31, R33, R34, R35, R36
10	Letniy Navolok	Agriculture	268	5	Subsistence economy	R37

11	Lopshenga	Agriculture, fish farms, airport	234	187	Municipality, museum, agriculture, subsistence economy, tourism, fishing collective farm	R38, R39, R40, R41, R42, R43, R44, R45, R46
12	Yarenga	Agriculture, fish farms	216	74	Museum, tourism, subsistence economy	R47
13	Pertominsk	Agriculture	186	245	Municipality, tourism, agriculture, subsistence economy	R48, R49, R50
	Total number of interviews					**50**

ethical practice, the respondents' real names were encrypted as R1–R50 (see Table 6.1).

The data obtained during field research were supplemented with archival materials, including historical information about the development of the island settlements on the Northern Dvina delta and coastal territories of the White Sea; ethnographic data and statistics; official documents about navigation and its features along the Northern Dvina and in the White Sea; scientific reports on climate change; social information from the media; and official sources about the delivery of food and vital medical supplies to the respective rural settlements.

Data Analysis

A content analysis was conducted to evaluate the meaning of the great amount of data, collected from multiple sources. To gain a deeper understanding of the evolvement of social responsibility practices in food supply chains, we located the phrases "food procurement" and "food delivery" in the interview data and archival materials. Then, we identified other words or phrases that appeared next to them (such as survival, social issues, transport challenges, culture, and isolation) and analyzed the meanings of these relationships to better understand the intentions and goals of residents involved in developing food supply chains. To obtain more detailed data, we also coded for other categories, such as local communities, disruptions in food transportation, and residents' mobility. Following our coding rules, we examined each data source in our sample. We recorded the characteristics and challenges of food supply chains in the respective rural settlements, along with all words and phrases related to social responsibility that were used to describe them. Once coding was complete, the collected data were examined to find patterns and draw conclusions in response to our research question. Then, we discussed our interpretations of the findings.

The content analysis approach helped analyze communication and social interaction without our direct involvement, as researchers, allowing independent and transparent findings to be obtained. At the same time, content analysis depends on the availability and accuracy of recorded data (Tangpong, 2011). So, to support our interpretation of data, respondents were repeatedly questioned for cross-checking and to grasp the true meaning of their words behind the emotions, voice tones, repetitions, and different rhetorical forms of the spoken Russian language.

Case Presentation

Historical and Contextual Settings of Rural Settlements in the Arkhangelsk Region

Historically, these lands have been inhabited since the 12th century as a result of Novgorod colonization and the emergence of monasteries. Fishery was traditionally the primary means of subsistence and survival in these White Sea coast settlements. During Soviet times, settlements on these lands received huge state support, since the development of the Arctic was a priority. A special socio-economic policy was pursued in the northern territories, which included higher wages compared to other regions, economic benefits, and additional vacation days, making the Russian North attractive for work and life. The economy of the island and coastal territories of the Arkhangelsk region was primarily based on agriculture; vegetables were grown and dairy products were produced and supplied to Arkhangelsk, the nearest regional center and major port, and other regional towns. Timber production and fisheries were also widely developed to be further exported.

After the collapse of the Soviet Union in the 1990s, there was a break in economic ties between the regions, which led to extreme deterioration in the local population's living standards and an outflow of people from northern areas. As one respondent stated:

> *In the nineties, rural villages began to gradually empty, and soon several houses were boarded up. Even today, a rare tourist can reach us, and their first impression is an empty, silent village. But no, not everyone left the ashes... (laughs)*
> *(R10)*

According to a local resident, there are up to 49 villages on the islands in the Northern Dvina delta, with a population of 1,896 people; however, population recordings have not been conducted since 2014 (R1). Further, according to the All-Russian Population Census of 2010, 504 people live on the White Sea coast; moreover, they consider themselves Pomors.

Despite dwindling considerably, these settlements retain their primary historical meaning and archaic features today but have lost their former economic significance (see Table 6.1). Traditional activities of the islands' and coast's inhabitants are fishing, hunting, picking, and harvesting berries and mushrooms. In Soviet times, agriculture was the main economic activity. However, many collective farms went bankrupt with the transition to a market economy. Today, there are only small private farms in some localities that develop agriculture, fishing, and the extraction of White Sea algae (see Table 6.1). In Pushlakhta, residents prepare firewood for the needs of the Solovetsky Monastery. In each explored settlement, except for Letniy Navolok, which has a permanent population of five people, there is a small shop, and some have a post office.

Regulatory Change as a Prerequisite for a New Reality for Rural Settlements

In the former Soviet Union, the viability of these northern settlements was mainly supported by such a phenomenon as Northern Delivery, a set of annual federal measures to provide the population of the Russian High North with basic goods for the long, harsh polar winter. Up to 70% of the Northern Delivery was fuel, followed by food, medicines, and other goods. The most critical reasons for Northern Delivery were the absence of its own production base, the remoteness of the main industrial areas, and the lack of roads and railways. In these conditions, the only possibility was the centralized purchase and transportation of goods from southern and central Russia to the High North, which was the federal government's responsibility.

After the collapse of the Soviet Union, Northern Delivery experienced serious difficulties and, subsequently, a radical transformation (Alekseev, 2013; Vasiliev, 2018). With the transition to a market economy, the centralized planned supply system for the northern territories was destroyed. The Russian government tried to transfer the functions of Northern Delivery to other actors. However, due to their institutional weakness, they were not ready to manage this supply phenomenon. This led to a growing number of operators involved in the Northern Delivery system, resulting in regular failures in northern life support (Vasiliev, 2018). As a result, during the market reforms of the 1990s in the Russian Federation, there were multiple declines in the total volume of goods delivered to remote northern settlements.

In 2001, the Russian government approved a new Northern Delivery scheme, according to which the responsibility for financing and ensuring the delivery of goods was assigned to regional and municipal authorities. Regional authorities determined the supply chain operators but could not provide sufficient control over them due to institutional and economic issues. From 2000 to 2004, the responsibility for Northern Delivery was transferred to oil companies. So, northern regions and oil companies became the main operators of Northern Delivery in the Russian High North, with the latter financing this supply system. According to official data, about 1.5 million tons of petroleum products, 3–4 million tons of coal, and more than 500,000 tons of food were delivered to the northern regions at the beginning of the 2000s.

Since 2005, the responsibility for ensuring the delivery of goods to the northern territories has been entrusted to the regional administrations. Further, the responsibility for preparing, determining the volumes of necessary goods (e.g., fuel, food, medicine, etc.), organizing bidding and concluding contracts with suppliers of these goods, financing purchases, and deliveries was assigned to the municipalities. An inevitable consequence became the deterioration of the northern settlements' life support, as well as a significant increase in the cost of goods delivered to the North. In general, this meant that from 2005, the Northern Delivery system was excluded from state-centralized financial support and, in fact, ceased to exist.

Until now, the Russian government has not succeeded in reconstructing or renewing an effective Northern Delivery system, the notion of which has recently been used only in the media and specialized literature. The current interdepartmental fragmentation and lack of a clear definition of the "Northern Delivery" notion and its mechanisms to meet contemporary conditions make it almost impossible to create a single mechanism to ensure a centralized process for extremely remote areas of the Russian High North. Consequently, the current Northern Delivery system is subject to serious criticism from local authorities despite repeated recent attempts to improve it. The most critical factors for this deplorable state of affairs are: (a) lack of a unified, systematic approach to Northern supply management and to monitoring the goods delivery process, (b) lack of assessment of the volumes and range of supplies, (c) the huge number of stakeholders involved in Northern supply delivery with different economic interests complicates regulatory mechanisms, (d) lack of coordination and coherence in actions of stakeholders involved in Northern supply management: e.g., federal and regional authorities, commercial companies, etc. (Vasiliev, 2018).

Insufficient transport infrastructure development is another critical factor affecting the Northern supply management system. A feature of most northern territories is sparse transportation networks and the absence of rail and road communication. In Soviet times, small aircraft and water transport, subsidized by the state, played an important role in Northern Delivery. By the end of the 1990s, the Russian North boasted about 1,300 airports. In addition, state atomic icebreakers regularly escorted convoys of vessels along the Northern Sea Route to supply remote northern settlements. However, after the transition to market conditions, these delivery types lost state funding. According to experts, more than 80% of airfields intended for the needs of small aircraft rapidly deteriorated, with erosion and roots breaking up the runways. Further, many shipbuilding and shipping enterprises went bankrupt. State support for passenger transportation and the delivery of industrial and food products was significantly reduced (Nenasheva and Olsen, 2018). As a result, over the past 20 years, many issues accumulated in the water transport sector: poor waterway conditions, insufficient port infrastructure, the “aging” fleet, and state regulation decline of water traffic management (Nenasheva and Olsen, 2018). To date, the most critical factors in the Russian High North are the absence of its own production base, remoteness of the main industrial areas (thousands of kilometers), and absence of large/medium trading enterprises that could perform the functions of regional wholesale intermediaries, as well as concentrating most of the commodity mass at the time of the opening of the navigation season.

As one respondent stated:

> *Northern settlements are thousands of kilometers away from the main industrial areas... This makes it difficult and expensive for private entities to deliver goods, even in summer. So, there is no particular growth of entrepreneurs to replace the state provision with essential products.*
>
> *(R23)*

The funds earmarked for financing Northern Delivery are used to pay for one-time deliveries by air at high tariffs.

The settlements we consider in this chapter have specifically been challenged by stopping centralized supplies in line with Northern Delivery. This led to significant economic and social issues since the northern municipalities could not find a solution to organize the centralized procurement and delivery of goods exclusively from the local budget (Alekseev, 2013).

Geographical Proximity and Complete Transport Isolation

It is surprising that, despite their proximity to the main regional center and main port of Arkhangelsk, settlements on the islands of the Northern Dvina delta and even on the White Sea coast are extremely isolated. This is due to limited transport accessibility. There is no all-season road network or transport infrastructure, only scarce opportunities to travel here. As several respondents observed:

> *Waterways play an important role for us, the rural residents. They are very helpful in passenger transportation and food delivery because there are no bridges and roads between the settlements and Arkhangelsk.*
>
> *(R1–R22)*

During the navigation period, from the beginning of May to the end of October, the island and coastal territories are connected to Arkhangelsk by the regular river and sea transport and in winter by ice roads, which locals call the "roads of life" (Olsen et al., 2021). There is also a rare air connection with Letnyaya Zolotitsa and Lopshenga settlements, but this transport is not used for product deliveries because of high transportation costs.

At the same time, most households have boats: small rowing and motorboats that locals use to visit neighbors, relax, travel for mushrooms and berries, and/or go fishing. As one respondent noted:

> *These small boats are, for the locals, like a car for city people.*
>
> *(R6)*

According to numerous respondents, shipping plays an essential role in the livelihood of the inhabitants of the islands and the White Sea:

> *If there were no shipping here, we would have died out long ago!*
>
> *(R10, R13, and others)*

During the Soviet period, the regularity and frequency of passenger traffic was supported by the state. As one respondent said:

> *During Soviet times, the passenger boat used to run every half hour between the island settlements and Arkhangelsk. The coastal settlements were also*

> *connected with Arkhangelsk by regular sea routes. But after the collapse of the Soviet Union and the crisis of the 1990s…(sighs)… many locals left for cities. River and sea transportation became unprofitable and today is supported by subsidies from the local budget.*
>
> *(R14)*

Now, there is twice-daily river transportation to the settlements in the Northern Dvina delta. During the navigation period (May to October), the ship "Belomorye" carries passengers once a month on routes of the White Sea, including the coastal settlements on the Onega Peninsula. Often,the "Belomorye" is delayed or postponed due to storms, bad weather, fog, and ice conditions despite the voyage schedule (R1, R16–R17).

A significant issue is the seasonality of water transport, whose availability is limited to the navigation period. Traditionally, the navigation period on the northern rivers lasts six months. However, conditions have recently been affected by climate change. Most respondents emphasized that, if earlier winters were colder, now they are milder, and snow melts faster (R6, R8, R14–R20). Climate warming leads to a shift in the opening and closing dates of navigation, as well as the emergence of cases of forced opening of navigation in December and January for several days or weeks after it being closed due to winter thaws (R6–7, R21). Recalling similar cases, one Vyselki resident noted:

> *Before, there was always an ice drift between May 5 and 9. Now, it's between April 25 and 28.*
>
> *(R16)*

As other respondents stated:

> *Just a few years ago, the ice appeared in February; now, already in March, it has melted.*
>
> *(R10, R20, R37)*

Another respondent also confirmed:

> *Now there are no such severe frosts: it freezes, then melts again. The autumn season has become too long; everything used to freeze faster.*
>
> *(R22)*

According to the official representative of the Arkhangelsk River Port:

> *Navigation traditionally opens in late April – early May; the closure of navigation depends on the actual onset of winter. However, I have to say the opening date of navigation has not changed significantly over the last 20 years.*
>
> *(R6)*

Table 6.2 Dates for the opening and closing of navigation between 2002 and 2021 (excluding data during the thaw)

Opening navigation	*Closing navigation*
14.05.2009	01.12.2009
15.05.2010	23.11.2010
09.05.2011	12.12.2011
10.05.2012	10.11.2012
14.05.2013	10.11.2013
10.05.2014	25.11.2014
01.05.2015	17.11.2015
29.04.2016	06.11.2016
08.05.2017	23.11.2017
09.05.2018	23.11.2018
01.05.2019	07.11.2019
05.05.2020	07.11.2020
28.04.2021	05.11.2021

The opening and closing dates of navigation are shown in Table 6.2.

These northern territories are famous for the special natural phenomenon of "*rasputitsa*", when traveling on unpaved roads, across country and sea routes becomes impossible, owing to muddy conditions from rain, melting snow, or ice drift. The off-season in the North (usually in spring and autumn, rarely in the winter months) is always a test of patience and character, and people in the out-back have long been accustomed to this weather. During this period, the population of these northern settlements becomes completely cut off from other villages and regional centers for a long time, up to several months (R2, R8, R10, R18, R23). As soon as the "*rasputitsa*" season reigns in the autumn, transportation to the islands is carried out by ice-class passenger ships – tugboats, but not to coastal areas – until the ice thickness is safe enough to open ice winter roads. Conversely, the end of the spring "*rasputitsa*" season marks the beginning of navigation. In recent years, muddy conditions have become frequent due to noticeable climate changes and ice conditions. As one local told us:

> *Previously, rasputitsa lasted two or three weeks, but now it can stretch for two months or more. For example, in 2019, stable ice formation was not seen right up to the New Year time [grins]... oh, we had to live without normal bread for a long time.*
>
> *(R20)*

Changes in ice conditions have a significant impact on the life of the population of Pomor villages:

> *In rasputitsa, we are cut off from life for two weeks.*
>
> *(R10)*

Or even longer than two months.

(R18)

On one hand, the change in the navigation period contributes to some extent to the development of shipping and an increase in the volume of cargo and passenger traffic. On the other hand, the late onset of a strong ice formation on the rivers and the shackling of the ground cover significantly reduces the delivery time of goods to hard-to-reach settlements along the so-called winter roads, as well as through the forest, more often on snowmobiles. In addition, climate change has a negative impact on the coast and coastline, leading to their degradation (Nenasheva and Olsen, 2018). Thus, the specifics of supply chain practices vary greatly and depend on the season and contextual settings.

Development of New Food Supply Chain Practices

In line with a complete absence of centralized supply chains and regular deliveries after the cessation of the Northern Delivery to these settlements, today, residents of the coastal and island settlements independently provide procurement and their social security by planning in advance the delivery of necessary products, including food, medicine, and energy carriers. Over the last decade or more, this has been done thanks to local entrepreneurs who are natives and residents of these villages. This was facilitated by the fact that there were no large trading enterprises left capable of performing the functions of a regional wholesale intermediary. Further, high transport costs have left the region with no operators capable of organizing the regular delivery of goods to these settlements. Most local entrepreneurs have small shops in the largest settlements, e.g., Letnyaya Zolotitsa, Lopshenga, and Pertominsk, and are also engaged in delivering food and industrial goods to the island settlements. Local shops are often a hut, where the fishing farm director sits in one room, and the shop and its storage area are located in another. Private entrepreneurs form stocks of food and essential goods based on the preferences and orders of the residents themselves. This is regulated and financed by the regional administration. As one local entrepreneur stated:

In winter, villagers mainly order canned food, frozen products, and juices. In summer, the store sells freshly caught and lightly salted fish, berries, and mushrooms, which residents put up for sale. We bring in flour in large quantities without fail so that villagers can bake fresh bread. The revenue is a penny, but there are a lot of troubles and expenses. Nevertheless, keep the enthusiasm up…[chuckles]…Often people come and order specific items for themselves, for which a special list is drawn up.

(R11, R32)

For residents of island villages during the period of "thaw", including ice drift and spring flood, when they are cut off from transport communications, private shops provide exceptional support, although prices are 30% higher than in Arkhangelsk. According to our respondents, local entrepreneurs often speculate and try to store short-shelf products, even perishable, for at least three months, when in fact, food can be stored for one to three weeks (R6–R7). In other seasons, residents themselves aim to bring food and other products from Arkhangelsk (R3, R14–R15, R22–R24).

The situation concerning the White Sea coastal settlements is entirely different. In summer navigation, the only cargo motorship, "Dauria", owned by the Arkhangelsk algae plant, is involved in delivering essential products to all coastal settlements. From May to October, "Dauria" traditionally works to provide sea sites with all necessary resources for harvesting algae and, along the way, approaches the coastal settlements to unload food, fuel, and other life-sustaining goods. "Dauria" carries cargo once every 10–12 days. On return voyages to the regional center, it transports dry algae – raw materials for the plant. This ship performs about a dozen trips per summer; the total volume of harvested algae is 370–400 tons during the summer season. As one respondent commented:

> *The current navigation began a little later than usual. This year, we only went on the first voyage on the night of May 28. Yesterday, there was ice in the waters of the Solovki islands, and the harbor looked like a winter landscape. They had to use a special ice-breaking boat that cleared the Monastyrsky pier from fast ice. Onboard, we had only 40 tons of cargo. Some cargoes are tools, materials, and supplies for algae sites; another part is for local shops…Hmmm, it has been very important both for the residents of the White Sea settlements and the workers of the algae plant.*

This is the only motorship which is a reliable transport connection between the regional center and the settlements on the White Sea coast.

The "Dauria" is mainly processed at a distance of 400 meters from the shore, in a protected area of water, in which sea ships can anchor. This is due to shallow water, plentiful sandbanks, and thickets of algae. In this regard, there is an absence of berths near the coastal settlements. As one respondent stated:

> *Each arrival of this ship to our Pomor village is a big event. It means that our local shop will soon have fresh products and some other necessary kinds of stuff. It will be possible to please the kids with delicious things you can't get here in spring and autumn… Wait until the ice drifts or the river freezes! Products are stocked up in advance.*

As soon as the "Dauria" (this also applies to the "Belomorye") stops in the roadstead, local boats immediately detach from the shore and quickly head to the ship where they take on board food cargo and/or passengers. As one respondent told us:

> *We, the whole local community, help with the unloading of the ship. The water area is so silted up you can hardly get a rowboat through. But every minute counts.*

Then, local boats charge straight up the unequipped sandy bank to unload cargoes and passengers. Sometimes bread and dairy products are delivered by boat from the neighboring village, Lentnyaya Zolotitsa, or Solovetsky monastery, located on the Solovetsky archipelago. In addition, in Lentyaya Zolotitsa, there are two collective fishing farms with their own ships, which, along with "Dauria", deliver products to this village (R28–32). As one resident from Vyselki village said:

> *When 'Dauria' finally comes to our banks… and products end up in our local shop, people from such distant villages come to us by boats and in winter by snowmobiles with tied sleds, to buy food.*

However, such situations are only seen during a short navigational period in summer. In recent years, climate change has adversely affected the local entrepreneurs' activities in developing and maintaining food supply chains in the island and coastal areas. Since the period of impassable muddy land from rain and wet snow conditions and the thaw has significantly increased, stocks of goods in spring before the rivers are free of ice and in autumn before the freeze-up are depleted to such an extent that the shelves are empty for more than one or two months. Also, in the White Sea coastal settlements, the Union of Consumer Societies of the Arkhangelsk Region plays a significant role in supplying necessary products by maintaining small shops in the Pomor settlements. As one of these shopkeepers told us:

> *In summer, I negotiate with the director of the local fishing collective farm, and they deliver some food and goods here on their fishing boat. And, in winter, I myself ride a snowmobile – tie a few sledges together and slowly make my way through the snowdrifts to Arkhangelsk.*

So, in other seasons, mainly in winter, when the ground cover freezes, communication and delivery of necessary cargoes are carried out by using snowmobiles on so-called winter roads (R22–27).

Meanwhile, the point is that far from all the residents' requirements and needs are satisfied by these articles delivered by local entrepreneurs when using "Dauria", fishing farms' ships, and snowmobiles. This is especially true for medicines. Back in Soviet times, stores were state-owned, and there were food and commodity warehouses in the settlement, that is, large stocks of products were created within the Northern Delivery framework. Various ministries formed specific lists of goods to be delivered to the northern areas. As one elderly resident of the village of Pushlakhta told us:

> *In the Soviet years, medicines were always brought, at least against colds and heart problems, and now our local merchants have their own vision of the list of necessary goods to be brought in. Their main concern is to sell quickly and get benefits. The list of goods is minimal, flour is always mandatory. I always ask my neighbor to bring me medicines from the city when she travels on the Belomorye ship. I know that she always asks all the neighbors around who needs what. So, we meet her on her way back with huge heavy knapsacks and bags... [Laughs]… Or when someone else is going to the city on the passenger ship, he always asks the neighbors, makes a list, and brings food and other goods for everyone.*

In conditions of limited and unstable transport links, remoteness, and the lack of centralized and regular goods supply chains, a particular phenomenon has emerged: social community thinking and mutual assistance, which allows the constant transport mobility of rural residents to be maintained. Such a social community is built on personal (neighborly) ties between village inhabitants, which become the basis for survival and reinforce the perception of a shared identity and the sense of belonging to a single community. It also contributes to a sense of security in an uncertain situation. From interviews with our respondents, we found out that, in summer, if a regular river trip is canceled, residents of the island settlements in the Northern Dvina delta use the services of acquaintances, who are essentially private carriers with small boats, to get to Arkhangelsk (R2–18). On the White Sea coast, private rowboats, motorboats, and launches are currently the only means of transporting residents across the White Sea. Neighbors often help and deliver someone to neighboring villages using these sea "cars" (R23–42). In addition, locals do not hesitate to borrow groceries and some other goods at local shops with the promise to pay later. As one respondent in Lopshenga said:

> *While you wait for payday, some food products may already be spoiled or run out. After all, delivery is not every week. I can always come in for some product and ask the seller to put me on a special list that confirms I will pay the money later. Everything is built on trust. Very convenient and simple.*

In the island villages, we noticed how the locals were engaged in the private sale of manufactured goods right on the street (see Picture 6.2). Residents of coastal villages told us that they themselves bake bread and pies, fish, pick berries and make jam for the winter, and grow vegetables (potatoes are everywhere). Some of them grow vegetables for later sale in Arkhangelsk. One resident stated:

Picture 6.2 Private sale market organized by residents (Photo taken by the second author).

> *It would be so helpful if the municipal authorities organized a mini-market for locals, where they could sell vegetables to neighbors and tourists.*
>
> *(R6)*

That also confirms independent actions by the local population to ensure food and energy security.

Further, in most studied settlements, we met enterprising villagers who were involved in maintaining the socio-economic life of these settlements. As a rule, these are people born in the northern areas who have lived all their lives in their native village. Having retired, they are engaged in reviving and preserving their native land's historical and cultural heritage, as well as in a number of organizational issues. For example, one of the residents of Pushlakhta village told us that she simultaneously performs several daily tasks: she meets occasional tourists, organizes cultural activities for residents, and monitors the lighthouse in the White Sea (R27).

Discussion

The northern Russian settlements case study, which we propose as a good practice example of social issues in supply chains, illustrates how residents have become accountable for the survival and welfare of their neighbors and local communities by addressing existing social needs. Thereby, villagers' voluntary intention initiative, which subsequently turned into a kind of obligation, to contribute to the development of food supply chains in the presented settlements in conditions of complete isolation and the absence of regular food delivery, reveals an unexpected phenomenon of social responsiveness.

The findings show that most of the rural population is concerned about unpredictable changes in economic and social life, climate challenges affecting navigation conditions, and the lack of measures to support the mobility of the population in the form of regular water, land, and air communications, as well as transport infrastructure. As Pilyasov and Zamyatina (2019) emphasized, this is due to the fact that the economic and social viability of the northern areas was supported by the state for a long time. Indeed, while, in Soviet times, the state was involved in ensuring the procurement and delivery of necessary goods to the settlements, and thereby performed social responsibility, consisting of economic, regulatory, and social obligators, today, the same issues have become residents' concern. Further, a significant part of the Russian North population has an "innate craving for mobility", which is not only an important component of the culture and life of northern communities but also the basis for overcoming peripherality and reducing the feeling of isolation from the rest of the country (Pilyasov and Zamyatina, 2019). Thus, residents' social responsiveness is essentially a "response" to economic challenges and, as a rule, is advocated by the need for the adaptation and maintenance of mobility, which is initiated and carried out by local residents or entrepreneurs, mostly with little support from local authorities.

On the other hand, remoteness in the supply chain and the inaccessibility of these settlements affect the adoption of socially responsible supplier practices. Surprisingly, despite occasional speculations about certain products' expiry dates, local entrepreneurs' actions are often driven by social objectives rather than commercial benefits in terms of how the procurement and delivery of goods are treated. This is largely due to their being residents of the same communities and working for their neighbors' welfare. Therefore, our findings reveal that social responsiveness occurs as a result of someone being socially responsible. Compared to CSR, it is possible to say that social responsiveness constitutes concrete actions and reactions to social responsibility or social issues rather than focusing on ethics. In this light, managing social issues in supply chains reflects the role of stakeholders, in our case local residents, in driving socially responsible actions that help implement initiatives, build capacities, and achieve trust and commitment along the supply chain. So, our findings contribute to previous research (Strand, 2009; Klassen and Vereecke, 2012; Yawar and Seuring, 2017) but in terms of a person's obligation and proactive volunteering activities, rather than from a business and managerial perspective.

Further, our findings have identified several features that contribute to the sustainable welfare of the presented settlements and social adaptation to the economic, institutional, and contextual challenges. One of the most startling features is the cooperative co-existence of local communities, which creates an extraordinary combination of shared identity and coherent sense, by enhancing trust, close ties, and contacts. This results in increasing commitment in relationships between local residents. So, our findings support Yawar and Seuring's (2017) assumptions that responsible supply chain actions produce actions that stakeholders "initiate to address social issues that are subsequently accepted, adopted and implemented by other supply chain members" (p. 625). It is the integrity of the social structure of local communities that increases residents' ability to adapt to external challenges. The next feature is preventive actions of life support, when residents are independently involved in providing their own food, industrial, and energy security. Both features are drivers for socially responsible supply chains in these northern areas.

Our findings have also pinpointed mutual assistance and commonality between local residents in response to economic and contextual challenges by developing a specific cultural setting. Within these cultures, roles, ties, relationships, and cultural attributes emerge in order to achieve the local community's welfare and survival. These are "clans" of sorts, where behavior is governed more by moral messages of social responsibility than official contracts, state legal norms, and markets. Within these cultural settings, our case study has identified a number of new socially responsible roles, which are necessary to ensure and sustain the local food supply system. Therefore, our findings have revealed that commitment and trust play a powerful mediating role in integrating SCM practices and social exchange. In light of this, our findings contribute to the extant literature on a relatively underexplored area of how social responsibility principles and responsiveness initiatives enable supply chains to contribute to the needs of local communities in terms of the values of the northern settlements' society (Tsvetkova, 2020). This is especially intriguing, considering the absence of regulatory or societal requirements, except for the need to survive.

Conclusions and Implications

This in-depth study identifies how SCM research can extend its scope by learning through cultural anthropology the roles and relationships needed to encourage socially responsible SCM practices and social influences on values and behavior. This study emphasizes that supply chains become socially responsible when they create value for residents' survival and adaptation to the economic, institutional, and contextual challenges, as well as sustainable welfare through supporting and building capabilities in local communities.

Responding to calls to conduct more case study-based research within the SCM field (Näslund, 2002; Seuring, 2005; Pagell and Wu, 2009; Quarshie et al., 2016), and to the scarcity of research empirically examining the issue of social responsibility in food supply chains (Spence and Bourlakis, 2009), this study reveals the social responsiveness phenomenon which has been originated from local residents' concrete actions and reactions to social issues in the island and coastal settlements of the White Sea. Within these cultural communities, proactive volunteering activities by local residents, which over time turn into a kind of social obligation, result in the terms of increased commitment and trust and improved quality and performance of suppliers who are both local residents themselves and entrepreneurs. This contributes to integrating SCM practices and social exchange. Further, our findings extend the current knowledge in the area of how social responsibility principles and responsiveness enable supply chains to contribute to local communities' needs in terms of the values of the northern settlements' society.

Reflecting on social issues in developing food supply chains within the northern cultures of the Russian High North can be useful for policymakers, entrepreneurs, suppliers, and logistics managers. Our findings can provide an understanding of how they can better manage social issues in these remote and isolated settlements and ensure the regular and centralized procurement and supply of necessary products and goods. Moreover, the knowledge of cultural attributes and local capabilities before deploying procurement, food delivery operations, and supply chain strategies may be crucial for managers and policymakers in choosing a set of subsequent strategic actions and improving their awareness and execution. Finally, as our findings show, social issues and cultural attributes can be a challenge and a source of innovation and inspiration within existing SCM practices; that also should be taken into account in decision-making.

Our study was limited to individual volunteering actions by local residents who initiate social responsiveness and are directly involved in developing socially responsible food supply chains for the White Sea settlements, thereby potentially affecting our findings' generalizability. Further research is necessary to explore behavioral and social issues dealing with the interaction between all participants (suppliers, customers, consumers, and policymakers) in the procurement and supply of food and other necessary goods. Therefore, a behavioral perspective may provide promising theoretical insights to further research on SCM. In light of some significant differences between social responsibility and social responsiveness, a valuable avenue for future research could be a comparative analysis of how both lead to socially responsible and more socially sustainable practices within the SCM field and contribute to servicing the needs of local communities.

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7 Navigating toward a Sustainable Arctic

Trade-offs and Adaptation in Greenland's Fishing Industry

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Introduction

For many Greenlanders, fisheries are a vital part of their identity and cultural heritage. Aside from public administration, fisheries are the country's main economic activity and a key source of employment. The sector has a dual role in Greenlandic coastal communities: as vital commercial activity in larger towns and as a means of subsistence in small settlements. In recent years, climate change has influenced the fisheries development prospects of these communities. Warmer temperatures in the Arctic are generating a retreat of Arctic sea ice, ocean acidification, and permafrost thawing. Since Greenlandic fisheries (particularly Atlantic cod, Greenland halibut, and deep-sea prawns) depend on the use and application of different types of know-how about sea ice conditions, water currents, depth, and seabed, the imminent changing conditions create economic uncertainty for the livelihoods of local communities.

As a response, local fishing companies and the government are constantly adapting by maintaining or intensifying fishing activities aiming to improve their efficiency and profitability levels, keeping fisheries as an economic engine of the communities in terms of employment and social cohesion. Fisheries management systems are generally aligned to biological estimates of the fish stocks, which assist in preventing overfishing, maintaining, or improving the fish stock. Yet, a rapidly changing natural environment coupled with the economic uncertainty in the Arctic region has become a serious sustainability challenge. Maintaining a balance that does not endanger present and future generations certainly requires crafting policies that pursue environmental, economic, and social objectives.

Some research has shown that it may be contradictory to pursue these objectives at once because of the existence of inherent incompatibilities or, in other words, "trade-offs" between the objectives (e.g., Pauly et al., 1998; Béné

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et al., 2016). On the other hand, some cross-country studies have shown no evidence of trade-offs in the sustainability of fisheries because the adjustment in management systems gradually corrects the conflicts (Asche et al., 2018). In general, trade-offs may exist because promoting economic objectives in the industry, such as profitability and trade expansion, can lead to overfishing and permanent damage to the marine ecosystem. On the other hand, not pursuing the economic objectives because of environmental concerns could undermine the social objectives of the local community, such as preventing the community from benefiting from its natural resources, keeping the cultural identity, job security, and social mobility, among other relevant qualities of social development.

There is an ambiguity in the notion of sustainability in the Arctic. There are diverse discourses or "sustainability narratives" that make specific agents responsible within a specified space; e.g., some studies argue that relevant actors choose to shape narratives according to their social identities (see Gad et al., 2019). These different meanings of sustainability can be traced to the early scholarly literature on Arctic nature and Indigenous People's research. Notwithstanding the existing level of abstraction on the concept of sustainability of Arctic issues, in this chapter, we seek to employ a more comprehensive conceptual view of the sustainability of Greenlandic fishers amid climate change: the three pillars of sustainability view. This notion seeks to reconcile social, environmental, and economic dimensions of analysis, and, at the same time, it shows potential trade-offs between these dimensions.

This chapter attempts to provide an understanding of the sustainability challenges of marine logistics operations in the supply chain of the Greenlandic fishing industry. It aims to address the adaptation and constraints that fisheries are encountering amid the effects of climate change and increasing economic competition. By applying the lens of sustainability theory, this study explores how local fishermen (or local fishing companies) navigate through their particular perception of sustainability and cope with ongoing changes in the business and natural environment from an economic, environmental, and social perspective.

Through a qualitative methodology based on a series of semi-structured interviews with key stakeholders of the industry, this chapter sheds light on the type of trade-offs that Greenlandic fisheries are currently encountering and how they perceive the integration of the world's best practices that shape the sustainable supply chain management in Greenland. The findings show that many of the sustainable practices in the fishing industry in Greenland precede the global agenda of the UN SDGs (United Nations' Sustainable Development Goals). Most of this precedent on sustainability is associated with the prevalence and safeguarding of existing local and indigenous knowledge. In general, the findings show that despite the apparent trade-offs, some of the sustainability principles are an intrinsic part of local business practices despite market constraints and external shocks.

The chapter is organized as follows: the following section reviews some recent studies related to supply chain management and sustainability trade-offs in the Arctic. A third section discusses the analytical framework employed, followed by a fourth section that depicts the contextual factors of the fishery in Greenland. The fifth section discusses the method and data used. In section six, the empirical evidence is presented, followed by a discussion. The last section concludes by summarizing the findings.

Sustainable Supply Chain Management in the Arctic: A Brief Review of Recent Studies

The term sustainable supply chain management (SSCM) has emerged in recent decades as a result of the pressure that different stakeholders (e.g., non-governmental organizations) have placed on large multinational firms, looking to hold them accountable for the environmental and social problems they generate across their production processes. Seuring and Müller (2008, p. 1700) define SSCM broadly as

> *the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development into account.*

Several studies have documented how the literature on the SSCM under different approaches has increased exponentially in recent years (Seuring, 2013). The rise in research interest obeys the urgent need to evaluate whether the local, regional, and global supply chains are operating under a more holistic perspective using the sustainability dimensions amid climate change. Consequently, the research interest in the SSCM in the Arctic region has also received greater attention. Given that the melting of the Arctic Sea ice is creating new shipping routes feasible for facilitating trade, some studies have explored the logistics of arctic marine operations in the shipping sector (e.g., Tsvetkova and Gammelgaard, 2018).

In a recent study on the supply chain in Baffin Bay and Greenland, Taarup-Esbensen and Gudmestad (2022) argue that increased shipping traffic in the Arctic requires investments in systems and infrastructure to manage potential hazards and increase reliability. The authors claim that emergency response systems and icebreaker capacity should be upgraded and placed closer to emerging shipping lanes in the Arctic. Yet, their analysis undermines the sustainability concerns of the local population and environmental vulnerability.

There are other types of studies that have addressed related sustainability aspects which question whether the supply chain activities in the Arctic are sustainable. For example, Ng et al. (2018) argue that although the prospects for the industry are positive, it is still required an improved sustainability framework. Particularly, the authors claim that:

> *…opening up the Arctic seas may trigger competing conflicts between global supply chains and local interests. To minimize such impacts on social and environmental systems, shipping via the Arctic needs to be supported by quality infrastructure (e.g., ports, navigational aids, support vessels, and rescue systems) and know-how to ensure the safety of these shipping routes, as well as the environments they may impact.*
>
> *(Ibid, p. 14)*

Similarly, the study by Downing (2019) indicates how increased maritime shipping could change the lifestyles of Indigenous populations in the Arctic and the need for plans and policies that protect these populations. Champalle et al. (2015) suggest creating a community-driven approach as indigenous knowledge frameworks and local skills are vital for shipping companies across the Arctic.

In another qualitative study, Tsvetkova (2020) explored how social responsibility initiatives in the Russian Arctic shipping industry emerged after fulfilling the environmental and economic aspects. Her findings show that the supply chain in Arctic communities becomes sustainable when it creates value not only for the companies but for the local economies through the support and building capabilities locally. On the other hand, for the case of Arctic Canada, Tiller et al. (2022), using a comprehensive approach (four pillars – culture as an added pillar) to the sustainability of shipping operations, argue that although Arctic shipping may be complementary to local economic development, it still may pose a threat to the ways of living and viability of the practices of the local community.

The mixed findings on the sustainability of maritime shipping and the variety of perspectives encountered in the literature on SSCM in the Arctic are not unexpected. As the study by Zhao et al. (2021, p. 8) puts it:

> *There are certain differences in the cultural concept, economic development level, national quality, and sustainable fishery technology level of Arctic shipping countries. It is a long-term process for Arctic shipping countries to accept and practice the sustainable fishery development concept.*

Yet, the authors argue that countries such as Norway, China, and Denmark (that is, Greenland) are "well-positioned" to take a leading role in creating a trade network disseminating the best practices of SSCM in the Arctic.

Studies exclusively focused on the fishery sector in the Arctic with a view of the SSCM and sustainability trade-offs are scarce. The existing ones on the fishery sector are longitudinal quantitative studies containing large data sets on multi-country analysis (e.g., Pan and Huntington, 2016) and case studies of countries that have diversified economies and are not fully reliant on the fishery sector (e.g., Norway and Denmark). In the case of Greenland, studies are also scarce. The existing ones are found in Jacobsen (2018), Jacobsen and Raakjær (2014), and Jacobsen and Raakjær (2012). In these, issues of fishery policy reform and discourse analysis on social sustainability are discussed. However, the issues of the SSCM and trade-offs between sustainability objectives are downplayed and underexplored.

Analytical Framework: Sustainability Trade-offs and Adaptive Capacity

The origins of the "three-pillar" view of sustainability have been attributed to the Brundtland Report, Agenda 21, and the 2002 World Summit on Sustainable Development (Moldan et al., 2012). The summit somewhat formalized the notion of a more comprehensive view of sustainability based on three pillars – social, environmental, and economic – and it was symbolized by the summit motto "People, Planet, Prosperity". The United Nations later identified them as important elements for understanding sustainable development. In the academic economic literature, the approach began to appear in the late 1980s, and some articles included notions such as "sustainability requires the subordination of traditional economic criteria to criteria based on social and ecological values" (Milne, 1996).

In 2015, the UN declared 17 Sustainable Development Goals (SDGs) as a worldwide call for ending poverty and improving the quality of life while protecting the planet for future generations. The goals are not binding for countries and private entities; however, governments and companies are expected to achieve these goals using their own resources. The goals are: no poverty (1), zero hunger (2), good health and well-being (3), quality education (4), gender equality (5), clean water and sanitation (6), affordable and green energy (7), decent work and economic growth (8), industry, innovation, and infrastructure (9), reducing inequality (10), sustainable cities and communities (11), responsible consumption and production (12), climate action (13), life below water (14), life on land (15), peace, justice, and strong institutions (16), and partnerships for the goals (17).

Yet, there are various challenging issues related to their redundancy. For instance, in regard to the goal "life below water" (14) and the goal "life on land" (15), it can be said that acting against climate change directly improves the quality of life on land and also life below water in tandem. The redundancy, thus, may create policy ambiguity and give rise to trade-offs. For example, if the goal of "decent work and economic growth" (8) is interpreted as a long-term relationship, it could result in a policy that pursues economic growth via industrial expansion with the commoditization of fish that could lead to overexploitation. Thus, the adherence and commitment to the SDGs does not warrant a universal path toward sustainable development. Instead, it is a call for establishing concretely at the policy level a more nuanced concept of sustainability based on the economic, social, and environmental dimensions.

Starting with the notion of economic sustainability, this is the idea that economic growth (of output and/or capital) should not result in an excessive economic burden on future generations. Some authors have defined it as the condition where the use of resources today does not reduce real incomes in the future (e.g., Markandya and Pearce, 1988). Regarding social sustainability, it is usually referred to as "the extent to which social values, social identities, social relationships, and social institutions can continue into the future" (Black, 2004). On environmental sustainability, the Organization for Economic Co-operation and Development (OECD) defined it across four specific criteria: regeneration (which implies renewable resources that shall be used efficiently and their use shall not be permitted to exceed their long-term rates of natural regeneration); substitutability (non-renewable resources shall be used efficiently and their use limited to levels which can be offset by substitution with renewable resources or other forms of capital); assimilation (releases of polluting substances into the environment shall not exceed their assimilative capacity); and avoiding irreversibility (OECD, 2001).

Trade-offs between the Sustainability Objectives

A trade-off is a situation where there is a compromise or exchange between choices or objectives. Regarding fisheries, the literature suggests there are two main trade-offs among the sustainability objectives. The first is an economic–environmental trade-off that states that the poor conservation of a fishery reduces economic profits for fishers (Clark, 1973). Second, an economic–social trade-off consisting of policies (to promote conservation) that limit the access of a group of fishers reducing the overall harvest and profitability, which negatively affect the social objectives of fishing communities (Olson, 2011). There are some studies that argue that fisheries management with individual catch shares (like theindividual transferable quotas (ITQs)) can help in reconciling the economic objectives with the environmental ones (e.g., Birkenbach et al., 2017) because when there are strong property rights, ITQ holders benefit from the income that may arise as a result of conservation efforts and improved fish stock. Yet, the evidence is still mixed on whether this management system produces positive social outcomes due to the possibility of having an excessive concentration of fishing quotas, generating inequality and tension in the fishing communities (e.g., Chambers et al., 2017).

Ultimately, as Hilborn et al. (2003) argue, when allocation among competing fishers is not separated from the process of setting allowable fishing harvests, all fishing decisions have allocation implications and conservation often suffers. These two types of decisions (conservation and allocation) need to be separated to achieve the social, economic, and biological objectives of most fisheries systems.

Most of the evidence on fishery trade-offs is country-specific because conflicts often are context-dependent since every country has diverse technological advances, demand levels and distribution trends, economic and social inequality, and different types of governance (Finkbeiner et al., 2017). Thus, the specificity of Greenland's sustainability objectives is crucial to exploring the potential trade-offs.

Adaptive Capacity to Climate Change

According to the Intergovernmental Panel on Climate Change (IPCC), adaptive capacity is the ability of systems, institutions, humans, and other organisms to adjust to potential damage, take advantage of opportunities, or respond to consequences (Solomon et al., 2007), e.g., of climate change. There are different dimensions in which adaptive capacity can be observed in society. Studies have determined that aspects such as community connectedness, institutional development, and access to knowledge are critical to building capacity. For example, in a study exploring the case of the management of permafrost thawing, Jungsberg et al. (2021) argue that community awareness, institutional organization of adaptation measures, and scientific knowledge to inform decision-making are all relevant factors for adaptive capacity in Greenland.

Adaptive capacity is different from the concept of resilience. Usually, the term 'resilience' is associated with the ability to tolerate shocks or abrupt changes. Adaptive capacity is the ability to respond to changes (Engle, 2011). Yet, adaptive capacity to climate change is not overarching property applicable to every economic sector or country. Similar to the sustainability challenges, it is a context-dependent capability. For Greenland, climate change is expected to affect shrimp fishery leading to a decline in the total amount of prawns in Greenlandic waters. The increase in sea temperatures is expected to dramatically increase the number of codfish that feed on prawns. Therefore, currently, the main concern for Greenlandic fishers is how climate change will affect the interaction between shrimp and codfish in the future. This is ultimately related to how the industry will adapt to the changing interaction between codfish and prawns, which are the major export commodities and the engine of growth of the country.

Although historically, the Greenlandic economy has proven to be resilient to unexpected natural resource transitions heightened by climate change (see Arnaut, 2021), adaptation to the 21st century's sustainability challenges described in the three pillars view requires consolidation and a transformation toward a sustainable supply chain management (Seuring and Müller, 2008). For instance, the accumulation of local technical knowledge will be needed to live up to international competition and the world's productivity levels of the industry. There appears to be a consensus that the ability to build adaptive capacity is critical to avoid being "trapped" between the aforementioned trade-offs.

Fishery in Greenland: Stakeholders and Contextual Factors

The sustainability of fisheries is a global concern, and this is reflected in the SDGs as Goal 14 "Life below water", where the overall goal is to "conserve and sustainably use the oceans, seas and marine resources for sustainable development". For Greenland, the concern is of greater importance given that fisheries are part of the country's historical heritage, and nationally, it represents between 90% and 93% of the country's exports. Their fishing industry, aside from its social and economic considerations, has had major historical and geopolitical implications. Looking to secure the management of fish stocks within its Exclusive Economic Zone (EEZ), Greenland decided to withdraw from the European Union (EU) in 1985 after a national referendum. To date, and as our respondents pointed out, fishing dominates the local political landscape. Fishing companies, fishers, and employers' organizations like the Greenlandic Fishers and Hunters (KNAPK) and the Employers' Association of Greenland (GA) have a strong presence in shaping the country's policymaking and institutional arrangements (Fiskerikommissionen, 2021, p. 12).

Fisheries in the country are usually categorized into inshore (or coastal) and offshore fishery sectors. The inshore fishery is small-scale fishing using dinghies, small and medium-size trawls gears with catches landed and processed locally, while the offshore fishery uses large demersal trawls gears (800–1400 meters) landing the majority of catches from deep-sea waters (Fiskerikommissionen, 2019, p.14). Following the scientific advice by the Greenland Institute of Natural Resources (GINR) in collaboration with the Northwest Atlantic Fisheries Organization (NAFO) and the International Council for the Exploration of the Sea (ICES), these catches are regulated by quotas and licenses issued by the Greenlandic Self-Government, *Naalakkersuisut*.

The quotas follow the biological advice to ensure the sustainability of the species. Based on this, at the end of each calendar year, the government establishes the following year's Total Allowable Catch (TAC). The main catches in Greenlandic waters are the Northern prawn, mackerel, capelin, Atlantic cod, Greenland halibut, Atlantic halibut, Greenland cod, Polar cod, Lumpfish, Redfish, Queen crab, Atlantic herring, Atlantic salmon, and Iceland scallop. For the case of Northern prawns, which has the largest TAC in the country, roughly 57% is allocated to the offshore fishery, while the remaining 43% is given to the coastal fishery. Within the offshore prawn fishery, a single company or private person may own a maximum of one-third of the total quota while for the coastal fishery they may harvest a maximum of 15% of the total quota.

The management of the fisheries falls into two categories: free-quota fisheries (also referred to as Olympic fisheries) with TAC, and individual transferable quotas (ITQ) with TAC where these are traded between fishers. Although the Greenland Institute of Natural Resources determines the size of the stock of each species for the calculation of the TAC, the government authorities set quotas for coastal fisheries that usually exceed the scientific recommendations.

There are several reasons for exceeding the recommendations and it is related to a discrepancy between some of the stakeholders (self-government, the GINR, fishers, companies, and civil society) regarding the suitability of the quota for coastal fisheries. Given that coastal fishing is a vital activity in terms of income for local communities and fishers are a key source of electoral votes, they are usually successful when lobbying to raise the TAC going beyond the scientific advice from the GINR (Jacobsen and Raakjær, 2012). Also, the overcapacity of the inshore fleet and the existing limited employment opportunities in the local market generate a larger pressure from fishers to the authorities disregarding scientific advice (Long and Jones, 2021).

Stakeholders in Greenland's Fisheries

To simplify the analysis, we adopt a broader definition of a stakeholder, that is, an entity who has a stake in fisheries and/or their management and who affects and/or can be affected by actions taken by themselves or others that impact the fisheries. The stakeholders in the Greenlandic fishery sector (Figure 7.1) have competing perspectives on sustainability. As explored by Jacobsen (2018), there are different reference "objects" of sustainability in Greenland which

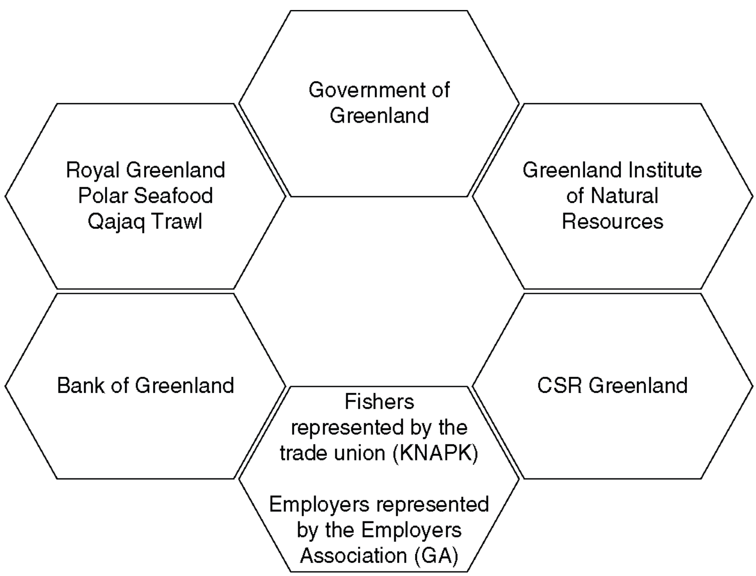

Figure 7.1 Key stakeholders in Greenland's fisheries (*Source*: the authors' elaboration).

are related to the local perceptions of the environment, the fish stocks, the financial aspect of sustainability or the public "purse" from fishing, and the societal view of sustainability. In general, these perceptions are maintained and changed constantly by stakeholders, perceptions that are shaped by their interests and political considerations.

The key fishing stakeholders in the sector are the large national suppliers that dominate the sector and share the vast majority of the offshore fishing quota: the government-owned company, Royal Greenland, and a privately owned, Polar Seafood. Also, a small fishing company, Qajaq Trawl A/S, is included in the analysis. It was chosen because of its small size in comparison with the two major companies to represent the small-scale nascent sector, which also symbolizes the Greenlandic fishing industry. The Government of Greenland is a key stakeholder in regulating economic activity in the sector and corporate enforcement. The Bank of Greenland is a private commercial institution that plays an important role in Greenland's capital investment in the fishery sector. Although Greenland's monetary policy is overseen by Denmark's central bank (Danmarks Nationalbank), the Bank of Greenland is a relevant stakeholder that has served as a channel for regulating the local financial activity, influencing microfinance projects, and facilitating loans to medium and large investments in the fishing sector.

Stakeholders that are part of social dialogue are, on the one hand, KNAPK, the Association of Greenlandic Fishers and Hunters founded in 1953, which represents most coastal fishers in Greenland. On the other, GA is the Employers' Association of Greenland that currently represents the interests of around 500 businesses in the country. A relevant stakeholder within the civil dialogue is CSR Greenland, an organization that advises and collaborates with companies on establishing the best practices of corporate social responsibility in Greenland. Finally, a stakeholder representing the scientific and research community is the Greenland Institute of Natural Resources (GINR). This institution is engaged in Arctic ecosystems research, monitoring the living resources and advising the Government of Greenland and other authorities on the sustainable exploitation of living resources.

Since 2009, some of the aforementioned stakeholders have been part of reform in fisheries management. This, however, was path-dependent, that is, the outcome of the reform was negligible and determined on past political decisions, not on the necessities affecting the fishery sector (that is, low capital investment and low productivity). After the recommendations of Greenland's Fishery Commission in 2009, this process finally delivered significant change in 2012 with a reform of the Fisheries Act. This set of reforms has been called the "Grand Reform Network" by Jacobsen and Raakjær (2014) and was directed to remove the investment constraints of the sector, increasing the efficiency and profitability, looking ultimately to increase the growth of the overall economy. For example, the "rubber boot" paragraph was removed from the fishery law. That paragraph prohibited non-fishers to invest and have ownership in the fishery. Only active fishers engaged on local activities (hence the meaning "rubber boot") had access to it. Removing that legal hurdle intended to boost capital investment. The reform also included the introduction of ITQ for the fishing of the Greenland halibut (the second most important fishery after prawns) in coastal waters and an increase from 10 to 15% in the maximum allowable quota.

In 2017, the Greenlandic offshore fleet obtained the Marine Stewardship Council (MSC) certification, which is one of the main seafood eco-labels attesting that the fishery complies with the international best practices for sustainable fishing. Yet, there are criticisms about how the MSC can be framed as a reliable notion of environmental sustainability. There are questions in terms of objectivity by the Conformity Assessment Bodies (CAB) that carry out the audits and assessments of the fisheries. Some studies have shown that industry stakeholders are "too close" to the certification process, which represents a serious societal concern. The lack of credibility of the certification challenges the market mechanism as a way to ensure quality and move toward sustainable supply chain management (see Long and Jones, 2021).

The trade-offs may arise between specific sustainability objectives given the different interests and expected outcomes from the stakeholders. For example, a direct trade-off between the economic and environmental pillars can arise when fishing companies aim to sustain their profitability by increasing the yearly catch, but then this is counteracted by the GINR's advice on biological targets together with the government's aim of enforcing the preservation of the ecosystem through astringent quotas. Another trade-off may appear between the economic and social objectives in a situation when looking to maintain profitability and lower financial risk: the Bank of Greenland, after monitoring the TAC and quotas, may limit new loans to fishing projects on financial risk grounds.

Because of these conflicts, in recent years, there has been increasing evidence that countries endowed with the higher adaptive capacity and effective management experience fewer conflicts or trade-offs between sustainability objectives (e.g., Blanchard et al., 2017). The ability to adapt to unpredictable changes has been key in dealing with fishery conflicts among stakeholders. For example, some fisheries have been able to build adaptive capacity through diversification of their fishing gears, focusing on less vulnerable targeted fishing species and building sustainable supply chain management.

Method and Data Description

Method

Although the fishing industry in Greenland is vital domestically, from an international perspective, the country is a micro-state reliant on a comparatively small fishing sector. The number of firms, employees, and trade unions is rather small in comparison to other countries heavily reliant on fisheries. Thus, a comparative longitudinal data method was not suitable for understanding the involvement of stakeholders in the aspect of sustainability trade-offs.

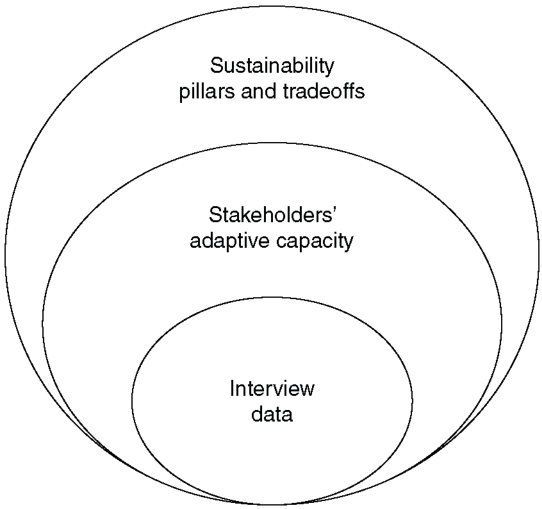

Figure 7.2 Conceptual diagram of the analytical framework (*Source*: the authors' elaboration).

We employed instead a qualitative case-study approach based on a series of semi-structured interviews following a descriptive and inductive perspective. This method allows us to gather in-depth responses and explanations. Semi-structured interviews for case studies are a useful tool to obtain a more precise identification of various factors that interact with each other and capture both depth and breadth of responses related to the analytical framework. Figure 7.2 synthesizes the underlying analytical framework employed for the data analysis. In this, we use the notion of sustainability pillars and trade-offs and the stakeholders' adaptive capacity. The diagram indicates how the framework integrates the conceptual elements with the interview data to derive the ensuing analysis.

Data Description

The data was collected via open, face-to-face semi-structured interviews that lasted around an hour for each interviewee. There were six interviews in total, all conducted in Danish, voice recorded and the resultant transcriptions in Danish were translated into English. To ensure the validity of the interpretations, further clarifications from the statements were given by communication on the phone or via text message. The interviews took place in Nuuk, Greenland, and Copenhagen, Denmark, from August to September 2021.

The interviewees were selected on the basis of their knowledge of sustainability issues in Greenland, their interaction with the local community, and their rank or position within their organization. The sample aimed to comprise a diverse organizational rank that included, e.g., a chairman of the board, a section manager, a maritime pilot, and a fisher. They were asked about their views on whether they consider there exist sustainability trade-offs in the industry. In order words, they were questioned if, in their view, there are priorities or a difference in the level of importance between the following three overarching objectives:

1) community improvement, or a reduction of social conflict within the fishery sector;
2) improvement of the fishery profitability and socioeconomic structure; and
3) conservation of the marine environments.

The abovementioned overarching objectives are designated as the three sustainability pillars stated in the analytical framework of the present study. They were briefly mentioned verbally at the start of the interview to each of the interviewees looking to facilitate communication related to a concrete set of concepts.

Empirical Evidence

Trade-offs between the Sustainability Objectives in Greenland's Fishing

After reviewing the respondents' views on sustainability trade-offs, it was possible to obtain related statements that point out their concerns about the potential conflicts of the sustainability objectives. For example, starting with the stakeholder Royal Greenland A/S, the company's representative indicated that the company is committed to business practices following the United Nations' Sustainable Development Goals. However, it was argued that:

> *We cannot work with all goals at once. One of the ways to start reaching the goals is tackling the social aspect by offering employees opportunities to improve their education levels and obtain decent salaries.*

On the other hand, the representative indicated that a trade-off is faced between the economic and social objectives:

> *The company is maintaining the factories open along the coast despite profitability levels that are not particularly high but sustainable, economically speaking. This, in turn, keeps the levels of employment stable in the country as well as the company's labor rotation.*

To keep up with this development and a way to adapt to a potential conflict of shutting down factories (because of the meager profitability of some processing plants), the company presented a case to the Board of Directors led by the Government of Greenland, *Naalakkersuisut*, to follow an investment approach to developing labor-intensive technology based on local knowledge, new products, and process innovation in every stage of the value chain. The main aim was to absorb new labor force and maintain the levels of employment stable across the country (Royal Greenland Annual Report, 2017, p. 12).

Rather than promote investment in capital-intensive technologies that would employ less labor force, the company argues that to counteract the unintended conflicts associated with the mechanization of the industry, labor-intensive technologies in fishing fleets and coastal factories help to maintain labor productivity and the company's profitability levels sustainable.

However, theoretically, in the long run, the situation described above and confirmed by the stakeholder's statement creates inevitably an economic issue known as excess capacity. When more fishers and physical capital investment are included than the necessary to harvest under the yearly quotas, there is excess capacity that leads to a decline in the overall efficiency (e.g., Lindebo et al., 2007). In addition to this, the labor market in the country suffers from a shortage of local labor. The importation of foreign skilled and non-skilled labor has covered the shortage, yet it is a "bottleneck" given that labor mobility from abroad is not immediate because immigration procedures are managed by the Danish authorities in Copenhagen and not by the Government of Greenland.

The situation described above on the issue of excess capacity and labor shortages naturally affects the local labor market of the fishery. Thus, KNAPK (Kalaallit Nunaanni Aalisartut Piniartullu Kattuffiat), looking to protect the interests of its members in the workplace, argues that there are discrepancies between the trade union, the government, and the GINR. A key representative of the trade union believes that the main discrepancy is regarding the assessment of the fish stocks:

> *Who should assess the status of the fish stocks? Many experienced Greenlandic fishermen consider that they can assess correctly whether the stock is doing well or bad and arrive at a sustainable yield. There are fishers stationed there on the sea all year long, covering much larger maritime areas than biologists from GINR do, but the local fishers' expertise is rarely considered. Many of our fishermen do not agree with the way stocks are calculated. We think the government and the GINR should more pay attention to the fishers' local knowledge.*

Statements like the one above indicates the existence of the trade-off between the environmental pillar and the economic one. The underlying argument from the union's representative on the quotas is that the current estimates of the fish stocks by the authority and the corresponding scientific advice are too conservative and do not incorporate indigenous knowledge and the local expertise from fishers reducing, as a result, the community's income. This conflict is intrinsically connected to the social pillar because the conservative estimates are restricting the community's access to the local resources on which their cultural identity and way of life rely upon.

On this particular trade-off, the stakeholder, Bank of Greenland A/S, has also a standpoint. The Bank of Greenland has a unique peculiarity relative to other commercial banks in the Nordic region because it has functioned as a sort of development bank supporting private projects in the fishing sector. However, since 2020 given the stringent quotas and the limited fishing licenses in recent years, the bank has limited new loans for the purchases of private fishing trawlers. In this regard, the main representative of the Bank argues:

> *…we have two roles in Greenlandic society, first, we finance economically sustainable projects, where the terms of the financing must be solid, and second, we see if these projects are closely linked to biologically sustainable patterns, thus, we take the environmental aspect into account in our finance equation. We want to finance proven sustainable projects from Greenlanders short and long-term. For example, if there is a small fisherman that has obtained a sudden large income as a result of overfishing because he or she took advantage of a high quota above the biological advice, then even though the income is sufficient, we would have difficulties in lending him or her a loan.*

The previous statement suggests that the bank is aware of the economic–environment trade-off. Yet, although the concern about environmental sustainability is clear, the ultimate motivation may be on the financial self-sustainability of the bank because certainly when there is a foreseeable scenario of unsustainable fish stock and low harvest, the loans' default risk increases.

Adaptive Capacity in Greenlandic Fishery

Aside from the trade-off between the environmental objective and the economic one depicted in the previous subsection, it was also revealed a key trade-off between economic profitability and social development that the main country's fishing company (Royal Greenland) has experienced. An adaptive capacity emerged to counter the trade-off in the short run by investing in labor-intensive technologies in fishing fleets. The positive economic indicators (sustained profitability and stable employment) generated amid the COVID-19 pandemic that created supply chain disruptions are a positive indication of resilience and adaptation. Yet, structural economic factors (excess capacity and labor shortages) and the continuous warming of the Arctic Ocean will be present in the decades to come, which will certainly challenge the current conditions.

In this regard, the representative of the trade union KNAPK argues that climate change has had a varied impact on the coast of Greenland. While it has been positive for some regions, it has not for others. He argues:

> *It is a long and diverse coastline. For example, it seems there has been a positive effect on the codfish and mackerel stock in Maniitsoq (West Greenland). However, in South Greenland where codfish was abundant, it is not the case anymore. Given that there is now a lot of fresh water from the ice coast thawing, there is less cod entering the fjord. Although there is some stability for some species in area 47 (Disco Bay, Uummannaq, and Upernavik), halibut has started to disappear in some areas.*

The union also mentions that environmental protection is important:

> *…we had biodegradable fishing gear that is supposed to protect our marine ecosystems but most of our members have not used it because it is not as efficient as the standard one and is not obligatory to use it. Perhaps future legislation could make it mandatory.*

Furthermore, evidence of adaptive capacity in the sector was suggested by the stakeholder, Polar Seafood A/S. The company's representative maintains that social considerations regarding employment stability across the Greenlandic coast are important, but not economically sustainable in the medium and long run. Naturally, given the private commercial nature of the company, it was expected that the adaptation strategy to counter the economic–social trade-offs is different from a state-owned company. The company claims to place its efforts in aligning its practices to the UN SDGs on a local non-profit association where major stakeholders of the industry are members: Sustainable Fisheries Greenland.

The company considers that adaptation to climate change and potential sustainability conflicts can be resolved through their own innovation efforts and technical change which are following the SDGs, providing them a certain advantage over the competition, as told by one manager from Polar Seafood:

> *Currently, our trawlers can freeze up to four times as much as before, saving time and fuel enormously. Waste incinerators have been placed inside most of our trawling fleet, thus, they incinerate waste on board, and not as in the old days when the waste was just put in a black bag and thrown out overboard. We are becoming better at recycling and re-using shrimp shell waste.*
>
> *(Polar Seafood, interviewee)*

Similar to Polar Seafood A/S, which is also a major shareholder of the company, Qajaq Trawl A/S places its efforts of sustainable innovation as an adaptive capacity measure:

> *We've developed a more efficient packing of our catch where the racks in the container are better utilized, this, in turn, saves space and reduces fuel usage and total costs. Also, we have done something regarding our personnel's quality of life. The rotation of our personnel is low, and we believe is due to the*

> *reshuffling of the working hours. The eight-hour shift accommodates better to the crew's well-being and raises productivity compared to the six-hour shift. The six-hour shift meant having an extra shift during the day, which exhausted our crew.*

Also, the stakeholder's representative (Qajaq Trawl) argues that climate change has not benefited the company, on the contrary:

> *There is less harvest [because of climate change]. Yet, the change of locations for prawn harvest due to climate change has been incorporated into our fishing routes. The crew avoids the places where the shrimps are smaller because of the commercial regulations and where the result is less yield.*
>
> *(Qajaq Trawl, Member of the Board of Directors)*

The representative considers that the local indigenous knowledge of Greenlanders, aside from being a great competitive advantage for the company, is also a way to respect local knowledge, which is often environmentally sustainable. For instance, thanks to the ancestral knowledge of Greenlandic fisheries about the seasonal behavior of fish, they spot strategic places where they get a greater harvest.

The stakeholder, CSR Greenland, acts as an interlocutor to create dialogue across sectors and local companies related to corporate social responsibility and sustainable development within fisheries and raw material activities. The representative in place for CSR Greenland mentions:

> *The effects of the climate crisis are becoming more and more visible in Greenland. Local fishing companies like Royal Greenland and Polar Seafood are being pressured by their international customers to focus on the environmental aspect of their products like the carbon footprint (this is why they've obtained the MSC certification). Yet, although local companies have a good CSR, at this point they are mainly focused on the social part like ensuring there is no child labor, no corruption, and decent working conditions. More focus should be placed now on the supply chain and how to reduce the carbon footprint.*

Discussion: Are Greenland's Fisheries Really Navigating toward Sustainability?

Based on the data analysis of the stakeholders' interviews sketched in the previous section, there is qualitative evidence of adaptive capacity building that is targeting the Greenlandic sustainability trade-offs amid climate change. The company Royal Greenland has anticipated the potential escalation of the trade-off between economic efficiency and social development by keeping labor-intensive technologies in coastal fisheries despite the that their profitability relies on offshore fishing (mainly pelagic fishery) with capital-intensive technology. The ability to prevent a conflict is coming at the expense of loss of overall efficiency due to excess capacity. Thus, it can be said that the company-generated capacity building for one trade-off (economic–social), but it has downplayed the environmental–economic one at the coastal fishery.

As pointed out by the stakeholder CSR Greenland, the company (Royal Greenland) has developed a "good" CSR and obtained the MSC certification in most of their deep-sea fisheries, but accordingly, more efforts should be placed on a sustainable supply chain. Indeed, although it appears that the company is navigating toward sustainability, the multidimensional aspect of the concept is where the question may rely: The company can be seen as environmentally sustainable by international standards (recognized by MSC certification) in its offshore fishery and socially sustainable by maintaining the labor-intensive activities in the coastal fishery. However, although the company is one of the main engines of growth of employment and economic output locally, the structural barriers such as excess capacity and dependence on foreign labor are threatening the path toward long-term economic sustainability. Smaller private companies such as Polar Seafood and Qajaq Trawl face similar issues, yet their capacity to adjust through innovation and cost-based measures might allow them to adapt faster to competition, environmental change, and the structural barriers characteristically of Greenland.

Another aspect of which it can be questionable whether the Greenlandic fishing industry is navigating toward sustainability is the trade union (KNAPK) controversy with the government and the GINR regarding the assessment of the TAC. One key sustainability trade-off is the environmental–social one, in which a fishing stringent quota undermines the development of the local community. The trade union argues that the assessment of the TAC has been conservative over the years disregarding the knowledge of the local fishers who cover greater maritime areas than the scientists at the GINR. On many occasions, it is argued that the expertise of local fishers can assess more accurately the size of the stock and potentially arrive at a maximum sustainable yield. Currently, the government and the GINR consult KNAPK and the employers' association (GA) before the determination of the TAC. However, important discrepancies persist in the final estimation of the TAC at the technical, regional, and political levels.

As a response to the discrepancies on this issue, since 2009 local fishermen, hunters, and Greenlandic environmentalists began to collaborate with the Ministry of Fisheries, Hunting and Agriculture, KNAPK, and other associations and local institutions, forming the PISUNA Program (www.pisuna.org). The program aimed to generate documentation of observations of nature with the contribution of extensive local knowledge and citizen proposals for management measures on natural resources. Yet, although community-based documentation cannot replace scientific monitoring, a synergy between the two could provide a more sustainable resource management (Tengö et al., 2021). This initiative is another adaptive capacity bottom-up that may attenuate the sustainability environment–society trade-off. The ultimate challenge for the synergy between indigenous knowledge and western scientific knowledge regarding the assessment of the TAC is whether the local dialogue has sufficient legitimacy for a common understanding of the regulation and adjustment of the yearly quotas.

Lastly, tightening the lending criteria on environmental grounds has been a maneuver from the Bank of Greenland anticipating the difficulties of repaying loans or the long-term private fishing defaults in light of possible stringent quotas. Certainly, this macroprudential conservation policy can be seen as an adaptive feature that inadvertently preserves the maritime ecosystem. Yet, the social pillar of sustainability is vital for coastal communities in Greenland and small-scale fishers are in danger of being locked out of accessing financing. Financial inclusion is an enabler to sharing prosperity in fisheries and as the World Bank describes it (financial inclusion) is "making financial products and services accessible and affordable to all individuals and businesses, regardless of their personal net worth or company size" (World Bank, 2013). Thus, a closer collaboration between the Bank and remote coastal communities could promote inclusion and at the same time minimize the risk and improve the viability of fishing investments.

Table 7.1 shows a broad view of the sustainability pillars and the fisheries stakeholders' objectives in Greenland. It sketches some of the main outcomes that stakeholders create within the sector and provides a snapshot of the necessary considerations and expected outcomes to craft a sustainable supply chain covering the three pillars.

Table 7.1 illustrates that in order to promote or/and strengthen SSCM, the government, private entities, unions, employers' association, banking sector, and the scientific authority require a greater coordination to share responsibilities according to their specific sustainability objectives and expected outcomes. That is to say, the introduction of a new green technology throughout the supply chain logistics (that is, harvesting, shipping, storage, and distribution) has a cross-cutting stakeholder involvement encompassing the three pillars of sustainability. For example (and as mentioned by an interviewee), the introduction of an onboard waste incinerator that reduces weight of the trawler, saves fuel, and attenuates the carbon footprint, which ultimately deliver sustainable seafood products into the market, entails a three-pillar sustainability approach. The market expansion of sustainable foodstuffs may uphold the fishing company's profitability, yet, as depicted, it can hardly be executed in the medium or long term at the expense of local labor and the reproducibility of the marine species. The stakeholder's specific sustainability outcomes, particularly the ones from the scientific authority, the government, and the banking sector may assist in counteracting an unsustainable growth pattern.

Table 7.1 Sustainability pillars and the objectives of fisheries stakeholders in Greenland

Sustainability pillar	*General objective*	*Stakeholder*	*Specific sustainability outcomes*
		Fishing companies	Sustained profitability and trade expansion
		Union & employers' assoc.	Safeguard workers' & employers' monetary interests
Economic	Economic growth	Government	Raise public revenues, and GDP growth, reduce unemployment
		Scientific authority	No specific expected outcome
		Banking sector	Liquidity, solvency, lowering risk and raising profitability
		Fishing companies	Maintain the reproducibility of the marine species
		Union & employers' assoc.	Preserve the marine ecosystem
Environmental	Natural resource use	Government	Enforce and promote the preservation of the arctic ecosystem
		Scientific authority	Monitor marine stock health & advice biological targets
		Banking sector	Monitor the annual changes of the TAC for lending purposes
		Fishing companies	Local labor, training, career opportunities, community services
		Union & employers' assoc.	Employment stability, cultural identity, strengthening the local network
Social	Social development	Government	Employment source, welfare, and social mobility
		Scientific authority	Share scientific knowledge on the effects of ecosystem variability
		Banking sector	Support green businesses & knowledge of financial services for locals

Note: Fishing companies are Royal Greenland, Polar Seafood, and Qajaq Trawl. Union refers to KNAPK and Employers Association refers to the Employers Association of Greenland, GA. For scientific authority, it is referred to as GINR (Greenland Institute of Natural Resources). CSR Greenland was not included in the table for space parsimony.

Conclusion

Greenland is a fishing powerhouse in the Arctic. Yet, as this chapter has shown, it is not free from structural barriers and long-term challenges that are making its fishing industry entrenched between sustainability trade-offs and navigating slowly toward an inclusive notion of sustainability. The stakeholders in the industry have built relevant adaptive capacities to anticipate further intensification of conflicts related to climate change, social development, and economic efficiency. One of the main players in the industry, the state-owned company, Royal Greenland, has made important efforts in expanding its market share internationally and locally through innovation, aligning its practices of offshore fisheries to the UN SDGs. However, its coastal fishery is mainly dependent on labor-intensive technologies carrying important challenges that are intrinsically related to the necessities of social development of the communities in terms of employment and cultural identity. The company's adaptation to this dichotomy of efficiency and social cohesion might define the long-term economic structure of a country characterized by labor shortages, remoteness, and environmental change.

A decade ago, environmental and economic sustainability were viewed by local stakeholders as more relevant than social sustainability, resulting in market-based reforms such as the establishment of ITQs for the halibut fishery. Nowadays, the social aspect of sustainability is becoming relevant again and pivotal for the country despite competing financial interests related to macroprudential policies and external shocks. One of the most challenging trade-offs aside from the economic–social one is between the environmental and social pillars. Maritime ecosystem alterations due to climate change are modifying the fishing routes and locations in the Arctic. The new estimates of fish stocks and the ensuing TAC established by the local scientific community and international organizations are being challenged by stakeholders of the social dialogue, namely fishers' unions where local indigenous knowledge of fisheries plays a central role. It is claimed that stringent and conservative quotas are a "rush" to environmental sustainability putting small-scale fishers at risk and the cultural identity of the coastal communities. Developing a data-sharing system that incorporates the existing citizen-driven program with the scientific surveys elaborated by the scientific research authorities could pave the way to attenuate the discrepancies and trade-offs in the Greenlandic community.

Although this chapter expands existing research on Greenland's key sustainability issues in the fishing industry, it does not address the sector of subsistence fisheries in the north and east sides of the country. In recent years, a greater emphasis has been made on developing a small-scale sector in remote coastal settlements and building a supply chain for intra-regional consumption. Further research is needed to explore the interplay between the local indigenous capabilities, western organizational logistics, and adaptation to climate change in small coastal communities. A proper understanding of the interplay of these elements and the challenges in the supply chain from a bottom-up perspective could become a scale model or a "maquette" for the green transition of the industry in the arctic region and other emerging countries.

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8 Sustainable Supply Chain Governance through Marine Stewardship Council Certification

Global Standards and Local Practices in the Barents Sea

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Prologue

In northern Russia, along the White Sea coast, lies a quaint village, "Shoyna" – the world's northernmost "desert" town. This area is covered in mounds of sand and locals have to dig their way out of their homes. It was originally a bustling fishing port: vessels lined the shores and families benefited from the abundance of fish. But, after a few decades, the waters were overfished, and the trade went into steep decline. The dunes advanced on homes with the restless winds and swallowed them, leaving only a couple of roofs visible above the sand...

Researchers are inclined to believe that this phenomenon is the result of long-standing trawling that scraped the ocean floors clean of their marine lifeforms, microorganisms, and algae, which had held these submerged sandy steppes in balance. This is a vivid example of years of misalignment between local fishing practices and the marine ecosystem they harvested and depleted for future generations, leaving in their wake sand dunes that stretch for tens of kilometers, devouring this settlement in retribution.

Introduction

Arctic fisheries hold considerable economic, social, and cultural value for northern communities and offer a wide range of internationally traded commercial

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species. Fisheries management has often been considered an activity mostly entailing consideration of resources, economic productivity under increased fishing pressure, and efficient fish and seafood supply chains to markets and end consumers. Since the 1950s, fisheries management has been considered the prerogative of governments and rigidly dominated by their actions and rules. However, long-term traditions of open access to fishery resources, especially in many Western countries, and the global escalation of fishing pressure have led to excessive depletion of fish and seafood resources. These insufficient and ineffective practices put many commercial stocks at risk of overfishing – jeopardizing ocean health, trade, revenue, and food and livelihood security. Further, they resulted in conflicts between conservation requirements and socio-economic implications. Recently, awareness of the need for new approaches to fisheries management, in terms of sustainable development, has grown. This is vital for Arctic ecosystems, which are particularly vulnerable and require strong security measures to ensure that seafood brought to market is legally caught, verifiable, and traceable. Governments' obvious failures to pursue these goals led to the involvement of organizations seeking to mobilize civil society by using different governance mechanisms, e.g., market-based incentives – either through consumer choice or pressure on industry (Karlsen et al., 2012; Agnew et al., 2014). Marine Stewardship Council (MSC) certification and eco-labeling have become one of these market-based tools to promote the development of sustainable fishery operations and supply chains.

Inspired by the Grand Banks cod fishery collapse in the early 1990s, the MSC was set up in 1997 by the collaboration of the World Wide Fund for Nature (WWF) and the Unilever group, one of the world's largest fish buyers (www.msc.org; www.unilever.com). An underlying strategy was to develop a rigorous standard for certification and make seafood wholesale supply chains and retailers commit to purchasing only MSC-certified products as eco-labeled. The eco-labeling instrument requires fisheries to comply with requirements designed to promote sustainable practices. So, all stakeholders along the seafood supply chain – from fishermen to buyers to consumers – are engaged through their purchasing power to encourage governments and fishery managers to improve their operations and therefore make fisheries more sustainable and keep illegal and unregulated fish from entering supermarkets. As a result, MSC-certified products with eco-labeling achieve higher prices and the most lucrative markets, compared to non-MSC-certified ones (Kaiser and Edwards-Jones, 2006). In 2019–2020, more than 400 fisheries and 17% of the world's wild marine catch had MSC certification (www.msc.org). However, the MSC has increasingly been criticized for its lack of standards (Jacquet et al., 2010; Karlsen et al., 2012), its focus on larger fisheries, mostly in Europe and North America, and for assessing relatively few fisheries in developing countries (Gulbrandsen and Hønneland, 2014).

At the same time, institutional changes in fisheries successfully implemented by spreading global certified seafood chains can vary greatly in different countries and regions and entail several transformations at the local level. On one hand, the MSC and other non-state organizations pressurize governments to take stricter measures and establish national or regional regulations for sustainable fisheries. On the other hand, MSC standards and eco-labeling can significantly weaken government control and thereby be used as a tool to justify the containment or inaction of taken-for-granted, more powerful regulations. Further, the seafood supply chain, like any other, involves several interdependent actors, who can influence one another's performance, operations, and even reputation. This creates a challenge to manage sustainability along the whole supply chain and, in turn, makes actors go beyond their boundaries to their supply chain partners. However, the literature on governance mechanisms to extend sustainability within supply chain management (SCM) has focused chiefly on supplier assessment and collaboration (Krause et al., 2000; Gimenez and Sierra, 2013), rather than considering the various actors involved. Further, standards, distributed by the MSC, are an imprescriptible but woefully underexplored institutional form of governance. This is also critical, as the spread of standardization sparks numerous concerns about the consequences of their adoption (see Brunsson and Jacobsson, 2000; Timmermans and Epstein, 2010). Thus, our study aims to explore *how MSC standards as a global seafood supply chain governance mechanism may enable sustainable local fishery practices in Arctic waters.*

To address this problem, we focus on fisheries management and seafood supply practices in the Barents Sea, the most productive ice-free area in the Arctic, which represents a successful case of international fisheries management between Russia and Norway. This said, there seems to be a lack of in-depth studies of seafood supply chains and local fishing practices in the Russian part of the Barents Sea. MSC certification was first introduced in Russia in 2005. It turned out to be completely new and received a surprisingly controversial impetus for subsequent implementation. Although MSC certification received less public criticism in the Russian Barents Sea than in other parts of the world, the process of accepting rules imposed by non-state actors whose authority was granted by the market was relatively slow and even drawn-out, as it clashed with local fishery practices, often conservative and difficult to change. Thus, it remains unclear how fishermen, fisheries management authorities, auditors, retailers, and others affect each other's behavior when implementing MSC certification requirements in local practice in the Russian Barents Sea. In doing so, we applied an institutional perspective on following standards that was helpful in revealing the issues of making MSC standards work, resistance to standardization, and the multiple outcomes of these standards in the Russian Barents Sea.

The study is organized as follows: first, we provide a literature review on governance mechanisms and sustainable supply chain management. Then, we outline an institutional perspective on following standards. The fourth section describes the research method. Then, the case study is presented, discussing the findings thereafter. The study concludes with theoretical and practical implications and an outline of future research directions.

Sustainable Supply Chain Governance: Literature Review

Sustainable Supply Chain Management

A growing body of academic research has addressed a sustainable SCM framework as an integration of various environmental, social, and economic responsibilities. One of the most comprehensible descriptions of sustainable SCM is Seuring and Müller's definition that it is

> *the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements.*
>
> *(2008, p. 1700)*

In line with this, sustainable SCM appeals for greater integration and cooperation between partners to make supply chain practice and performance sustainable by pushing environmental and social criteria beyond a single company to cover the whole supply chain (Bai and Sarkis, 2010). Furthermore, several scholars have emphasized that sustainable responsibility can be achieved by simultaneously addressing environmental, social, and economic concerns and incorporating all chain partners in the process (Faisal, 2010; Bai and Sarkis, 2010; Mani et al., 2016; Tsvetkova, 2020). At the same time, supply chain partners have equally to remain competitive by meeting customers' demands; that has been often highlighted in the SCM literature (Childerhouse et al., 2002).

Various internal and external enablers can help transform a supply chain into a truly sustainable entity (see Faisal, 2010; Grzybowska, 2012). Customer concern regarding more sustainable practices, along with a regulatory framework, stakeholders, and awareness about sustainable practices, has been recognized as the most pivotal trigger of dependence power (Grzybowska, 2012). Kleindorfer et al. (2005, p. 484) argued that "companies are most likely to improve their environmental performance when public pressure results in strong regulations". Further, Roberts (2003, p. 160) emphasized that non-governmental organizations (NGO) increasingly apply "corporate reputational vulnerability" to promote and adopt social and environmental responsibilities.

Recent literature reviews have identified the intensification of research on environmental concerns about sustainability to minimize industrial impact and fuel consumption, thereby effecting a shift toward green practices (Seuring and Müller, 2008; Quarshie et al., 2016). Much research has reduced social concerns to environmental issues concerning the potential adverse effects of environmental pollution on human health, safety, and quality of life (Mansouri et al., 2015). However, as many scholars emphasize, the social aspect itself is rarely addressed in SCM studies (Seuring and Müller, 2008; Wu and Pagell, 2011; Mani et al., 2016; Quarshie et al., 2016), making it difficult to measure advances in sustainable supply chain practices (Davidson, 2011).

In SCM literature, the social aspect of sustainability or social responsibility (see Mani et al., 2016; Tsvetkova, 2020) generally refers to an organization's behavior that needs to be measured by, more than its economic desirability, how it affects the public overall, customers, stakeholders and, more importantly, local communities. The public and customers have a sense that businesses will "output back" according to their desire for high-quality products and services, and this constitutes the "expectation" aspect of the responsibility. However, the social responsibility consideration within supply chain practice can create greater managerial challenges due to the complexity of involving a wide range of stakeholders with various motives, goals, and demands that may interpret the same situation differently (Matos and Hall, 2007) and impose their own private governance rules, with the appearance of so-called "stakeholder ambiguity" (Hall and Vredenburg, 2005). Further, the social implications of sustainability may arise via enhanced trust and more intensive interaction between actors.

Governance Mechanisms

In response to growing concerns about the marine crisis and the consequent need to develop sustainable fishery practices, new forms of private rule-setting governance arrangements and institutions have emerged alongside government regulation. In our study, we follow Raynolds (2004) and determine governance as "the relations through which key actors create, maintain, and potentially transform network activities" (p. 728). Governance can be driven by both internal and external factors and actions. As Bush et al. (2015) indicate, a distinction should, therefore, be made between governance in chains, of chains, and through chains. Sustainability governance in chains is predominantly analyzed in terms of intra- and inter-firm operations and coordination, whereas governance of chains is located within the global value chain tradition supported by non-state and non-firm actors that define the rules through which the chains are governed and organized (Bush et al., 2015). Further, private governance is often pursued by social movements, international NGOs, private companies and states (McCarthy et al., 2012). Accordingly, by governance mechanisms, we mean those practices used by firms to manage relationships with other partners throughout the seafood supply chain to improve their sustainable performance, which generally refers to the ways the production process results from environmental, economic, and social solutions.

Earlier literature on governance mechanisms mainly focused on factors shaping governance structures within global supply and value chains. A distinction in governance structure has been made between producer-driven and the buyer-driven chains (see Gereffi et al., 2005). While producer-driven chains are engaged in outsourcing manufacturing components, in a buyer-driven typology, retailers or brand-name companies dictate terms and set rules for actors' behavior in the chain, usually without owning production facilities (Ponte and Gibbon, 2005). In SCM literature, these buyer-driven chain practices refer to supplier development. Some researchers have observed that along buyer-driven chains, different types of buyers – e.g., retailers, brand marketers, NGOs and industrial processors – may be lead actors who tend to be more assertive in establishing a certain order and transfer of information between the buyer and suppliers than in producer-driven chains (Humphrey and Schmitz, 2001; Gereffi et al., 2005; Ponte and Gibbon, 2005; Tallontire et al., 2011). This debate has led to further discussions on governance issues in terms of how certain actors establish and enforce the "parameters under which others in the chain operate" (Humphrey and Schmitz, 2001, p. 20). In this regard, the view on governance has changed in terms of exercising control through the specification of what is to be produced – and how. This approach focuses on "inter-firm relationships and institutional mechanisms through which non-market coordination of activities in the chain is achieved" (ibid., p. 22).

Criticism of earlier research suggested that supply and value chain practices constrained by institutional orders and norms (Tsvetkova and Gammelgaard, 2018) do not operate in "an institutional and regulatory vacuum" along the seafood chain (Ponte and Gibbon, 2005). There is a multiplicity of actors, institutions, agents, and factors formally and informally influencing the so-called drivers, such as governmental policies, civil society organizations, and different consumer categories. This entails governance being involved in balancing self-interest decisions and the interdependence between firms in the supply chain (Richey et al., 2010). Information and communication technologies play a steering role in driving private governance that requires transparency, broad stakeholder participation, and trust (Mol, 2008). While transparency is considered to improve governance by enhancing actors' capacity to scrutinize decisions (Mol, 2014), empirical evidence is mixed (Kosack and Fung, 2014).

Moreover, Humphrey and Schmitz (2001) argued that governance can be exercised in different ways, and various parts of the same chain can be governed differently. Some researchers argue that governance mechanisms can even replace centralized government (see Mayer and Gereffi, 2010). So, governance arrangements can face indirect and distant interactions among various supply and value chain actors that are to be enforced by private standards and rules regarding information flows on product characteristics (see Ponte et al., 2011), e.g., in terms of sustainability and environmentally friendly production for better quality. However, these governance aspects raise certain issues when global, sometimes invisible, forms of power face local practices and create a sort of "global" vs. "local" gap (Boström et al., 2015) in the existing practice, causing arguable consequences for production contexts. This remains uncovered in the literature. In line with this, we argue that private rule-setting governance, shifting the dynamics between the private sector, state and civil society, expands the vertical management structure in a horizontal dimension. Such horizontal governance can become a source of concern regarding how key actors achieve compliance and legitimize their actions in both public and private domains by setting, monitoring, and implementing such MSC global standards.

Translating Standards into Practice: Theoretical Framework

Standards as tools of governance have been approached in the literature from a variety of perspectives. In this study, we explore the issue of sustainable governance through MSC certification from an institutional perspective, focusing explicitly on a "following standards" approach (Brunsson and Jacobsson, 2000). This approach concentrates on identifying sources of private rule-making authority and, specifically, on how standards and organizations that drive them and translate them into practice achieve legitimacy.

Standards, specifically those which have acquired a rule-like status (Czarniawska and Joerges, 1996), can be seen as ubiquitous but underappreciated tools for regulating and organizing social life by rendering the modern world equivalent across cultures, time, and geography (Timmermans and Epstein, 2010). However, they lurk in the background of much sociological research. As with organizations and markets, standardization can be used deliberately for control in order to influence actors' behavior and choices and, therefore, may explain why actors behave in a certain way. At the same time, standards are tools of control that facilitate cooperation and coordination across time and space. Amidst contemporary trends toward globalization, new kinds of transnational and nongovernmental organizations, such as the MSC and others, have emerged to promote specific standards and offer advice on a range of issues, from public policy to technological specification.

Bowker and Star (1999) defined standardization as the process of creating uniformity across time and space through the generation of consistent agreed-upon rules. According to Brunsson and Jacobsson (2000, p. 2), "a typical standard consists of a statement about the generally desired qualities of a product, an activity, or a document" . The standards thereby created tend to embrace more than one community of practice or activity site; they make things work together. In further elaboration, Brunsson and Jacobsson (2000) emphasize that the promulgation and enforcement of standards is a major type of social regulation. It is also assumed that standards could quite productively replace various other forms of hierarchical rule-making. For example, if organizations or government regulations are weak and cannot enforce behavior through direct orders, standards can fill a gap in coordinating operational activity (Brunsson and Jacobsson, 2000).

Following a standard means establishing some consistency between the standard and what organizations do in local practice. This consistency or so-called translation can be achieved in two ways: by changing either practice to comply with the standard (practicing the standard) or the presentation of practice so that it appears to be according to the standard (standardizing practice). The former aspect of translation implies a process "from talk to action" and "from general to the specific" when the standard's general requirement is implemented in the follower's specific practice. The standardizer usually tends to convince others to follow its standards, by arguing that the follower's specific activity represents an appropriate environment to adopt these specific standards. The standard is general and abstract, whereas operations are always specific. Practicing a standard is mostly about adapting practice so that the standard describes it with reasonable accuracy. The standard is said to be implemented or practiced when practice is changed while the follower performs a translation (Brunsson and Jacobsson, 2000). Further, standards can be considered "expert knowledge stored in the form of rules" (Jacobsson, 2000, p. 41; see also Brunsson and Jacobsson, 2000). From this perspective, expertise is a kind of knowledge that claims to be correct, embodies practical advice, is produced by specialists, and can be challenged only by specialists (Jacobsson, 2000).

The latter (opposite) aspect of translation involves a path "from action to talk, from the specific to the general, from own activity to categories" that means that the follower of a standard generates changes in the presentation of its practice but suggests no changes in the practice itself. In this way, existing practice is continued as before but described in compliance with the standard. It means that the follower standardizes its practice but does not practice the standard. Brunsson and Jacobsson (2000, p. 128) emphasize that "this strategy is likely when the adopter believes that its practice complies reasonably well with the standard – and there is reason to assume that this belief is shared by relevant others". The dynamics of this kind of decoupling can take different forms and may have adverse effects – for instance, on the morale of the organization's members (MacLean and Behnam, 2010). However, in some circumstances, existing practice cannot possibly be described credibly as consistent with the standard. In this case, standardizing practice requires practicing the standard, when the follower must change not only the presentation but also the practice itself. Further, standards are expected to result in uniformity, achieved through diffusion, innovation, and imitation. So, following standards implies that adopters make efforts to translate a generally formulated rule into terms relevant to their particular situations and circumstances by not inventing their own solutions or imitating anyone else (Brunsson and Jacobsson, 2000).

The world is flooded with competing standards, so many of them risk not being widely adopted in local contexts. The voluntary nature of many standards makes translating them into practice challenging, especially if built-in incentives do not encourage compliance. For example, the incentive may come from a crowd effect, in which non-compliance with standards becomes a cost. However, incentives alone do not guarantee that standards will be implemented and followed. To ensure compliance by adopters, pressure may come from third parties, particularly when a standard has become so institutionalized that its adoption is taken for granted (Etzion and Ferraro, 2010). It is noteworthy that each standard implies a "scenario" (Akrich, 1992) defining the different roles of users and their skills, motivations, requirements, tools, performance, and outcomes. At any time, any of these factors may not work as the standards' creators intended, and the standard may fail or transform into a new form (Timmermans and Epstein, 2010). It relates to the fact that, despite their abstractness and obscurity (see Thévenot, 2009), standards can be interpreted in different ways, and each of many followers can adapt their interpretation to their needs and preferences. On the other hand, there is often less room for interpretation of what needs to be said. Often, uniformity is provided more by what followers say and proclaim about their actions and much less by what they actually do in practice (Brunsson and Jacobsson, 2000).

Method

Research Design

A qualitative single-case approach was chosen to explore the outcomes of translating MSC certification as a global governance mechanism into local fishery practices in the Russian Barents Sea. This approach was helpful in understanding "the processes by which phenomena take place" (Maxwell, 1996) from bounded real-world settings (Barratt et al., 2011) and interpreting them "in terms of the meanings people bring to them" (Denzin and Lincoln, 2005). The criteria for case selection were a fruitful and long-term experience of the MSC sustainability standards well established and further developed during the last two decades of operation in Russia. The case turned out to be attractive and valuable, in that it helped to identify the features and outcomes of the collision between global standards and local fishery practices, as well as their integration into developing strategic supplier management and sustainable fishery management.

Data Collection

The primary sources of empirical data were nine semi-structured interviews and archival materials, including the MSC's certification reports. We chose the semi-structured interview method, as it was useful in performing the strategic selection of respondents from different groups of key actors involved in the MSC certification, such as representatives of two fishing companies, NGO experts, scientific experts in fishery management, the WWF regional organizations and MSC representatives (see Table 8.1).

The interviews, which lasted from 45 min to two hours, were conducted and tape-recorded by the second co-author of this chapter in Russian and then translated into English. Then all records were fully transcribed, validated with the respondents, and consequently analyzed. The transcript length was 45,525

Table 8.1 List of respondents

#	*Type of organization*	*Date of interview*	*Location*	*Type of interview*
1	WWF Russia	May 2021	Moscow, Russia	Online
2	Fishing company	August 2021	Murmansk, Russia	Face-to-face
3	MSC auditor	August 2021	St. Petersburg, Russia	Online
4	Polar Research Institute	August 2021	Murmansk, Russia	Online
5	Regional association of fishermen	August 2021	Murmansk, Russia	Face-to-face
6	WWF Murmansk	September 2021	Murmansk, Russia	Face-to-face
7	MSC certification body – 1	June 2022	Russia	Online
8	MSC certification body – 2	June 2022	Russia	Online
9	Fishing company	July 2022	Murmansk, Russia	Face-to-face

words. The interviews took place in Moscow, Murmansk, and St. Petersburg between two periods: May–September 2021 and June–July 2022. When necessary, follow-up questions were conducted via email.

Data Analysis

Our study applies an abductive method of data analysis (see, e.g., Timmermans and Tavory, 2012) that refers to the iterative interpretive process of going back and forth between the theoretically surprising empirical findings and their tentative explanations. As emphasized by several researchers, it is useful for coding qualitative materials (see, e.g., Deterding and Waters, 2018). Because the concrete implementation of abduction remains underdeveloped, especially for coding (Vila-Henninger et al., 2022), and there is a different set of tactics for abductive coding of secondary and primary data, our analysis was inspired by a technique elaborated by Gioia et al. (2013). This approach was helpful in imbuing our study with "qualitative rigor" while retaining the creative potential for bringing light to empirical features and generating new ideas and unexpected findings. We used NVivo software to support our coding process by keeping the codes in order to operationalize complex phenomena that span codes in the abductive codebook. This was crucial for data reduction and allowed for further inductive coding that facilitated a final round of qualitative analysis.

The analysis included several consecutive steps. First, each co-author read the interview transcripts, documents, MSC certification reports, and other material to develop a mutual in-depth understanding of empirical features between all the co-authors before coding. Then we organized a series of coding sessions and transferred our independent open coding into jointly developed codes, thus creating a list of 110 informant-centric codes and categories. This helped us to adhere faithfully to respondent terms and meanings and facilitated agreement in our collective interpretation process. After several rounds of reading, seeking similarities and differences, thematic grouping and revising, we refined the initial list of informant-centric categories into 18 first-order concepts. Despite these 18 codes being firmly based on "empirical voices" (Gioia et al., 2013, p .21), we treated ourselves as knowledgeable agents, making it possible for our knowledge of the theory and prior understanding of our phenomenon to also influence their formation. Then, we organized our first-order categories into second-order themes. In the second-order analysis, we delved into the theoretical realm, wondering what concepts might help to describe and explain the phenomenon we observed. Once we had a working set of themes, we investigated whether it was possible to frame the second-order themes further into theoretically inspired "aggregate dimensions" (see Gioia et al., 2013). Our data structure is presented in Appendix 1 (Figure 8.1).

Case Presentation

MSC Effects on Fishery Practice

Historically, Russian fisheries in the Barents Sea were heavily dominated by bottom and pelagic trawling as the predominant fishing gear. Enforced mainly by the British and German trawler fleets, which outnumbered Russian trawlers 400-to-1 until the 1920s, trawling practice pressure reached its peak in the 1950s–1980s (Shevelev et al., 2011). This pernicious practice resulted in a five-fold increase in discards by the mid-1970s and, subsequently, numerous stock collapses and associated declines in catches up to the beginning of the 2000s. While the overall number of trawl vessels declined, and in the mid-2000s, approximately 280 worked the North Atlantic – less than half the number that did so in the 1950s (Grekov and Pavlenko, 2011) – trawling methods still challenged the viability of fish stocks (ICES, 2015).

Fish are not a stationary natural resource that respects human-made boundaries. Most valuable commercial species inhabit both parts of the Russian and Norwegian Barents Sea and the Norwegian Sea. It is also indicative that overall declines in Barents Sea stock abundance influence both Russian and Norwegian fisheries equally (Matishov et al., 2004). In response to these issues, an enforcement system was developed by the Russian and Norwegian stakeholders with the active assistance of the Joint Norwegian–Russian Fisheries Commission (JNRC) to address any fishery declines equally. Due to these political agreements, the commission provided bilateral management of the most important fish stocks of both countries, resolved quotas, harmonized technical regulations and control measures, and could create internationally managed fish stock-sharing systems (NMFCA, 2018). This resulted in reducing the adverse effects of trawling in the Barents Sea. The stipulation of the total quota for the various joint fish stocks has been and remains a key element of the annual negotiations between Norway and Russia, which are based on the scientific recommendations of the Council for the Exploration of the Sea (ICES). Because ICES and JNRC have translated international requirements for fisheries in the Barents region for many years, the emergence of MSC certification has not become a completely new practice for Russian fisheries and, accordingly, has not resulted in fundamental changes. Moreover, many MSC rules were based on international agreements that complied with the requirements for sustainable fisheries presented by ICES and JNRC.

Furthermore, the adaptation of MSC standards to local practices was reinforced by the active efforts of the WWF regional representative office in Murmansk. With solid support from scientific institutes, WWF experts elaborated measures to reduce fishing companies' impact on the environment by using more forgiving fishing gear and environmentally friendly fishing techniques. Also, they acted as public overseers of MSC certification standards' implementation, focusing auditors' attention on challenging areas. As stated by a WWF respondent:

> *For example, sorting grids were inserted in trawlers. This helped to screen out whitebaits before getting caught and ensure considerably low by-catches of non-target species. That was a condition of some certificates. It was particularly useful in prawn trawls. The grid is designed as a barred grid; the space between the bars must be at least 22 mm. This means fish and anything else larger than 22 mm are pushed back out of the trawl, while the smaller prawns pass through the grid and are caught. This method was well-received by most fishermen, since it eliminated manual catch sorting and overall resulted in more efficient fishing.*

Additionally, special devices were used to scare away seabirds, which was also one of the certificate's requirements. Thanks to this, the death of birds decreased by 80%.

It is worth adding that certified Russian fisheries are managed nationally. However, Russian fishery management is determined by traditions that vary considerably from those the MSC standards suggest. Primarily, Russian regulations pay less attention traditionally to the ecosystem impacts of fish stock conditions, which were repeatedly addressed in almost all certifications. Further, public awareness of the need for a sustainable market and practice has not been sufficiently prevalent in Russia to justify putting pressure on businesses and society. Yet, several respondents emphasized that the MSC certification helped create an integrated fishery management system. A notable effect has been an increased focus on the environmental aspects of fishing and maintaining a balance between sustainable use and conservation of marine ecosystems by fishing companies.

Transparency from Boat to Plate

Customers are used to seeking products that benefit their health and the environment. They like to know where their fish comes from and how it has been handled. This concerns certified and non-certified fish and seafood products. Traceability is an integral part and instrument of MSC certification within the chain of custody of seafood products. It ensures that fish are independently assessed and certified along each link in the supply chain from fishing vessel to plate, in order to prevent illegal, unreported, and unregulated fish from entering the marketplace, the share of which ranges from 18% to 26% for different types. Moreover, fake producers do not buy licenses and are not involved in MSC certification. In practice, the traceability dilemma concerns whether it ensures the absolute legal origin of the product or creates a system of voluntary environmental compliance like MSC eco-labeling, or both. Our respondents state that high levels of traceability have been achieved in the overseas export of fish from Russia, and MSC certification primarily means the catch qualifies as responsibly caught. However, there is a lack of traceability for Russian consumers concerning the origin of fish.

Meanwhile, the disclosure and openness promoted by MSC rules are insufficient domestically in Russia. MSC certification required Russian fishing companies to introduce dedicated MSC logbooks, which contain exhaustive data on discarded fish and seafood species. As emphasized by a respondent from a fishing company:

> *Fisheries data is essential for proper stock assessment and helps manage our fisheries. We record data every time our vessel goes out to fish. We present this data weekly or monthly. Reporting fish catch data is important; without it, our fishing license could be suspended or even denied.*

However, contrary to regular state-stipulated catch logs, MSC logbooks were intended for internal company use, and some data may not be fully disclosed.

One crucial issue in implementing a traceability system is compatibility and data standardization (Kim et al., 1995). Further, the seafood supply chain can involve many intermediaries between fisherman and consumer, including brokers, traders, and others, which may appear within virtually every link in the chain. As a fishing company's manager reported:

> *A few years ago, we worked with one processor who aggregated the catch from many small fishers and then sold to us and one more retailer. Those small fishers were not involved in a system for certificating and labeling the product.*

> *Consequently, it was almost impossible to trace caught fish back to the source. This caused unnecessary trouble with checking the quality of products.*

Further, a relatively new feature of the global seafood supply chain is the emergence of a third-country processor, meaning unprocessed products are exported to become processed and can be re-exported again. As one respondent stated:

> *A significant amount of Russian fish is exported to middlemen abroad. This is especially true for illegal fish, of course, because they are cheaper and almost impossible to trace back. Foreign traders often re-export such fish to China, which is well known for such business where the product is processed and thereby laundered. And then, such fish re-emerges on the Russian market for consumption as legal "product of China". Without a tight traceability system, the black market for seafood re-exports flourishes, and low-quality and unregulated fish can easily end up on store shelves.*

So, the MSC eco-labeling has not produced a strong impact in eradicating illegal and counterfeit fish and seafood products in both the domestic Russian and international markets, but it has become an additional means of identification applied to the product packaging to allow tracking of fish movement throughout the supply and value chain from catch site to final consumers.

Broad Actor Participation, Communication Issues, and Coastal Fisheries

The MSC rules require the involvement of broad stakeholder participation within seafood production and supply chains toward customers. Fishing companies were tightly integrated into cooperation with various non-state actors, one of which is the auditors, whose responsibility is to confirm fisheries' compliance with the new MSC rules. Auditors act as mediators between the global and local levels and make decisions on the compliance of a particular fishery and fishing vessels with the MSC requirements of sustainable and socially responsible fishing practices, recommending improvements for the management system and interacting with all stakeholders involved. They also help establish transparency of fish sources from suppliers and whether they follow ethical fishing norms.

In the first years of implementing the MSC system in the Russian Barents region, non-Russian speaker specialists were engaged as auditors in the assessment procedure. As several respondents reported, non-Russians in assessment teams added communication issues that, in turn, caused extra time to be required for translating documents and reduced effectiveness during oral communication regarding understanding local specific cases on remote site visits. As several respondents noted, there could often be curious situations where foreign auditors baffled fishermen with questions that sounded strange and, frankly, senseless. For example, when a foreign certification team visited a Russian fishing vessel, they were surprised that it was well-equipped with modern gear and facilities to assess and address environmental constraints. This showed that foreign non-Russian-speaking auditors were not well acquainted with distinct features of Russian fishing practice that seemed quite alien. Further, some communication issues caused misunderstandings of the MSC assessment and certification process and, to some extent, rejection from ordinary fishermen and captains of fishing vessels, which could affect interactions between top managers of these fishing companies and assessment team members. This increased complexity and intricacy in the interaction between auditors and fishermen, involving several extra formal and ritual procedures to pass the assessment. Subsequently, Russian experts appeared as auditors in the MSC assessment system. So, it became easier to communicate and share data, as there was no language barrier but a similar mentality.

The MSC changed scientists' role, as the assessment process was based on scientific findings and research. Several respondents noted that, at first, there appeared to be difficulties accessing scientific data, which was critical to certification. This was mainly due to bureaucratic aspects rather than an actual lack of these data. However, in working within certified fisheries, fishermen began sharing information on fish stocks with research institute experts and consulted them directly.

A distinctive feature of introducing MSC certification in Russia was the participation of large fishermen associations and large-scale fisheries that were engaged in substantial commercial fishing and global trade networks. The life-sustaining activity of small-scale and near-coastal fisheries is usually contrasted with commercial fishing, which may overexploit marine resources and destroy vulnerable Arctic marine ecosystems. Near-coastal fisheries were initially envisaged as a separate entity, providing local markets with fresh processed fish to ensure the livelihood of locals and Indigenous People in coastal towns and settlements. This activity brings comparable returns in domestic local markets, and its establishment was traditionally supported by regional authorities. MSC stock assessments are hardly achievable for coastal fisheries and costly when audit prices range from $13,000 to $500,000 for full assessment, depending on the fishery's complexity and size. Further, as several respondents reported, the MSC certification system pays insufficient attention to local communities' social needs. So, while targeting the same fish stock as large-scale certified companies, near-coastal fisheries are not concerned with entering MSC certification. However, some target species, such as salmon and perch, are easily available to the local population in coastal and inland waters using simple fishing gear. Consequently, the number of salmon and perch caught by local people (legally or illegally) can be comparable to commercial fishing.

This local access to fish resources, in turn, can significantly impact certified fisheries and make regulatory enforcement more difficult than on the high seas. Currently, regulations oblige fishing vessels to use a vessel monitoring system (Lajus et al., 2018).

Trust, Private Cooperation, and Responsibility

The MSC certification process brings together a vast number of companies working within the fishing sector in a community where they organize themselves and produce actions according to their specific goals and strategies. This establishes the ground for trust, mutual responsibility, the assignment of duties, and discipline.

While MSC certification was intended to increase trust among participating fishing companies, traders, suppliers and retailers, and their networks, local fishermen and authorities saw MSC audit and assessment with varying degrees of skepticism. They even expressed ideas about creating a national certification system. However, administrative levers of control did not permit the creation of a certificate that would be in demand on the world's international markets. Several respondents agreed:

> *These attempts to create a unified Russian certification could hardly be considered serious for their successful implementation, as many large foreign retailers, e.g., the Japanese corporation Marubeni, refused to accept the Russian domestic certificate. They explained this by the fact that such a document should be based on market-based mechanisms and recognized by other national and global actors.*

Local authorities were very reluctant to provide MSC's auditors with necessary data, referring to the fact that fish is a strategic resource, and, consequently, information on catches is confidential. An often-heard argument that questioned the implementation of MSC certification in practice was that the Russian market and consumers did not need more expensive seafood products and foreign inspections. One respondent, MSC's auditor, asserted:

> *It was often challenging for me to deal with state fisheries' authorities considering eco-labeling as a form of eco-colonization and even a kind of "green" imperialism, as some kind of threat imposed by Western countries. This conventional opinion undermined my credibility as an auditor. Any data on catches looked like quarrying a military secret.*

In contrast, recommendations provided by such intergovernmental organizations as the JNRC and ICES were taken into account. It is also worth emphasizing that the JNRC's commission did not include NGO representatives, including MSC's experts, in their sessions.

Surprisingly, expansion of MSC certification into the Russian domestic market also met with resistance. On one hand, the Russian authorities did not interfere with the MSC's involvement in the domestic market. On the other hand, they did not assist, as it could disadvantage local producers and distort the market balance. In the face of insufficient support from governmental institutions, MSC representatives had to disband these fears and claim that MSC functions as a marketing instrument to make sustainably produced fish accessible to Russian consumers. Subsequently, due to the need to enter international trade and markets, local authorities formed a more favorable perception of these specific non-state private rules, such as MSC.

The introduction of MSC principles has created the prerequisites for changes in actors' behavior, related not only to fishing companies' managers but also to fishermen's activities and thinking. As another MSC representative in Russia reported:

> *In recent years, we have seen Russian fishermen become more responsible for fishing and preserving biological resources. They (fishermen) paid billions for new vessels, which can catch 30–40 thousand tons per year, and they do not want them to become idle in only three to four years because all the fish stock is caught today. Therefore, they would rather hold back their activity now than leave the sea empty sooner. It seems to me that the biggest achievement is that not only top managers understand the meaning and value of MSC certification but also ordinary seafarers and fishermen working on vessels start thinking about it. There is a certain evolution in the minds of fishermen.*

Tractability of Global Standards under Localization

The introduction of new formal rules inevitably leads to involved actors seeking to reduce the high certification cost price, trying to manage it. Also, the certification process is quite complicated due to the need to process and analyze a large amount of information on stocks and the state of ecosystems. In turn, local actors' aspirations and the peculiarities of the local context can affect the global standards themselves and result in their deformation in the process of their implementation. Working within certified fisheries, some companies tended to present their activities as up to MSC standards but without making the necessary changes in their work. In terms of which, some MSC certification principles have undergone modifications or a sort of imitation, also associated with a high level of trust among involved actors and some ease of manipulation or tractability.

According to MSC requirements, observers must be present on vessels working in the fishing grounds to control fishing methods and exploitation patterns. At the same time, companies often tried to exaggerate the number of observers on paper, including, e.g., border guards and state inspectors who performed utterly different functions. In some cases, this resulted in observers turning out to be people without particular expertise and, accordingly, unable to carry out control and monitoring with due quality. According to several respondents, fishermen tried to limit observation at times when captains were somewhat reluctant to give observers access to the deck during fishing operations:

> *During fishing, there is no place on deck for outsiders; work is in full swing. Every minute is precious. And observers, as luck would have it, stick their noses everywhere and frankly interfere with the process. Fishermen get nervous and can get injured. And who will be responsible for this if not the captain himself? In addition, the weather is often hellishly bad or shakes shamelessly to the right and left. We often agreed that the observer would spend time down in a warm cabin watching the TV, and we would share the data with him after fishing (…laughs…), and everyone always agreed.*

Another requirement of the MSC, which has been tractable to modification, was whitebait conservation under fishing to overcome population declines. It refers to the fact that accidentally caught juveniles must be released back into the sea. However, according to our respondents, such gear was often used to throw juveniles overboard, which only damaged them:

> *It is usual practice when the incoming fish on longline are gently brought on board using a gaff hook inserted in the lower lip. Fish are then measured to the nearest centimeter and handled on the deck. The use of circle hooks led to hook set in the edge of the mouth. But in cases when juveniles get caught, fishermen also use a gaff to expeditiously hook them by heads and tails and throw them away overboard. Well, imagine how fish will survive after that with apparent wounds or bleeding. But no particular protocol was implemented by the MSC to assess gaffing issues.*

Manipulation and imitation of MSC standards became possible due to the peculiarities of the certification and audit system itself. The point is that the MSC aims to certify fisheries with a particular focus on fish stocks and their potential for sustainability. Further, fisheries that engage in widespread and increasing discards and are severely depleted cannot be certified for commercial fishing. Fishing gear and methods applied by fishing companies are not taken into consideration. Consequently, the MSC audit procedure focused mainly on analyzing scientific data that gave necessary figures to estimate fish stocks and company documentation that gave an idea of the fishery management features. However, fishing practices themselves were rarely checked. As several respondents highlighted, this was because auditors were not granted permission or access to travel on board during the fishing season. One respondent noted:

> *The audit burden comes down to nervous scribbling and sorting through piles of documentation. At best, we auditors can come to Murmansk, for example, and visit a fishing company. We are sometimes allowed to board the vessel to look at the trawl and nets. But it is impossible for an observer to get permission to go to sea and check it with his own eyes. This is one of the weakest points, of course. Thus, what the company's managers said in words and documentation, one has to believe.*

Another respondent added:

> *It is natural that there are some informal agreements, I would even say games, between the client and the auditor, and then with the observers. Not everything is shown and reported to the observers.*

Discussion

MSC certification and eco-labeling, as private rule-setting governance arrangements, promote voluntary compliance by the various actors involved. This compliance with MSC global standards is intended to ensure that local interpretations of a given standard do not deviate excessively from what has been defined as appropriate or legitimate. Our findings reveal that several actors tend to standardize their operations and activities in fishery management rather than really practice all the MSC requirements and orders. So, MSC architecture in Barents Sea fishery management implies a sort of ambiguity that leads to imitation and even de-coupling. When the MSC standards were introduced into the local Barents Sea practice, they proved to be tractable and even amenable in some aspects. This was due to the inability to control all the fishing gear and methods used in real practice, as well as the peculiarities of the local context. It should be added, however, that insufficient independent surveillance was not considered a critical issue due to the confidence that fisheries were properly enough managed, which was particularly confirmed by many certification decisions. These findings can be considered original, since, to the best of our knowledge, no previous research focused on the tractability of MSC standards. Further, our findings have revealed that governance arrangements, such as certification conditions, surveillance reports and/or logbooks, can continue to function, despite little evidence of sustainability improvement. This also illustrates the illusion of improvement and limited watchdogging when key actors manipulate MSC standards by various interpretations and translate them into terms relevant to their local practices. The translation of MSC standards may further diminish their effectiveness in establishing uniformity. In turn, this indicates that MSC compliance mechanisms are superficial in the Russian Barents Sea, implying a credibility gap. The same effect of standardizing practice has been asserted before by several institutionalists who claim that firms are joining all relevant standards organizations, not necessarily with the objective of adopting their standards (Brunsson and Jacobsson, 2000). This study's findings support this claim by illustrating this effect in seafood supply chain practices, which received little attention in earlier studies.

An unexpected effect of MSC implications was that MSC ambivalence and ambiguity work quite well for practicing standards in fishery management in the Russian Barents Sea. On one hand, MSC certification allowed Russian fisheries' business to be made more transparent and open to the public, positively affecting law enforcement, monitoring, scientific research, and statistics. On the other hand, MSC certification has facilitated easier access of Russian fish and seafood products to global supply and value chains and, thus, to international markets. As our study has illustrated, MSC standards work when they are beneficial for the actors involved. In this sense, our findings are consistent with earlier studies that found that sustainable principles are well-functioned when they are economically viable (Tsvetkova, 2020). Yet, at the same time, our findings have surprisingly indicated that MSC may eliminate existing economic sustainability achievements when used as a market competition weapon.

Further, we observed that fishermen did not hasten to change their roles under the influence of MSC uniformity and retained their original fishing practices, particularly in the case of auditors' surveillance. As a result, they transformed the standards into some new hybrid form of cooperation that introduced new hierarchies and arrangements, balancing state and private rules. This phenomenon can be explained in two ways. First, it happened due to the voluntary nature and a variety of possible interpretations of MSC standards (see Brunsson and Jacobsson, 2000). Secondly, local actors, as partners in a co-creation process, understand better how local practices could be incorporated into global and generic standards like MSC ones and make them more context-specific (see Boström et al., 2015).

In most ways, MSC standards act as a source of expert knowledge, which in turn brings all actors, so-called adopters, together and creates implications for seafood fishery and supply chain cooperation. As shown in our findings, over time, fishermen's actions began to be driven by a long-term vision of fishing development, while reducing discards and focusing on stock recovery. This became possible due to integration mechanisms established under several conditions, such as more mindful fishermen's behavior, straddling fish stock management, market advantages, increased interaction between diverse groups of involved actors, and the introduction of more environmentally friendly fishing practices. Consequently, these cooperative governance arrangements, based on SCM integration mechanisms, have translated the symbolic power of sustainability tools imposed by MSC into a more socially responsible attitude to what the actors actually do and how, rather than empowered coercive pressure. Although social aspects and needs are formally absent from the certification principles and procedures, this finding shows that MSC raises the issue of actors' responsibility regarding the consequences of their fishing methods and operations. In this way, social responsibility can be viewed as commitment, responsiveness, and learning (see Boström et al., 2015). All these aspects point to the emergence of two compliance gaps regarding responsibility – reflexive awareness and reflexive learning. While reflexive awareness implies actors are capable of examining their motives for acting and how these may influence what they do in a specific situation (see Tsvetkova, 2021), reflexive learning involves considerations about how interactions between (local) existing practices and (global) standards produce and reproduce the same issues over again (see Boström et al., 2017). As shown in our findings, fishermen adjusted fish practice in such a way that it matched the MSC standards regarding compliance gaps and did this by being engaged in dialog and cross-fertilizing their experience with other partners. In light of this, our study contributes to the literature on a relatively underexplored area of how social responsibility evolves in supply chain practices and facilitates sustainability (Tsvetkova, 2020; Tsvetkova, 2021).

Conclusion and Implications for Theory and Practice

Through the lenses of the institutional perspective on following standards, this in-depth study presents a consensus between MSC global standards and local fishery management practices in the Russian Barents Sea. We show that MSC certification and eco-labeling make fishery companies reframe their conceptions of responsibility beyond the Russian national regulation and their own organizational borders along the seafood supply chain. This gives a better understanding that supply chain practices become sustainable when it is beneficial and creates value for the actors involved. Our findings provide us with an acknowledgment that there are no one-size-fits-all tools to achieve sustainability in supply chain practices.

The discussion in this study indicates that the involvement of fishermen's community and the multiplicity of governance arrangements, e.g., transparency, auditing, broad actor participation, trust, and mutual responsibility, have been encouraging incentives for the emergence of integration mechanisms. We found that integration of MSC standards' orders, expertise, and fishermen's imitation co-exist in fishery practice in the Barents Sea. Consequently, strategic collaboration is formed, which contributes to synchronization between actors within the fishing and supply practice and their sustainability commitment. Although we can hardly argue with certainty that integration mechanisms promote following and translating standards in local practices, our study expands the literature on supply chain integration by highlighting some pieces in this puzzle, such as reflexive awareness and learning.

What we can conclude is that standards do not lead to a standardized world, overwhelming local practices with their uniformity and formalized rules. On the contrary, we found that, despite the ambivalence and ambiguity, MSC standards as market-based rules can be subject to transformation, innovation, and imitation. Thus, standards can stabilize some actions of the actors involved and bring their behavior into compliance, but they are also forced to change under the influence of the specific circumstances in which they are made to work (see Timmermans and Epstein, 2010). This has resulted in a peculiar condition, creating not only a configuration of the sustainable fish market but also sustainable fish in the Barents Sea. Our study extends the literature by providing a better understanding of the socioeconomic significance of standards regarding overcoming sustainability issues.

Reflection on how local practices and performance become organized through specific standards, as well as how global standards and local practices interact and influence each other, may be crucial for practitioners and politicians to better understand what unintended consequences of voluntary certification procedures can be influential for operational outcomes. While meeting the standards is difficult and can be expensive, there is an increasing need for policy and business decisions to focus on reducing trawl, bycatch, and other fishery issues by developing their expertise and reflexive awareness and assessing the sustainability of annual catches. Our findings may be valuable for policymakers and managers responsible for developing seafood supply chain strategies and operations, not only in the Barents Sea but also in other localities.

Limitations and Further Research

The findings provide deep insights into the real-life situation of the translation of MSC standards into local fishery and supply practice. However, the Barents Sea is obviously a specific Arctic context, as it is ice-free all year round. Further research should include case studies on how global standards influence and adapt in other local practices, probably with more harsh natural conditions and contexts, to learn more about the processes that we found not to be solely a result of rational goal-setting by state and private rules.

We argue that governance is exercised beyond the vertical structure of seafood chains, and a focus on different stakeholders, internal and external, is needed. However, our understanding of how governance mechanisms can create sufficient legitimacy in the eyes of all stakeholders involved remains limited. Further research might provide deeper insights into these issues.

SCM literature emphasizes supplier relationships, but there is limited discussion in this study on how these can be harnessed to achieve sustainability. This represents a key future research area that is most likely to further enlighten us on integrated governance arrangements at all stages and interactions of the seafood supply and value chain, by going beyond economic and ecological rationalities to reflexive awareness of creating socially responsible and truly sustainable practices.

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Appendix 1

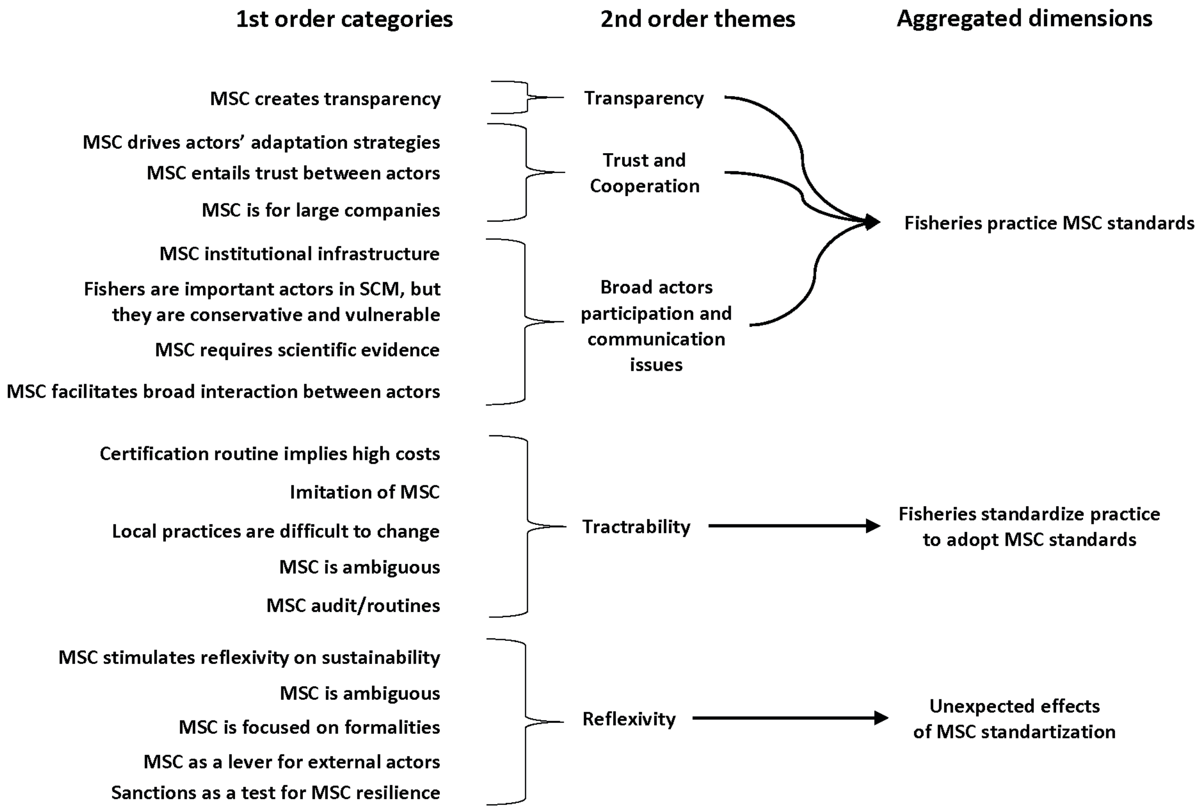

Figure 8.1 Data structure (*Source*: the authors' elaboration).

9 Is the Current Perinatal Regionalization Protocol for Indigenous Communities of Rural Alaska Adapting Sustainably and Equitably?

A Call for Larger Roles of Social Responsibility in Arctic Supply Chain Practices

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Introduction

In response to poor infant mortality rates, Alaska developed a transport system to mitigate risks associated with remote Alaska Native childbirth, beginning in 1973. Whereas earlier maternity services were provided by local midwives, the perinatal transport system began providing birthing Alaska Native women from remote communities access to biomedical birth, available at the urban tribal hospital. For areas unconnected by roads – where extreme Arctic weather can delay bush flights or medical evacuations – the network logically includes early air transport, along with provision of a distant hotel or hospital stay.

The Alaska Native Medical Center (ANMC) in Anchorage is the statewide referral center for specialty care for Indigenous populations and location for 1,600 Alaska Native births per year, of which about 50% to mothers from rural areas (ANMC, 2020). After 30–40 years of operating this unique healthcare supply system, the Association of State and Territorial Health Organizations (ASTHO, 2015) reported its effectiveness based on the transport system's ability to provide access to biomedical care. Thus, this study explores how social transport policies figure into sustainable provision of safe maternity services in rural Alaska.

Social sustainability is "concerned with the human side of sustainability" (Hussain et al., 2018, p. 1). Of the three pillars of sustainability – economic, environmental, and social – there tends to be scant treatment of social sustainability in supply chain management (SCM) literature. By attending to this pillar, especially in regard to healthcare supply chains, the decisions of

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all stakeholders can be effectively applied to SCM (Malik and Abdallah, 2019). Social sustainability is also a key objective in healthcare since it relates to the quality of life, with social consequences at the forefront for decision-makers. As healthcare facilities are moving more toward prevention and wellness, a major component of social sustainability – effective integration of business functions with all stakeholder perspectives is called for (Meidute-Kavaliauskiene and Ghorbani, 2021; Pohjosenperä et al., 2019; Khosravi and Izbirak, 2019). Supply chain sustainability in healthcare includes social outcomes aimed at improving the level of satisfaction, safety, equity, and well-being of all stakeholders, including patients and communities served (Mani et al., 2016; Subramanian, 2020). With an anthropological approach, including indigenous patient and community cultural perspectives, this value and supply chain analysis from a stakeholder perspective (Hussain et al., 2018) adds to these efforts.

This perspective also features a concept of intersectionality – a term for the unique experiences of discrimination and oppression while considering anything that can marginalize people – gender, race, class, sexual orientation, physical ability, etc. Alaska Indigenous women are frequently disadvantaged in healthcare, as are trans and nonbinary people. While historically, many Indigenous groups fully embrace members identifying as transgender, nonbinary, or bisexual (or "two-spirited"); those identifying as such, along with identities of Indigenity and/or female, can experience exponential, intersectional discrimination when dealing with colonial-biased mainstream policies and institutions.

In a comparison of both maternity services systems – the biomedical birth model and the midwifery (or community-based) model – different outcomes for local residents are identified. Using Tsvetkova's (2020) framework on social responsibility in sustainable development, comparisons are made between the tribal health agency and participant mothers' differing perspectives of benefits and drawbacks of processes, consequences, and institutional logic. The findings provide a glimpse of factors that tend to be overlooked when assessing sustainability in this healthcare supply system. The comparative approach was used to explore the impact of taking exclusively biomedical factors into account when assessing perinatal regionalization in Arctic Alaska and compare different social responsibility outcomes when applying biomedical and community-based frameworks.

The chapter is arranged as follows: the next section presents an overview of SCM in maternity health care for biomedical and midwifery models, followed by an explanation of anthropological approaches to SCM. A Methods section describes how comparisons are used to explore social sustainability in the perinatal care system of rural Alaska. An Analysis and Discussion section presents findings. The chapter concludes with a summary, limitations, and suggestions for future research on social sustainability in SCM of Arctic healthcare.

Theoretical Framework

SCM in Maternity Health Care: Midwifery and Biomedical Models

A distinction has been made between the doctors' traditionally interventionist view (biomedical) and that of natural birth process (midwifery-community), as described by Portela et al. (2018) in Brazil and Feenstra (2022) in a look at the negative impact of closures of rural Midwestern hospital-based care and thereby the quality of care and sustainability of services. Table 9.1, comparing biomedical and midwifery models of care, shows the biomedical model associated with lowering physical risks (usually measured by infant mortality rates) and attention to the needs of high-risk pregnancies. Doctors and personnel in this model typically refer to the mother as a "patient", in need of medical care. Risk associated with this model include infection and sometimes unnecessary cesareans, illustrating the trade-off for lower-risk birth situations, notwithstanding latent costs of overlooked cultural safety. Some hospitals have begun to offer non-medicalized features for low-risk mothers laboring there, but authority for decision-making in this model still lies within bureaucratic institutions (that is hospitals) and reflects the power and knowledge dynamics associated with fear and stress in childbirth (MacDougall, 2020).

The midwifery or community-based model reflects more woman- and family-centered features of care. Practitioners in this model can include other obstetric practitioners and Certified Nurse Midwives (CNM) but is mostly associated with direct-entry (lay) midwifery care. Caregivers in this model typically refer to mothers as "clients", needing assistance, support, and expert advice while experiencing a natural life event. It is unusual, however, for a non-nurse midwife to work in a hospital where biomedical protocols are in place. Authority for decision-making in this model is typically shared and distributed across non-medical caregiver, and the birthing person and family, themselves, with this framework supporting a more holistic body of knowledge reflecting acceptance and reliance on the process of birth.

Adverse Effects of Travel for Access to Maternal Health Biomedical "Standards of Care"

Many researchers (e.g., Grzybowski et al., 2011; Kornelsen et al., 2011) indicate that more birthing women exposed to travel to access services (resulting from Canada-wide closure of rural maternity clinics and hospitals) experience stress, anxiety, and other adverse outcomes. Lawford et al. (2018) found that the Canadian model for First Nations groups' healthcare resulted in a loss of community birthing services and Pember (2018) adds that this situation

Table 9.1 Comparison of features of biomedical and midwifery (or community-based) models of maternity healthcare

	Biomedical Model Features	*Midwifery (or Community-based) Model Features*
Features/ perspective	• ***Framework of birthing knowledge based on Western biomedicine,*** • **Low tolerance for clinical risks, and high tolerance for social risks** • Credited with saving mothers amd babies with advances in medicine; becoming the norm, even in most rural areas of the world. • Labor and birth managed with guidelines geared toward efficient timelines and formulas to control risks of infant morbidity or mortality; restrictive diet and movements in hospital 'standard of care.' • Birthing women expected to deliver within set number of weeks, or inducement of labor will proceed; thresholds also set for length of labor (and each stage) until emergency interventions offered. • Usually hospital or birthing centers inside hospital settings with IVs, continual, technical baby monitoring, and other hospital requirements; part of routine treatment for even low-risk birth. • High costs; higher levels of medicalized interventions and monitoring. • Practitioners in hospital delivery adhere to this model. • Practitioners tend to have a more formal, doctor–patient relationship	• ***A women- and family-centered framework of birthing knowledge based on reliance of a mother's natural abilities to give birth,*** • **Low tolerance of social risks and slightly more tolerant of perceived risks from unpredictable nature of birth.** • Originally, local non-nurse midwives more common birthing attendant; replaced by obstetric physicians in the United States • More alternative birthing sites (home birth, birthing centers) in use today, with non-nurse midwives in non-rural or non-indigenous communities; concentrating on health of mother and infant • Hands-on and intermittent, less invasive baby monitoring; Mother is freer to eat, move around, rest, or walk during labor • Lower-cost, non-medical interventions, like positioning, herbal baths, massages, etc. • Delivery site usually in a home or birthing center with a direct entry midwife (or other practitioners) • Direct-entry midwives attendance from early labor through delivery and more postpartum care • Typically more time and emotional support, less of a doctor–patient relationship, and more of a skilled, trusted advisor
Provides	• Relief from the difficulties and pain of natural birth through - Access to drugs and epidurals - Access to specialized care and cesarean delivery • Neonatal intensive care	• Continuity of Holistic care - Associated with less pharmaceutical medication, - fewer interventions, C-sections, fewer problems, even with Vaginal Birth After cesarean (VBAC) • Skilled care to supply oxygen, reposition babies, perineal massage

Note: Terms "women," "mother," & "mom" are used throughout this chapter, but it is recognized that people of many gender identities need and receive perinatal care.

translates into loss in ceremonies, cultural practices, and knowledge transmission that are imperative inclusions in culturally safe birth.

Houtari et al. (2020) found this same dynamic in Finland and questioned whether the "benefits" of centralization of larger units (mostly lower costs per delivery) were actually realized at the expense of geographical accessibility to services. They found increased travel time to be associated with adverse perinatal outcomes. Policy requiring personnel for cesarean capabilities is the driving force behind centralization in Finland and elsewhere, causing a sacrifice of accessibility in remote parts of these countries.

Declercq (Birthbynumbers.org, 2013) depicts the likelihood of cesarean birth associated with medical interventions in 2013 in Figure 9.1. More recent U.S. cesarean birth rate is just over 30% (Nethery et al., 2020). Lynch et al. (2005) concluded that there were no differences in adverse perinatal outcomes among providers with cesarean-section capability. Outflows of the non-cesarean local hospital, however, lead to transporting care to a clinic with the cesarean capabilities (as per "standard of care" practice) and places the local provider without those services in a position of having to close and not necessarily logical in rural and remote areas (Rolfe et al., 2017).

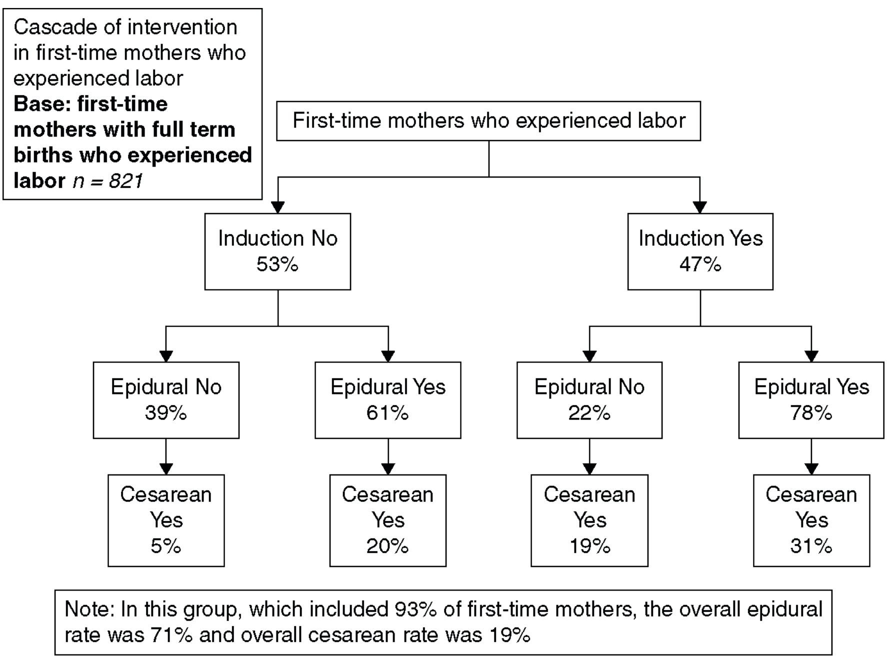

Figure 9.1 Cascade of intervention in first-time mothers (*Source*: Declercq et al., 2013).

Houtari et al. (2020, p. 3) call this dynamic a "trade-off between safety aspects related to the facility itself, and that of travel time." Economic factors like costs per delivery are favorable in the centralized system albeit a narrow, relatively short-term and Western-biased outlook, lacking attention to sustainability or cultural inclusivity.

In Finland, high-risk pregnancies requiring surgery are already centralized in the five tertiary hospitals. Therefore, the added benefit of centralizing maternity services, regardless of accessibility, was "not enough to outweigh the increased risk occurred by longer travel times" (Houtari et al., 2020, p. 8). While service accessibility is generally understood in Finland, it has not been considered when organizing health services.

Some studies point to differing worldviews and class divisions among doctors and patients as barriers to cultural competency, translating at times to poor access to health care for low-income and minoritized patients (Jones et al., 2017). Previous studies emphasized the element of social control of birthing women and the instillation of "birth fear" as common features of the medicalized view of birth (Jordan and Murphy, 2009). Maternal health programs now tend to be geared toward helping rural and remote birthing women access hospital care, with the idea that accessing this care will help combat infant mortality in underserved areas.

Yet, this globalized view of biomedical birth can cause difficulties for birthing women from areas lacking infrastructure to the point that some women and infants can be in dangerous situations with lengthy and difficult trips to the hospital. The logistical and bureaucratic structures that the Alaska Native people of Arctic Alaska must navigate can place them, at times, in similar situations. There has been, however, a recent resurgence of midwifery, especially in rural areas where families are particularly reluctant to relocate during COVID-19 (Davis-Floyd et al., 2021). Some studies suggest that while it is working so well to stay in the community with locally based midwives with extended certifications, this measure should become more permanent.

A number of researchers (Lynch et al., 2005; Schwarzburg, 2013a, 2013b; Grzybowski et al., 2011; Kornelsen et al., 2011; Declercq et al., 2020; Houtori et al., 2020; Umar et al., 2019) and WHO (2020) offer a more holistic stance. These studies present more inclusive data and input, taking a more community-based perspective of maternal health systems into account. Further, these approaches discuss the mitigation of both types of risk: biomedical and socio-cultural. The more common model, however, uses the maternal health system's ability to provide the products of the biomedical model to measure their success. This single-dimensional approach to risk assessment is at the heart of unbalanced policy assessments, especially in rural and remote areas of the Arctic. Current models lack adequate ability to respond to changing social elements and can evolve into perpetual system-sustainment rather than sustaining healthcare services in a fair and equitable manner.

Social Responsibility within SCM: Maternal Healthcare and Transportation

Socially responsible supply chains, especially within the health sector (Nara et al., 2020), require linguistic and cultural inclusion in service delivery. This accounting should include costs for all stakeholders: those associated with the biomedical models and those ignoring cultural safety. Attending to these areas in SCM analysis can improve the function of the supply chain in service provision of health care delivery (Portela et al., 2018) and are included within this framework.

Value creation and value destruction are challenges to the improvement of obstetric care in maternity hospitals – with differing cultures of medical versus community perspectives and the impact of those differences on care. Tsvetkova (2021) described a similar situation in Norway, where New Public Management policies and rationalization principles are behind the closing of outer-lying hospital maternities. The case study analysis used an institutional logic approach to show the conflict between political and hospital administration bureaucracies and social needs and public value. Women there protested against the closings, with one maternity ward's closing temporarily postponed. A merger is still set to take place by 2024.

Easter et al. (2021) explored provider perspectives surrounding national guidelines proposing regionalization of maternal care. The benefits to women with high-risk pregnancies with regionalization, in contrast to benefits experienced by those with low-risk pregnancies in approaches "minimizing unnecessary intervention and downstream morbidity" (Easter et al., 2021, p. 1403), were considered while developing the framework. Obstetric care providers' understanding of potential "unintended consequences" of regionalization made their input as central stakeholders critical to such analysis. Easter et al. (2021) neglect, however, to include the input of birthing patients.

Looking at births in hospitals without obstetric units the year following loss of local birth, Kozhimannil et al. (2018) found associations between increases in out-of-hospital and preterm births in study areas. The majority of certified birthing centers have extremely good outcome measures for births, but inappropriate representation of non-hospital births as unsafe (Goer, 2016), and non-western recognized caregiver involvement can present these births as unfavorable. The view of successful access to maternal services provided through the regionalization of Alaska Native maternity care without the inclusion of advantages of cultural settings lacks a holistic look at risk, safety, and equity (Kin et al., 2009; Kozhimannil et al., 2018; Levine et al., 2022), so-called social responsibility principles. Thus, with its biomedical-biased assessments, this one-factor accounting of created values results in a gap in the ASTHO (2015) report.

Anthropological Approach to SCM

Anthropological approaches in SCM studies are not exclusive to healthcare (Dolan and Rajack, 2016). Using an anthropological approach, Archer and Elliot (2021) show that companies touting themselves as sustainable can lack input from workers and mask the inequitable power dynamics of the system. In another example, El Baz et al. (2022) use content analysis to look at how SCM research addresses cultural issues including studies on the role of culture in sustainability, corporate social responsibility, and green practices.

In healthcare systems research, focus ethnographies of Mexican renal patients (Kierans et al., 2013) are used to show how health systems can be barriers to health care. Their study revealed that to increase access to renal therapy, complex social and economic demands should be taken into account. Arborio et al. (2020), addressing perinatal care in France, dealt with issues of risk using content analysis of professional discourses and found that the views of professionals were primary determinants of the network's management policies.

Methods

Research Design: A Qualitative Comparative Approach

A qualitative comparative approach was used to explore sustainability of the maternal transport system of rural Alaska, with a focus on social responsibility. An assessment to identify features of social responsibility (risk, safety, and equity) in the transportation and services provided by the maternal healthcare supply chain serving indigenous communities in rural Alaska was conducted as described below.

First, a framework itemizes the direct and indirect benefits (care) and costs (risks) of the system (from the content analysis described below) featuring each birth model (biomedical and midwifery-community) and separating "high-risk" versus "low-risk" women's experiences. Then, to analyze features that might enable or hinder its effective operation, different stakeholder cultural perspectives are compared in a look at value-creation/destruction components of the supply chain to show benefits and drawbacks for each, during processes (travel), consequences (distance delivery), and logics (driving factors).

Data Collection

Between 2009 and 2012, 21 birthing women from Buckland, Kotzebue, and Point Hope, Alaska, representing Pre-policy (before 1983), Early policy (1983–1990), and Recent policy (1991–2011) birth eras, participated in ethnographic

Figure 9.2 Map of Maniilaq service area, Northwest Alaska, and Point Hope.

interviews used in this study. Resulting data, however, includes information on 38 birth experiences during different transport system periods, as follows: 14 from 5 in Buckland; 10 from 4 in Kotzebue, and 14 from 7 in Point Hope, with seven deliveries transported to Maniilaq health center in Kotzebue and 19 deliveries transported to Anchorage ANMC for delivery.

Participating 2009–2012 study villages include: regional hub, Kotzebue (Maniilaq Health Center here), Buckland, an outer-lying village (studied prior to recently acquired household water access), and an Arctic whaling community of Point Hope (Schwarzburg, 2013a). Point Hope, politically part of the Arctic Slope Regional Corporation, but because of proximity, lies in the Maniilaq Health Service Area (see Figure 9.2).

The remaining reported birth experiences were either Kotzebue residents that stayed in their home village to deliver at Maniilaq (Figure 9.3 – *Mom4*) or outer-lying village residents that stayed in their village to deliver (Figure 9.3 – *Village Mom*). Geographic and situational differences were gathered, and shown in Figures 9.2 and 9.3, respectively.

Content Analysis

A comparative approach is used to explore the risk perspective involved in the social responsibility component of sustainability of the maternal healthcare SCM operating in Arctic Alaska. For a more inclusive look at stakeholder perspectives, this study used results from thematic and content analysis of

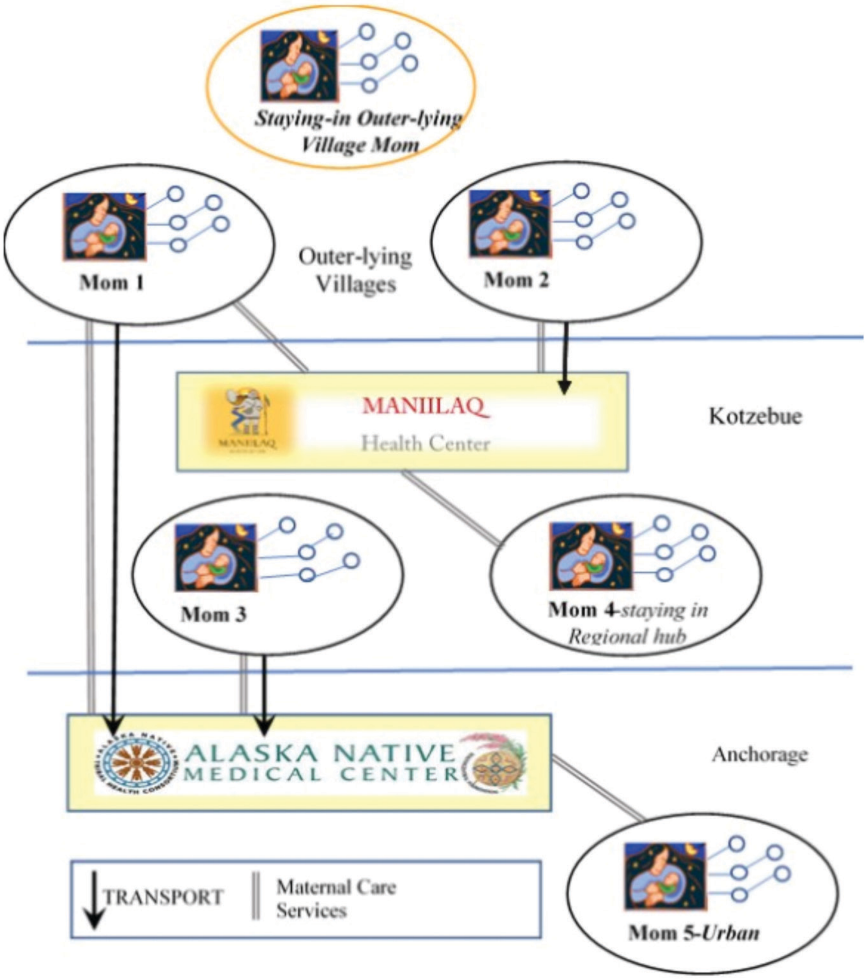

Figure 9.3 Scenarios of Moms in Maniilaq (Northwest Alaska) service area (*Source*: the author's elaboration).

patients and families exposed to the Alaska Native Perinatal Regionalization protocol, coupled with qualitative comparisons of identified features of social responsibility (Table 9.2).

Beginning with content analysis of earlier collected ethnographic fieldwork, cultural perspectives of Indigenous mothers and families from Northwest Alaska were used in qualitative comparisons with health agency/providers. This qualitative comparison was further incorporated into the analysis to reveal features of social responsibility (and value-creation/destruction) in the

Table 9.2 Social responsibility factors in biomedical and community-based frameworks within Alaska Native maternal transport supply network

Factors of 'social responsibility'	*Transport that accesses Biomedical Model*	*Local access to Midwifery (Community-based) Model*
Access to 'Safe Birth' ***For High-risk:*** • Access to life-saving measures • Higher level of monitoring, care ***For Low-risk:*** • Transport as needed & • Culturally safe	Access to measures for **'safer delivery' for high-risk**; **Exposes some low-risk birthing women** to • Culturally unsafe (loss of local care), • Less continuity of care, • Associated stress of travel and lengthy stay from home	**Certified Nurse-midwives in urban (and some regional) hospitals, still under hospital's biomedical-model based guidelines.** **Less intervention**, • more access in **regional hubs**, • ***somewhat*** **available for low-risk** deliveries in regional hospitals
Mitigating Risk Factors • Distance • ***High-risk birth*** • Risks associated with lack of attention to 'Cultural Safety,' continuity of care in ***low-risk births***	**Transport mitigates distance from specialized care for high-risk mothers** **Risks associated with transport to access biomedical model** are not always mitigated for **low-risk mothers**	**Provides access to local prenatal visits, & less intervention;** transport to **regional hub is less time away,** & usually a **shorter trip for low-risk mothers** **Not usually suitable for high-risk mothers**. Birthworker or doula support featured in either situation.
Relevant Outcome measure: Infant Mortality Rates (Table 1.4) • Neonatal (0–28 days) • Postneonatal (1 mo. to 1 yr)	Early **era transport system**, **both neonatal and postneonatal infant mortality rates lowered**. Later eras, • **More birthing mothers transferred out of home villages**, • **postneonatal mortality reached plateau, & recently on the rise**	More birthing mothers transferred out of home villages, **fewer midwives practice deliveries in communities other than regional hub communities**. **Location** (Regional hospital versus urban tribal hospital)-based birth statistics per Postneonatal mortality, not readily available.

(*Continued*)

Table 9.2 (Continued)

Relevant Outcome measure: Maternal Mortality Rates	Not as much an issue in early days; Recent statistics have shown **maternal mortality on the rise in rural areas**.	Maternal mortality, especially in postpartum period, • Associated with postpartum depression related suicide • Substance use; • **Association with lack of community-based model features** (support, continuity of care) could be a factor.
Equitable access for all birthing women	Improves Access to specialized care, as needed for **High-Risk mothers** Transport can disconnect low-risk mothers • displacing local birth attendants; • exposing indirectly to risks; • **less equitable access** for this group	Can improve access to features of equity within specialized care, for **High-Risk mothers, like Birthworkers** Maintaining community-based care for **low-risk mothers** • supports local birth attendants; • less exposure to cultural safety risks with continuity of care; **more equitable access** for this group

processes and consequences involved in the maternal transport system operating there (Table 9.5).

Transportation Services within Maternal Healthcare for Indigenous Communities in Rural Alaska

Challenges for Transportation of Birthing People in Rural Alaska

Transport in the Alaska Native maternal healthcare system involves mostly air travel, with a lack of road system connecting many of the villages. The travel to and from “bush” airports, long waits, along with time away from home, can make the transport even more complicated. Additionally, few of the assessments of this flying-in protocol look at the substantially documented trade-off mentioned by Houtari et al. (2020).

In Northwest Alaska, since 1983, the transport system has provided air transport of expectant mothers at 36-weeks’ gestation to the ANMC urban hospital, for delivery in Anchorage up to 700 miles and an eight-hour plane ride away. This transport, collectively financed through U.S. healthcare, U.S. Indian Health Service (IHS), and tribal health corporations, provides the access to maternal health services for Alaska Native families. These services include specialized care of CNMs, obstetricians, anesthesiologists, obstetric nurses, neonatal intensive care nursery, pain medication, and cesarean delivery when required.

Regionalization of Alaska Native maternal healthcare also means that these patients are often separated from their communities and families as they are flown out of their home village four weeks prior to delivery; stay in hotel or dorm accommodations; and return to their villages with their babies – usually within a day or two of delivery. The implementation of the perinatal care system varies from region to region, depending on the care available in the region’s hub at time of expected delivery; the determination of risk involved for the mothers and babies; and type of coverage (private or Medicaid-based insurance or IHS/tribal health corporation-funded coverage). As reported by the 2013 ANMC health officials, “This process [the maternal transport] has functioned with a fair amount of consistency for almost 30 years”, with informal but standardized protocols utilized between each of the individual ANMC regional units and Labor and Delivery unit in Anchorage.

At the time of the Maniilaq study, U.S. maternal mortality was rare and maternal morbidity was more of an issue. This is still the case, but in some areas, the maternal mortality rates, especially those associated with substance misuse disorders, report postpartum depression-related suicides that are increasing to concerning levels (Ebertz, 2021). The ANEC (2019) also reports a steady decrease in neonatal mortality, but an increase in postneonatal mortality among Alaska Native populations (see Tables 9.3 and 9.4; Figure 9.4).

Table 9.3 Alaska Native infant mortality rate by tribal health region, 2013–2017

Alaska Region	*Number*	*Rate per 1,000 births*
Aleutians and Pribilofs	–	–
Anchorage/Mat-Su	41	10.1
Arctic Slope	6	10.0
Bristol Bay	–	–
Copper River/Prince William Sound	–	–
Interior	13	8.6
Kenai Peninsula	–	–
Kodiak	–	–
Northwest Arctic (*Maniilaq area*)	15	16.0
Norton Sound	7	7.7
Southeast	9	7.3
Yukon-Kuskokwim	36	11.4
Statewide	139	9.8

(Data: Alaska Division of Public Health. Prepared by: ANEC).

Table 9.4 Alaska Native infant deaths and rates, neonatal and postneonatal, 2010–2017

Year	*Neonatal (up to 27 days)*		*Postneonatal (28 days to 1 year)*	
	Number	*Rate*	*Number*	*Rate*
2017	9	3.3	11	4.1
2016	11	3.8	14	4.9
2015	17	6.1	19	6.8
2014	14	4.9	19	6.6
2013	7	2.4	18	6.2
2012	13	4.2	10	3.2
2011	6	1.9	12	3.8
2010	-	-	9	2.8

Notes: Rates based on <20 deaths statistically unreliable; interpret with caution.
(Data: Alaska Division of Public Health. Prepared by: ANEC)

Organization of Maternal Transport from Rural Alaska to Anchorage

Figure 9.3 illustrates the different social transport possibilities for moms in different birthing situations in the region. This diagram shows the Maniilaq service area, with Maniilaq Medical Center in Kotzebue as the regional hub (with no cesarean birth capabilities) and ANMC in Anchorage as the urban tribal hospital. Each oval represents a birthing woman and associated support connections from an Outlying Village, the regional hub Kotzebue, or

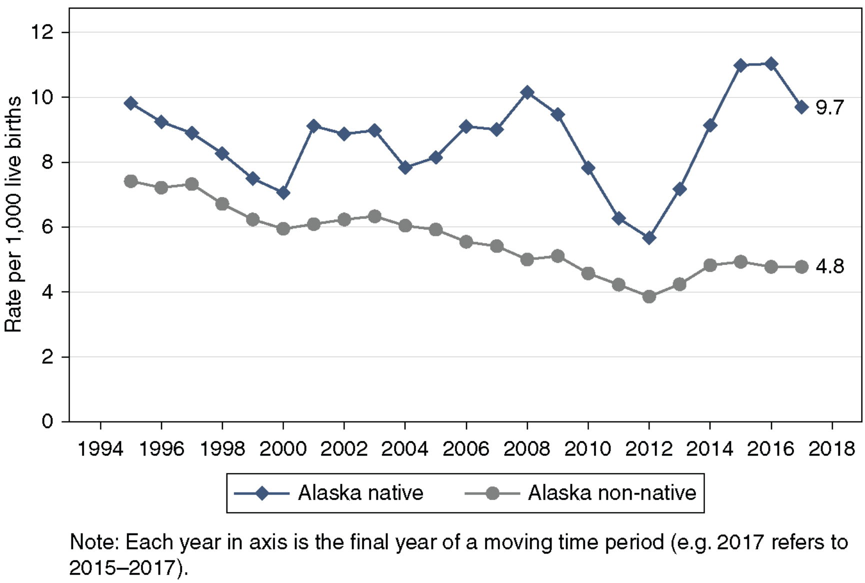

Figure 9.4 Alaska Native and non-Native Infant Deaths, 1994–2018, running three-year averages.

(*Source*: Alaska Native Epidemiology Center. Alaska Native Health Status Report Fact Sheets. Available online: http://anthctoday.org/epicenter/healthdata.html).

Anchorage. The determinations of which course to follow are largely based on a perception of risk involved.

With the exception of the now rare "Village Mom" scenario (see Figure 9.3), this decision is typically in the hands of healthcare practitioners. With transportation for hospital births to mitigate clinical risks, getting to the hospital has become synonymous with safe birth. While access to local non-nurse (lay) midwives in this area is uncertain today, outer-lying study villages were noted to have at least one or two at the time of the study. The driving force behind efficient SCM of maternal care in the Arctic, then, became hospital birth, as well. This system of perinatal regionalization has been around for so long that this embedded risk assessment has superseded "social responsibility" aims.

✓ *"Village Mom"*: outlying village
- Stays in their outlying village to birth.
- Implies presense of a village-level attendant. No official transport, unless emergency medical evacuation. Typically, "off-the-grid" scenario.

✓ *'"Mom 1"*: from outlying village
- Prenatal care (indicated by gray line) at the Maniilaq Health Center in Kotzebue

- High-Risk factors necessitate specialized care, transports to ANMC, in Anchorage (indicated by black arrow) a month prior to delivery; delivers there; and shortly returns home afterward.

✓ *"Mom 2"*: from outlying village
- Low-risk enough to deliver at the Maniilaq Health Center in Kotzebue
- Typically, transports closer to due date, stays in Kotzebue (hotel) for prenatal care, awaits delivery, and shortly returns to their home village with the baby.

✓ *"Mom 3":* from regional hub, Kotzebue
- Low-risk enough to deliver at the Maniilaq Health Center in Kotzebue
- Gets care in their home village, stays home until delivery, delivers as an outpatient, directly returning home with baby

✓ *"Mom 4"* from regional hub, Kotzebue
- High-risk factors necessitate specialized care, transports to deliver at the ANMC in Anchorage, requiring transport from Kotzebue.
- Transports a month prior to delivery, delivers there, and shortly returns home afterward.

✓ *"Mom 5"*: from Anchorage
- Direct locational and financial access
- Typically delivers at ANMC, with no transport involved.

In some cases, for more specialized services, maternal patients could then transport (by ground) to a private, non-tribal hospital in Anchorage for cesarean birth or more intensive infant care.

As in Norway (see Tsvetkova, 2021), conflicts of logic exist between political and administration of cost efficiencies and market competition; and public value delivery for citizens desiring equity and fairness in childbirth care in Alaska. Contrary to Norway, however, Alaska Native birthing people involved in the transport protocol have up until recently, been more indirect in their objections, simply addressing their care on their own through acceptance or avoidance at all costs.

The participants used the place terms "here" referred to their home – which means preferable and used "there" referred to the transport location – which means necessary. Some birthing women from outlying villages simply stayed to deliver with last available birth helpers (that is*, VillageMom*) and described her experience:

> *My water broke, and I drove myself to the [local] clinic. I had her [the baby] three hours later, and I went home. But, this was only possible as long as local midwives or skilled birth helpers were available in the local villages. This participant described the first birth experience of her sister (a Mom1) differently: '…she [sister] was there [Anchorage] two months. …all alone.*

She also expressed the impact on the family:

> *My dad had to pay his own way to be there with her, and a place to stay. When he got there [ANMC] she was scared out of her mind.*

For a *Mom2* participant transporting to deliver at Maniilaq, the lack of continuity of care was an issue:

> *Some of those doctors don't really get to know you. They only see you once or twice.*

Not all comments were negative, with some indicating either resilience or satisfaction with the system, but stressing that support made a difference:

> *I had my mom with me when I had [child's name] …"One more push," the doctor said, …and my Mom said "it's a girl, I'm an Ana" [Iñupiaq term for grandmother]!*

She added:

> *When you have your baby and you don't have family, it's hard. It's a big event and to have someone there is better.*

During this study, non-Indigenous social work and nursing staff made prejudicial comments regarding their Indigenous perinatal patients' use of services and perceptions of infant care. Transporting mothers can sometimes incur oppressive, discriminatory treatment from non-Indigenous caregivers because of lingering unflattering and harmful stereotypes. While this does not happen as much, participants said there is still a desire expressed to have culturally safe attendance at birth with family and community support and local-based care for low-risk births.

This described support is similar to that stressed in midwifery models of care, but local midwives are now largely unavailable, having aged and/or passed on without passing their skills onto others. Still, there are groups springing up to revitalize local Indigenous-based birthing assistance (discussed in later section). So far in Alaska, however, because of lack of political and structural support, this assistance is restricted to doula and lactation consultant care in urban Alaska Native communities. Ironically, remote villages – where the social and culture-based midwifery care originated – have lost or are in danger of losing this type of care.

Table 9.2 focuses on the social responsibility factors involved in each model, including relevant features in early era SCM in this comparative analysis. Additionally, it shows extracted features from biomedical and midwifery (or community-based) models and compares features involved in the constructs of "safe birth" and "mitigated risks" for each.

The latest relevant statistics for Alaska Native infant mortality are presented in Tables 9.3 and 9.4, and running averages over time are shown in Figure 9.4.

Table 9.3 shows the infant mortality rates, the statistic used in the ASTHO (2015) report to indicate the effectiveness of the maternal healthcare supply network. The item highlighted in Table 9.3 refers to the Northwest Alaska service area of study population.

Alaska Native Cultural Values in Families and Childbearing

"Iñupiat *Ilitqusiat* (values): "…With guidance and support from Elders, we must teach our children Iñupiaq values: Respect for Nature; Avoid Conflict; Family Roles; Humor; Spirituality; Domestic Skills; Hunter Success; Responsibility to Tribe." (http://ankn.uaf.edu/curriculum/Inupiaq/Ilitqusiat/whatis.html)

Alaska Maternal Child Death Review Committee released statistics showing regional maternal deaths from 2011 to 2020 (Ebertz, 2021). It was reported that 87% of these deaths are preventable. The main causes offered behind these deaths included substance abuse, postpartum mood disorders that lead to suicide, and homicide (para. 5):

> *Some of the things that the committee often believes would help prevent those losses of life is social supports and comprehensive perinatal care that includes mental health screening and support.*

They said a post-birth home-visiting program could also have positive outcomes for mothers at risk for substance abuse or suicide. This element has been somewhat absent in local communities, since the loss of the local midwife. While support programs like visiting nurses are being implemented, access to more consistently available Indigenous caregivers is still absent in most all of these communities. For many study participants, as expressed by one from Point Hope (*Mom1*) transporting to Anchorage, attachment to these values is important:

> *…With this one [baby], I want to make all the decisions and…raise him as an Iñupiaq boy.*

Resurgence of Indigenous Midwifery

The Alaska Native Perinatal Regionalization protocol gives birthing patients from rural Alaska access to CNMs, but not actual local birth. These CNMs are providing excellent care in their urban and regional environments, but some families (like the mother who turned her own baby) feel more comfortable and supported in their own community or do not wish to travel for whatever reason (obligations at home, discomfort with travel, etc.).

A recently founded grassroots group of Alaska Native of reproductive justice advocates, birth helpers, childbirth educators, breastfeeding counselors, and a CNM, called Alaska Native Birthworkers Community (www.nativebirthworkers.org/) is set to support families from preconception through postpartum with culturally matched care. In panel discussion on indigenous midwifery, Chosid (2020) writes about indigenous midwifery in Mexico, Canada, and New Zealand. Expert guest, Nicole Pihema, explains: "resurgence of Māori cultural birthing practices and traditional Māori birthing techniques have created better maternal health outcomes, because Māori midwives are less likely to introduce medical interventions in birth…Indigenous women with more interventions during birth suffer poorer birth outcomes."

Australia, New Zealand, and some Canadian examples offer plenty of models where culturally safe, self-determined care provided in midwifery models has proven effective (Brown et al., 2016; Butler et al., 2020). One of the components in decisions concerning evacuation of Indigenous birthing persons is risk. Kornelsen and Grzybowski (2012) addressed this dynamic element of the decision matrix of SCM of maternal service of Indigenous communities in Northern Canada. Rural communities there offering local maternity services resulted in a high outflow of parturient residents, leaving to give birth in larger centers for access to procedures. Some, however, choose to accept the risk and stay in their communities without this access (Van Wagner et al., 2007). Physicians tend to prioritize clinical risks, while birthing women choosing home community birth locale tend to prioritize social risks based on underlying values and beliefs. These findings echo Lane's (2015) results in a look at pluralistic risk cultures in Vanuatu, Australia.

This has not been the case in Lawford et al. (2019), where clinical assessment of risk appears to continue to dominate the decisions surrounding Indigenous maternal transport in most areas of Canada. Durst et al. (2016) describe the outcomes of a public hospital maternity unit in rural New South Wales, Australia, that transitioned from a general physican/obstetric practice to a low-risk midwifery group practice. Neonatal outcomes were similar in both experiences, yet lower intervention rates, less analgesic use, and fewer episiotomies in the Midwifery group, demonstrating how a rural maternity service "maintained quality care outcomes for low-risk women" (Durst et al., 2016, p. 385).

While rural, remote areas of the Arctic share some similarities with these areas with low-resource maternity care systems and services, such evaluations of maternal programs are not as appropriate in Alaska's mixed U.S. and unique tribal health care system. Even Easter et al.'s (2021) provider perspectives in regionalized perinatal systems lacked input from community participants. Through minding socio-cultural assets involved in supply of Alaska Native maternal care services, there can be value creation (Van Boerdonk et al., 2021; Hammervoll, 2009; Hardyman et al., 2015) in building and supporting community-based care.

Analysis and Discussion

Table 9.5 depicts the comparison of benefits and drawbacks of each maternal care model, showing the processes, consequences, and institutional logistics of

Table 9.5 Perinatal regionalization benefits and drawbacks for Health Agency and Alaska Native birthing people stakeholders

	Benefits	*Drawbacks*
PROCESSES (travel):		
• ***Health Agencyl Providers:***	• *Biomedical Framework adds control and predictability to unpredictable birth event*	• *Costly travel and housing maternal patients for such lengthy period*
• ***Alaska Native birthing people:***	• For *high-risk*-travel to needed care is provided; • For *low-risk*, might be coincidental, indirect benefits of access to urban shopping and other appointments.	• Leaving support system in community & lengthy time away • Inconvenient, stress from leaving work, other children at home • Difficulties of return trip with infant on bush or commercial flight; grounded for weather, stuck in airport
CONSEQUENCES (distant delivery)		
• ***Health Agency / Providers:***	• *Fulfill operating mission statements by providing care*	• *Lodging, maternal home, hotel, management of cross-agency budgets*
• ***Alaska Native birthing people:***	• High-risk access to specialized care at time of delivery; Neonatal Intensive Care Unit for infant • High- and low-risk, access to assistance during delivery and after; drugs for pain, epidural, cesarean delivery; positive views of hospital care	• Removal from family near and during delivery, loss of family connection at important social event • Difficulties of travel management of return trip after birth, with newborn, especially if alone; negative views of lengthy non-local stay, even for low-risk moms
INSTITUTIONAL/MOTHER LOGICS (driving factors)		
• ***Health Agencyl Providers:***	• *Cost efficiency and sufficient supply of services and care from intra-agency financing*	• *Supply bottlenecks caused by changing, unpredictable weather, nature of childbirth, emergencies*
• ***Alaska Native birthing people:***	• Safe healthy delivery, 'easier' access to care; possible to get provisions; food vouchers	• Fear and stress; things going wrong; time away; too much to do; boredom; not enough food vouchers; too little time after birth

the components involved for maternal care patients as main stakeholders. This comparison illustrates – using ethnographic results of Alaska Native community birth scenarios over three generations – that the main driving factors in this service supply system are largely dictated by biomedical standards of care from the Agency/Providers perspectives. Mitigating one set of risk factors outlined by the biomedical-biased protocol at the expense of neglecting cultural risks involved from the Alaska Native patient and community perspectives, this perinatal protocol is shown to fall short of meeting the safety and equity features of social responsibility in SCM. This comparison also reveals the added risk exposure from treating all birthing Alaska Natives as high-risk patients.

In regard to the social transport system, this comparative analysis of social responsibility indicates that at the beginning, increased access to biomedical care efforts to provide equal access to hospital birth for all rural Alaska Native birthing women reasonably qualified as an element toward a socially responsible supply network. As time went on, however, the impact of transporting *all* birthing women may have resulted in the "trade-off" mentioned for low-risk mothers, thereby offsetting some of the earlier social responsibility factor.

An added feature of "value-creation" of the benefits to low-risk birthing stakeholders and, potentially, their respective communities, was also revealed. This is somewhat in line with SCM authors Kozhimannil et al.'s (2018) recommendations to include key stakeholders' qualitative input to attend to features of social responsibility in healthcare value chain and SCM analyses. The current study, however, goes a step further, suggesting more balanced and effective protocols in rural and Indigenous communities (Portela et al., 2018) and includes patient/client and community stakeholders. With anthropological techniques to capture this input, more nuanced features of cultural safety and equity in social responsibility in SCM of these systems help balance the driving forces involved.

Today, infant mortality statistics appear to be fluctuating more than indicated in earlier report (see ASTHO, 2015). Therefore, it is difficult to make a direct correlation between the increased access to specialized care, hospital deliveries, and longer-term stays with any direct impact on infant mortality or survival rates. With this "customer" input, and anthropological analysis, more realistic and inclusive outcomes of the system become evident than those presented in the 2015 ASTHO report. While the Perinatal Regionalization is presented as operating as a logistical "success" for many years in Arctic Alaska (ASTHO, 2015), this doesn't necessarily make it sustainable. Including features from a community-based approach in assessment of this perinatal care supply system will help establish equity and therefore sustainability as important drivers to the system.

Overall, the value of benefits gained by accessing features of specialized care offered through the transport system loom larger for high-risk mothers than low-risk mothers. With this lenient "risking out" of mothers leading to over 90% hospital births among Alaska Native people, this analysis shows, as found in other Indigenous communities (Karltun et al., 2020; Kornelsen et al., 2011; Korneslen and Grzybowski, 2012), a system that supports hospital utilization rates over sustaining healthy communities of local support. This study's findings are consistent with others showing that the direct and indirect costs to low-risk women having to transport can sometimes cause stress and higher realized costs when the return is not as tangible as a necessary hospital trip (Brown et al., 2016; Lawford et al., 2019; King et al., 2009; Kornelsen et al., 2011; Korneslen and Grzybowski, 2012). As with First Nations groups' healthcare in Canada, the loss of community birthing services was shown to result in a loss in ceremonies, cultural practices, and knowledge transmission between community members and among generations (Pember, 2018). This is completely consistent with previous research by Schwarzburg (2013b) and Lawford et al. (2019).

It also appears that while mothers might sometimes feel safer with access to biomedical birth – feelings of fear and doubt, especially felt by mothers having to fly-in by themselves, might be mitigated with inclusion of more support care, like local doulas or birthworkers. Including this feature would slightly compensate for the unbalanced dynamic that can occur from participation in the transport, as noted by these authors.

These findings show that the Alaska Native maternal transport system has the potential to evolve into an integral, inclusive system that effectively incorporates locally based resources and approaches to bridge current gaps. Equitable community- and culturally based maternal health systems are possible in rural Alaska with decolonizing policies and commitment from existing state and tribal health entities for sharing of data, two-way training opportunities, and continual community-based evaluation.

Conclusions

This study reveals social responsibility principles within SCM of maternal care services in rural Alaska. Two models – midwifery (or community) and biomedical birth model – have been compared to show outcomes for Indigenous People from three aspects of sustainability: social, economic, and environmental. The findings have revealed the impact of applying the same SCM parameters for a system without built-in flexibility for adapting to new information. Levels and types of "social responsibility" in the different models were addressed, particularly in terms of risk assessment. While these models are not completely dichotomous in all perinatal healthcare supply systems, this comparison highlights the driving forces behind the system in Arctic Alaska, especially from stakeholder perspectives.

The features of social responsibility used in this study were derived from thematic content analysis of ethnographic interviews of Alaska Native mothers of three generations in Northwest Alaska. This anthropological perspective helps provide a look at the cultural risks previously missing in the SCM assessment of the perinatal travel protocol. The feature of "value-creation" of the benefits to low-risk birthing stakeholders and, potentially, their respective communities, was also revealed. The current approach of including key stakeholder input to address features of social responsibility in healthcare supply and value chain management systems is in line with SCM theorists and studies (Kozhimannil et al., 2018; Hussain et al., 2018). This study, however, goes a step further, as recommended by authors concerned with more balanced and effective protocols in rural and indigenous communities (Karltun et al., 2020; Oliver et al., 2020) and includes patient and community input.

Perinatal healthcare delivery systems that serve indigenous communities while incorporating cross-trained, locally based birth workers, have been shown to have a synergistic impact on effecting other areas of community health (Cidro et al., 2015; Duong, 2018; Levine and Sakala, 2022). This inclusive Arctic-based SCM evaluation of Alaska's Perinatal Regional uncovers the beneficial implications of indigenous birth worker involvement in meeting the needs for local birth. Indigenous-based input at the core of the logic model – instead of as a sidebar – makes for more accurate, equitable, and sustainable supply chain analysis of the Alaska Native maternal health care system.

As succinctly put in the Dot-Mom blog series on improving Alaska Native Maternal Health (Ramanarayanan et al., 2020): "Without prioritizing Indigenous women's health, well-being, and safety, the resources and interventions intended to serve Alaskan communities will miss the mark."

This study serves as an example of how important it is to attend to the socio-cultural component of sustainability in SCM and how, especially in Arctic environments, analysis centered solely on more quantitative measures can result in biased analyses. In addition, this study has disclosed how using an anthropological approach to capture qualitative data can be useful to balance the analysis with key stakeholder input in defining and creating value in the healthcare system.

At the same time, this look at the Alaska Native Regionalization Perinatal services protocol has limitations and like most ethnographic-based studies lacks generalizability. These findings were from Northwest Alaska Native communities and gathered from 2009 to 2012. Hence, updated data and a closer look at connections between the cultural risks in such perinatal transport systems in rural and indigenous Arctic communities are in order. Recent maternal mortality rates in Alaska, estimated to stem from substance misuse (Ebertz, 2021), could also be indicative of unaccounted-for cultural risks and should be investigated in future assessments and research.

The results from this study, however, suggest important features to incorporate in more inclusive looks at the healthcare supply and value chain management studies in other Arctic areas – where attention to the socio-cultural factors answers the call for tending to the "socially responsible" pillar of sustainability in SCM.

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10 Carbon Capture, Transport, and Storage Projects in Norwegian Seabed

Sustainable Implications and Challenges of New Green Technologies Rooted in the Past

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Introduction

Contemporary supply chain management (SCM) is often indicated by such integral parts as outsourcing and integration processes that ensure firms' operational performance. At the same time, introducing the sustainability concept in core business functions of the supply chain enables firms to extend their performance beyond traditional processes and achieve a more competitive advantage in the market (Ansari and Kant, 2017). Sustainable SCM has been considered a new era of incorporating economic, environmental, and social responsibilities into business processes. Understanding these three distinct responsibilities and their interrelationships is crucial (Pagell and Wu, 2009; Mani et al., 2016; Tsvetkova, 2020). However, a major challenge for firms is still to manage sustainability along the supply chain, which involves interdependent actors that can influence one another's performance and actions.

Further, the SCM literature represents a wide range of studies that illustrate supply chains forced to adopt new and/or costly practices that may have dramatically negative and quite uncertain consequences when building a more sustainable supply chain. Ever-increasing attention has been paid to so-called green technologies in order to reduce environmental and social harm (Green et al., 2012). Further, much research deals with environmental performance and focuses on various operationalizations of practices, where supply chain issues are only secondarily addressed (Seuring and Müller, 2008; Quarshie et al., 2016). Also, the understanding of sustainable development is often one-dimensional and limited to environmental improvements, neglecting the social dimension (Seuring and Müller, 2008). In the CCTS supply chain context, research has focused on resilience perspectives, from infrastructure and environment standpoints (Gabrielli et al., 2022). So, extant research offers a

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somewhat limited insight into how to create a cost-effective and economically viable supply chain that produces no harm or may even have a positive or regenerative effect on social and environmental systems (Pagell and Shevchenko, 2014). To address these shortcomings of sustainable SCM literature, our study aims to explore *how SCM facilitates the implementation and further institutionalization of the world's sustainability and climate strategies in the North Sea, with subsequent application in the Arctic Ocean.*

In an effort to understand the role of SCM in sustainable issues, we investigate the implementation of a carbon capture, transport, and storage (CCTS) project in the Norwegian seabed. This project sets the long-term objective of restoring climate-resilient carbon cycles to achieve sustainable development. These types of projects have been considered a new solution for the decarbonization of different industrial sectors to reduce CO_2 emissions and thereby limit global warming. Instead of being released into the atmosphere, CO_2 as hydrate gets sequestrated and stored under the seabed, mostly in offshore depleted oil and gas reservoirs. In Norway, such practices have been in place since 1996, when CO_2 from produced gas was removed and injected in the Sleipner area, with 19 million tonnes of CO_2 stored by 2020 (Equinor, 2022). However, some researchers point out that this solution can pose the risk of carbon dioxide re-emission from the ocean sinks. Further, CO_2 dissolution into the ocean can result in ocean acidification and an alteration of ocean chemistry that is detrimental to marine ecosystems (Zheng et al., 2020). The most significant change is the shift toward transportation of captured $CO_{2,}$ which brings more complex supply chain operations and additional risks related to shipping activities.

This study presents an empirical case of the development and implementation of "Longship", a full-scale carbon capture and storage (CCS) project that will demonstrate the capture of CO_2 from industrial sources, as well as transport and storage in the Norwegian continental seabed. The project sets the long-term objective of restoring sustainable and climate-resilient carbon cycles and receives substantial financial support from the Norwegian government (Norwegian Government, 2022). The case is noteworthy due to its pioneering nature. Specific regulation of carbon capture transportation and storage for implementing such sustainable and climate-resilient projects is still evolving. Moreover, there is no functioning framework for the evaluation of material financial, environmental, and social risks for the stakeholders involved, e.g., coastal communities and Indigenous Peoples. The project is relevant as a demonstration of the potential of CCTS-reliant supply chains to contribute to climate mitigation strategies as part of the Paris Agreement. It is assumed that outcomes from the "Longship" project will be utilized in developing further CCTS initiatives that do not rely on government support. In the Arctic context, the "Polaris" carbon storage project off the coast of northern Norway aims to store more than 100 million tonnes of CO_2 (Reuters, 2020; Horisont Energi, 2022). Hence, the knowledge about the sustainability aspects of CCTS supply chains is of great importance for evaluating the feasibility of these operations in the Arctic.

In our study, we attempt to show the dynamics of the circulation of sustainable and climate-resilient strategies and how they are institutionalized into existing practice through supply chain operations. Previous research is not so concerned with how meanings and actions change when companies face a choice of supply chain strategy (Tsvetkova and Gammelgaard, 2018). We follow Jepperson (1991) in our perception of institutionalization, which is the process whereby social activity becomes institutionalized and, eventually, is more or less taken for granted. Once fully institutionalized, ideas can survive across generations, accepted as the definitive behavior (Tolbert and Zucker, 1996). At the same time, the institutionalization process is cyclical, as "institutions emerge, diffuse, change, die, and, are replaced by new institutions" (Haunschild and Chandler, 2008, p. 630). Moreover, actors – e.g., competitors, suppliers, regulators, and consumers (Greenwood et al., 2002) – in such a heterogeneous environment as SCM act as drivers for the relentless promotion of institutionalization processes.

In the section that follows, we provide a literature review on sustainable SCM. Then, we present our methodology. In the fourth section, we present our findings. Finally, the chapter ends with concluding remarks.

Sustainable Supply Chain Management Literature

In this section, we provide an overview of the literature on sustainable supply chain management to identify the gaps between theory and practice. Sustainable SCM has gained increased attention in the academic community and has been specifically defined in numerous ways. In our study, we mainly adhere to the definition given by Carter and Rogers (2008, p. 368), which combines the desired performance with the actors' interests and is formulated as "the strategic, transparent integration and achievement of an organization's social, environmental and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains". This means that the voluntary integration of environmental and social considerations has to be applied by all supply chain partners to effectively and efficiently manage the material, information, and capital flows. Further, it is expected that a dimension of corporate socially responsible behavior is also encouraged (Lu et al., 2007; Pagell et al., 2008).

Over the past two decades, an increasing number of studies have addressed different challenges and issues in building more sustainable supply chains and management. Several recent literature reviews pointed out that previous studies have primarily focused on integrating environmental concerns about minimizing environmental impact, decreasing CO_2 emissions, and reducing fuel and energy consumption (Seuring and Müller, 2008; Quarshie et al., 2016; Ansari and Kant, 2017). This gave rise to the implementation of "green" SCM practices (see Jabbour et al., 2015). In contrast, social issues on the route to sustainability have rarely been addressed in SCM studies, as emphasized by many scholars (Seuring and Müller, 2008; Mani et al., 2016; Tsvetkova, 2020). Instead, social sustainability has been narrowed down to environmental issues regarding the possible adverse effects of pollution on human health, safety, and quality of life (Tsvetkova, 2020), as well as the product and process measures to ensure the safety and welfare of people in the chain (Mani et al., 2015).

Further, a large number of studies identified the impact of external drivers on organizations' efforts. External pressures, including contextual and institutional ones, encourage firms that govern the supply chain to adopt and implement sustainable supply chain practices (Seuring and Müller, 2008). Firms have to ensure and increase their external legitimization, to fit socially constructed systems of norms, beliefs, values, and institutions. Regulatory pressure and institutional constraints considerably impact firms' operational performance, by obliging them to adopt sustainable SCM practices. While some regulations may bring negative effects like penalties and fines, others may have positive impacts like environmental programs, partnerships, grants, and governmental support that encourage firms to undertake proactive environmental strategies and green initiatives (Ageron et al., 2012). In addition to various institutional drivers and pressures, researchers point to the impact of market mechanisms and conditions that can incentivize organizations' decisions to adopt sustainable practices at different levels. Not to be overlooked is also reputation related to sustainability that can not only enhance organizations' competitive advantage but also change organizational behavior to exceed accepted standards and thereby generate new business opportunities with other companies, e.g., suppliers and customers (Ageron et al., 2012).

Environmental and social issues, or forms of social sustainability, vary across different geographical locations and contextual settings (Huq et al., 2014; Mani et al., 2016; Tsvetkova, 2020). Implementing sustainable practices and strategies defines the nature of the interaction between the supply chain and the context or the external environment where these initiatives are applied. These interactions may uncover "unexpected results" and "unintended consequences" of the deployment of particular strategies (see Tsvetkova and Gammelgaard, 2018). Without simultaneously addressing environmental, social, and economic issues, our understanding of sustainability becomes insufficient to create truly sustainable supply chains (Pagell and Shevchenko, 2014); that, in turn, creates difficulty in measuring advances in sustainable supply chain practices (Davidson, 2011). Although scholarly attention to social issues has grown in recent years (see Tsvetkova, 2020, Tsvetkova, 2021a), some literature reviews still indicate a need for more studies to develop better scales for measuring the social impact of various supply chains (Rajeev et al., 2017).

Method

We apply a single qualitative case study approach to understand the dynamics of sustainable and climate-resilient strategies in a particular setting (Eisenhardt, 1989) from bounded real-world settings (Barratt et al., 2011), specifically the role of SCM under the implementation of a CCTS project in the Norwegian seabed. We selected “Northern Lights” (part of the “Longship” project), which is responsible for the transportation of the liquefied CO_2 by ship from the respective pick-up points to the receiving terminal located in Norway for subsequent storage in the seabed. The project involves several major stakeholders, including industrial enterprises, e.g., a cement producer, a waste incineration/energy recovery plant, and a fertilizer factory, and several oil companies, with the close involvement of the Norwegian government. Although there are great ambitions to rapidly increase the tons of CO_2 to be captured and to attract even more industrial enterprises in the near future, the implementation process is accompanied by a significant lack of a legislative framework for the legal CO_2 transportation definition to cover transportation by ships. So, this study has a dual unit of analysis, where the organizations are considered to be the unit of analysis for identifying the drivers for emerging new sustainable practices, while the supply chain – as an inter-organizational field characterized by heterogeneity of goals, motives, demands, and principles of managing – is the unit for understanding the impact of supply chain operations on the stakeholders’ behavior and actions.

Eight semi-structured individual interviews were conducted between 2021 and 2022. As Yin (1994) recommended using multiple sources of empirical evidence to ensure triangulation, we interviewed a variety of actors within CCTS projects and other critical stakeholders. It was helpful to provide insights from various perspectives. We mainly used the snowball technique, with participants suggesting additional respondents for our study. Interview questions were developed based on the literature reviews and contained open questions for discussion but did not limit the respondents’ scope and thinking. The interview data was supplemented by archival materials, including academic papers, legal documents, government reports, EU and national strategies’ papers that helped understand the institutional environment and drivers behind the emergence of CCTS initiatives, the role of SCM, key issues, and stakeholders involved. That was helpful in establishing a chain of evidence and reinforcing triangulation (Yin, 1994), thereby increasing the data’s internal consistency and the validity of our research findings (Voss et al., 2002). To better code and categorize our data, we used NVivo software, which allowed us to assign attributes and explore relationships in different logistics operations.

Carbon Capture, Transport, and Storage (CCTS) as Part of Green Transition

CCTS projects are viewed as a solution to mitigating greenhouse gas (GHG) emissions as part of Nationally Defined Contributions according to the Paris

Agreement (Paris Agreement, 2015). Emissions of carbon dioxide can be reduced through the reduction of energy intensity, carbon intensity, and carbon sequestration (Yamasaki 2003). Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. It is one method of reducing the amount of carbon dioxide in the atmosphere, with the goal of reducing global climate change. Carbon sequestration can be either biotic or geological. Biotic carbon sequestration refers to carbon stored in vegetation, soils, woody products, and aquatic environments. Biologic sequestration advocates hope to remove CO_2 from the atmosphere by encouraging the growth of plants, especially trees. Geologic carbon sequestration is a technique for storing carbon dioxide in deep geologic formations to prevent it from being released into the atmosphere and contributing to global warming as a greenhouse gas (Duncan and Morrissey, 2011); for an illustration of the technology, see Figure 10.1. Therefore, CCS is a form of geologic carbon sequestration. The technology for sequestration must ensure long-term safety, stability, and environmental acceptance (Zheng et al., 2020).

The long-term storage of anthropogenic CO_2 in deep-sea sediments, using the existing offshore infrastructure, has been proposed. At the same time, the multiphysics process of CO_2 injection, postinjection fate, and subseabed disposal feasibility under different geological and operational conditions have not

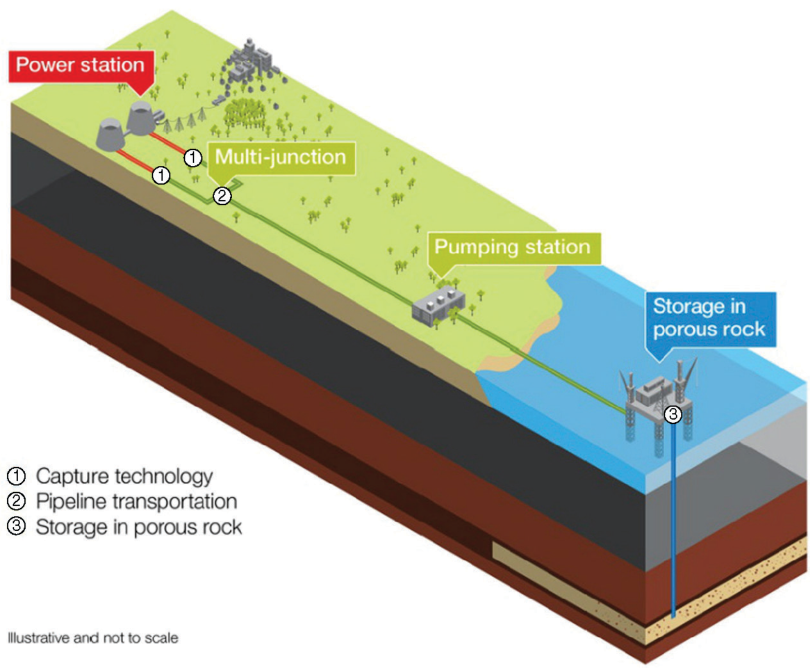

Figure 10.1 Geological storage of CO_2 (*Source*: OSPAR Commission, Quality Status Report 2010, https://qsr 2010.ospar.org/en/index.html).

been well studied. Teng and Zhang (2018) find that, in a deep-sea setting, CO_2 sequestration in intact marine sediments is generally safe and permanent. At the same time, CCS entails several hazards (loss of containment of carbon dioxide, explosive decompression, cold, toxic scale, ignition, etc.) that need to be considered (Wilday et al., 2011).

Typically, CO_2 can be stored in depleted oil and gas fields because these reservoirs have suitable sealing caps, porosity, permeability, etc., as shown by their ability to store oil and gas for a long time before discovery and development. Enhanced oil recovery (EOR) uses CO_2 as a displacement agent to produce oil that cannot be produced by natural field pressure or water flooding. Depending on the reservoir, oil properties, and existing infrastructure, this may make CO_2 storage more economical. EOR technologies are mature, and many commercial projects have been completed. However, due to marginal economics, almost all of these use low-cost, naturally occurring CO_2 (that is, CO_2 that was previously underground), with only a few using anthropogenic sources of CO_2 (Zheng et al., 2020).

The difference between CCS and CCTS is the addition of transportation of CO_2 to the supply chain operations. While previously only locally produced CO_2 was captured and stored, the inclusion of transportation brings the possibility of transboundary shipment of CO_2. After CO_2 capture, the captured gas is purified and compressed (usually to a supercritical state) to generate a transportable stream of concentrated gas. In the United States, pipelines are the most frequent technique for delivering carbon dioxide. CO_2 can also be transported worldwide by ship. Marine tankers transport liquefied natural gas and liquefied petroleum gases like propane and butane globally. Some marine tankers transport CO_2, although demand is low. No large-scale CO_2 transport system via vessels (millions of metric tons per year, e.g.) is running. However, the European Union has proposed implementing just such an idea. Hence, marine tanker prices for CO_2 shipping are uncertain as it stands (US Congressional Research Service, 2022).

Most road maps that address keeping global warming below 2°C include CCS. According to the International Energy Agency (IEA), CCS alone could reduce global CO_2 emissions by nearly 19% by 2050 (IEA, 2022). Moreover, the IEA forecasts that 100 CCS projects will be required by 2020 and more than 3,000 by 2050 if CCS is to completely contribute to the least expensive technology portfolio for CO_2 mitigation. As early as the 2009 IEA publication, *Technology Roadmap: Carbon Capture and Storage*, it was recommended that international legal barriers to global CCS deployment be removed by 2012, including the ban on transboundary CO_2 transfer under the London Protocol (IEA, 2011). It took about ten years to remove these legal obstacles, which was only done in 2019, with an amendment to the London Protocol. The latest 2022 Intergovernmental Panel on Climate Change (IPCC) report, "Mitigation of Climate Change", states that geological CO_2 storage capacity is estimated to be 1,000 gigatonnes, which is greater than the CO_2 storage needed until 2100 to limit global warming to 1.5°C. Global rates of CCS deployment are now substantially below those in simulated paths that limit global warming to 1.5°C or 2°C. According to the IPCC, these hurdles could be reduced by enabling factors such as governmental instruments, increased public support, and technical innovation (IPCC, 2022). Moreover, countries are integrating climate change measures into national policies, strategies and planning, as part of adherence to the UN Sustainable Development Goals.

The Global CCS Institute maintains a database of all active and planned CCS facilities. In 2022, there were 29 fully operational CCS facilities worldwide (GCCI, 2022). The first facilities that are going to be involved in the transportation aspect of CCTS are the Norwegian ones, that is, Northern Lights as part of the Longship project and the future Polaris project in the Barents Sea.

Institutional Drivers as Prerequisites for CCS and CCTS Projects Origination

London Protocol

For many years, industrial pollutants, including radioactive waste, were dumped in the oceans. In the 1970s, the practice became governed by an international treaty with the purpose of standardizing procedures and prohibiting actions that could cause marine contamination (Sjoeblom and Linsley, 1994). The international treaty, the "Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972" or the "London Convention", has been in effect since 1975. Its goal is to improve effective control of all marine pollution sources and avoid pollution from waste dumping. However, the London Protocol of 1996, which aimed to protect the marine environment more effectively and prevent waste disposal into the ocean, was modernized and finally replaced the Convention. The London Protocol expressly prohibited incineration at sea and the export of wastes and other matters for the purpose of ocean dumping. Dumping is forbidden under the Protocol, except for specified waste or other items mentioned in Annex I, which include dredging material, fish waste, and inert, inorganic geological material.

In 2006, the United Kingdom, Norway, and others proposed amendments to Annex I of the London Protocol to add CO_2 streams from carbon capture processes for storage to the list of wastes or other matter that may be considered for dumping and thus to regulate "carbon-dioxide streams from CO_2 capture processes for sequestration" (London Protocol, 2006). Thus, since 2006, the London Protocol has regulated the injection of CO_2 waste streams into subseabed geological formations for permanent isolation and safe carbon dioxide (CO_2) storage beneath the seabed.

Hence, initially, no export and transport of CO_2 was allowed. Then, the Netherlands and Norway proposed a resolution at the Protocol's October 2019 meeting. A Resolution authorizing the interim application of an amendment to Article 6 of the Protocol to allow CO_2 export for subseabed storage was adopted between contracting parties. This removed the last significant international legal impediment to carbon capture and storage (CCS), enabling CO_2 to be exported globally for offshore storage (Dixon and Birchenough, 2021). Parties would then be able to "provisionally apply" the 2009 amendment, allowing "cross-border transport of CO_2 for geological storage without breaching international commitments" (Dixon and Birchenough, 2021). It should be noted that the observer from Greenpeace International and the observer from the Advisory Committee on the Protection of the Sea (ACOPS) both raised concerns over the protocol amendment (IEAGHG, 2021). On its website, ACOPS mentions that

> *this resolution was framed as a necessary removal of a barrier to CO_2 removal which has been highlighted by the IPCC (Intergovernmental Panel on Climate Change) as one of the necessary solutions.*
>
> *(ACOPS, 2022)*

The Chair of the London Protocol further emphasized the necessity of a focus on CO_2 source reduction and control, as well as the sharing of information on projects and agreements resulting from the provisional application. Countries that intend to export or import CO_2 for storage are now required to inform the International Maritime Organization of any agreements or arrangements.

OSPAR Commission

OSPAR (named because of the original Oslo and Paris Conventions) is the mechanism by which 15 governments[1] and the EU cooperate to protect the marine environment of the North-East Atlantic. Following its study on ocean acidification in 2006, the OSPAR Commission amended the Convention's Annexes to allow carbon dioxide storage in geological formations beneath the seabed. According to OSPAR, capturing CO_2 at the source and storing it in subsea geological formations could aid in the long-term mitigation of climate change. The ultimate purpose of CO_2 storage is to ensure long-term containment in geological formations while minimizing substantial adverse effects on the marine environment, human health, and other legitimate users of the maritime area. Therefore, OSPAR has approved a decision (OSPAR Decision 2007/02) to ensure the safe storage of CO_2 streams in geological formations, as well as risk assessment and management guidelines for CO_2 stream storage in geological formations (OSPAR Agreement 2007–12). In addition, offshore oil and gas infrastructure, such as wells and pipelines, exists in the OSPAR maritime area and could be adapted for CO_2 transport and storage. At the moment, the only functioning CCS projects in the OSPAR Maritime Area are in Norway's Sleipner and Snøhvit. Sleipner started operations in 1996 and Snøhvit in 2008. Both projects include separating and capturing CO_2 from produced natural gas, and both inject CO_2 into saline formations (Bankes, 2020).

So, the London Protocol of 1996 and the amendments in the OSPAR Convention marked significant legal changes, which in turn made the implementation and promotion of CCS and CCTS projects possible and fully legitimate.

EU Legal Strategies toward Climate Adaptation

European Green Deal

From a legislative viewpoint, in 2009, the EU introduced Directive 2009/31/EC on the geological storage of CO_2 (so-called CCS Directive), which created the legal basis for the geological storage of CO_2 to address climate change. The Commission works closely with Member State authorities to implement the CCS Directive, enabling exchanges, producing guidance materials, and adopting Commission Opinions on draft storage licenses.

In 2019, the European Green Deal introduced a package of measures ranging from reducing greenhouse gas emissions to investing in cutting-edge research and innovation to preserving Europe's natural environment. Climate and resource front-runners are needed in the EU industry to develop the first commercial implementations of breakthrough technology in major industrial sectors by 2030. Priority areas include clean hydrogen, fuel cells, and other alternative fuels, energy storage, and carbon capture, storage, and utilization (Communication from the Commission, 2019).

The EU Green Deal includes the following parts: European Climate Law; European Climate Pact, to engage citizens and all parts of society in climate action; 2030 Climate Target, to further reduce net greenhouse gas emissions by at least 55% by 2030; and the New EU Strategy on Climate Adaptation, to help make the EU more resilient. European Climate Law states that

> *solutions that are based on carbon capture and storage (CCS) and carbon capture and use (CCU) technologies can play a role in decarbonization, especially for the mitigation of process emissions in industry, for the Member States that choose this technology.*
>
> *(European Climate Law, 2021)*

The EU 2030 Climate Target Plan sets a more ambitious and cost-effective path to achieving climate neutrality by 2050. CCS is viewed as an essential part of the Climate Target plan.

> *In order to further reduce emissions from industry in line with the higher climate target for 2030, major changes need to be made in the way industry consumes energy and produces its products notably via increased material and energy efficiency, greater material recirculation, new production processes and carbon capture technologies.*
>
> *(Climate Target Plan, 2020)*

The New EU Strategy on Climate Adaptation 2021 views that “in coastal and marine areas, nature-based solutions will enhance coastal defense and reduce risk of algal blooms. Simultaneously, they will provide benefits such as carbon sequestration, tourism opportunities, and biodiversity conservation and restoration” (The New EU Strategy on Adaptation to Climate Change, 2021). The EU will seek mutually beneficial alliances and ensure an international level playing field regarding new sustainable technologies, such as renewable hydrogen, advanced solar and wind, batteries, and carbon capture, as well as critical raw materials for these technologies, such as rare earths. The EU’s position as the world’s largest trading block provides significant opportunities in this respect (Stepping up Europe’s 2030 climate ambition, 2020). As seen from these initiatives, the EU supports CCS through the European Green Deal (2019) legislation package and views it as part of a climate change solution.

Role of the EU Taxonomy

EU taxonomy, introduced in 2020, represents a classification system that includes economically sustainable activities (EU Taxonomy, 2020). It might help the EU increase sustainable investment and achieve the EU Green deal. The EU taxonomy defines sustainable economic activities for enterprises, investors, and regulators. Under the Taxonomy Regulation, the Commission was required to define technical screening criteria for each environmental objective by delegated acts, in order to generate the actual list of environmentally sustainable activities. needed. Notably, CCTS is included in the directory of activities that are listed under climate adaptation and climate mitigation objectives; see Table 10.1 (Commission Delegated Regulation (EU) 2021/2139 2021).

Translating CCTS Technologies into Actions and Objects: Longship Project in Norway

Norway has ambitious goals regarding the Paris Agreement, that is, Norway’s Nationally Determined Contribution under the Paris Agreement is to reduce emissions by at least 40%, compared to 1990 levels, by 2030. Norway will cooperate with Iceland and the EU to fulfill their respective emission reduction targets under the Paris Agreement (Meld. St. 13 (2020–2021). Norway has established policies and strategies to minimize or eliminate greenhouse gas emissions. The polluter-pays idea underpins Norwegian climate policy. CO_2 taxes on mineral oil and petrol were imposed in 1991 to cost-efficiently control greenhouse gas emissions, and, in 2010, CO_2 tariffs were imposed on natural gas and liquefied petroleum gas (Meld. St. 13 (2020–2021).

Table 10.1 Role of EU taxonomy in CCTS (compiled by the authors)

Activity	*Substantial contribution criteria*
Transport of CO_2	**1.** The CO_2 transported from the installation where captured to the injection point does not lead to CO_2 leakages above 0.5 % of the mass of CO_2 transported. **2.** The CO_2 is delivered to a permanent CO_2 storage site that meets the criteria for underground geological storage of CO_2 set out in Section 5.12 of this Annex or to other transport modalities which lead to a permanent CO_2 storage site that meet those criteria. **3.** Appropriate leak detection systems are applied and a monitoring plan is in place, with the report verified by an independent third party. **4.** The activity may include the installation of assets that increase flexibility and improve the management of an existing network.
Underground permanent geological storage of CO_2	**1.** Characterization and assessment of the potential storage complex and surrounding area, or exploration within the meaning of Article 3, point (8), of Directive 2009/31/EC of the European Parliament and of the Council (224), is carried out in order to establish whether the geological formation is suitable for use as a CO_2 storage site. **2.** For operation of underground geological CO_2 storage sites, including closure and post-closure obligations: appropriate leakage detection systems are implemented to prevent release during operation; a monitoring plan of the injection facilities, the storage complex, and, where applicable, the surrounding environment, is in place, with the regular reports checked by the competent national authority. **3.** For the exploration and operation of storage sites within the Union, the activity complies with Directive 2009/31/EC. For the exploration and operation of storage sites in third countries, the activity complies with ISO 27914:2017(225) for geological storage of CO_2.

Norway became a forerunner in terms of CCS technology when it commissioned the world's first offshore CCS project, "Sleipner", in 1996. More than a million tonnes of CO_2 have been stored in the Utsira formation below "Sleipner" every year since then. In the "Snøhvit" CCS project, CO_2 has been separated from raw natural gas at the onshore liqueified natural gas (LNG) plant at Melkøya and transported and stored offshore, since 2008. Analysis of legal framework development for CCTS demonstrates that Norway led the change for allowing the transboundary shipment of CO_2. The Norwegian Parliament authorized the Longship capture, transport, and storage of CO_2

project in the state budget for 2021. The project will cost NOK 25.1 billion, which is approximately $2.49 billion (www.regjeringen.no). The Norwegian government approved a decision to cover approximately two-thirds, and the industry will cover approximately one-third of the costs in the project's first phase. Part of the Longship project is the Northern Lights CCTS project which has been supported by the Norwegian government with NOK 14.2 billion, which equals $1.63 billion (www.regjeringen.no). Actually, an essential premise for the state is the industrial partners' self-interest in CCS projects. However, as highlighted by one of our respondents, there are several barriers to commercial CCS investments:

> *Business companies don't have a tendency to invest in technology with uncertain future market potential. And policymakers cannot commit to a technology they do not know. We can say it can be a sort of deadlock for future development.*

It is also worth emphasizing that one of the primary project goals defined by the government is to demonstrate that full-scale CCS is feasible and safe, and to reduce the cost of future CCS projects through learning curve effects and economies of scale (Killingland et al., 2020). As a result of this, sentiment for investment by business companies should increase. As a representative of Northern Lights stated:

> *There are a lot of challenges first related to the fact that this is still a new concept. We sometimes feel like test pilots because we develop new contracts and new ships and have to deal with a market that doesn't exist. There is little or no operational experience in this area...uh, there is a lot of risk management that needs to be done... The cost focus and structure are something that we need to pay attention to because CCS in Europe will only be successful if we manage to keep the costs down.*

Longship involves capturing CO_2 from industrial sources in the Oslo Fjord region (cement and waste-to-energy) and transporting liquid CO_2 from these industrial capture facilities to an onshore terminal on the west coast of Norway. The CO_2 will then be transferred by pipeline to an offshore storage facility in the North Sea for permanent storage. Northern Lights is responsible for the project's shipping and storage requirements (see Figure 10.2).

As part of Longship, the Norwegian government's large-scale CCS initiative, Northern Lights is responsible for building and operating CO_2 transportation and storage facilities accessible to third parties. It will be the world's first open-source, cross-border CO_2 transit and storage infrastructure network, and it will allow businesses across Europe to store their CO_2 underground. Halfway through 2024, the first phase of the project will be finished, with a capacity of up to 1.5 million tonnes of CO_2 per year (Northern Lights, 2021).

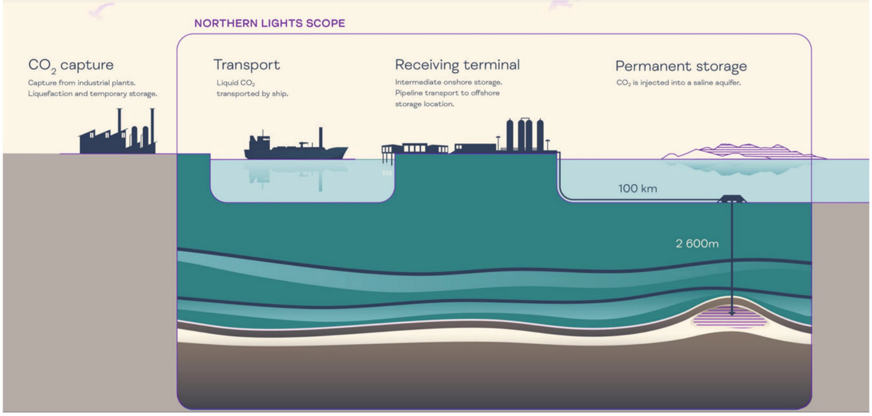

Figure 10.2 Longship project (*Source*: Northern Lights).

Currently, two CO_2 emitters – the Norcem cement plant in Brevik and the waste recovery plant in Oslo (Fortum Oslo Varme) – are the key first customers that will capture and provide intermediate storage for CO_2 in liquid form in dedicated tanks on existing quay facilities. Both emitters plan to capture 400,000 tonnes of CO_2 per year for transport and permanent storage: a total of 800,000 tonnes of CO_2 per year (Northern Lights, 2021).

The Northern Lights project builds on the experience that three owner companies have from their various CCS operations across the world. The completely innovative component that has never been applied before is a ship-based transportation system. Previous projects like the Snøhvit CCS storage project used a direct link between the emission source, which is the LNG facility in Hammerfest, and the storage facility. So, the value and supply chain in Northern Lights is unusual because it is based on transporting CO_2 using two ships. However, the shipping solution has not been covered by the provisions of the CO_2 Storage Regulations. This follows from the fact that the capture of CO_2 by industrial sources is not subject to these rules, which define "facility" as follows:

> *Installations, plants and other equipment for exploitation of subsea reservoirs for storage of CO_2, but excluding supply and utility vessels or vessels that transport CO_2 in bulk. Facility also includes pipelines and cables unless otherwise determined.*
>
> (*Regulations, 2020*)

The transport ships, of cargo size 7,500 m^3 (8,000 tones CO_2) and 130m length, carry cold (–26°C), pressurized 15 barg and liquid CO_2 from capture players to a receiving and intermediate storage facility on land in western Norway.

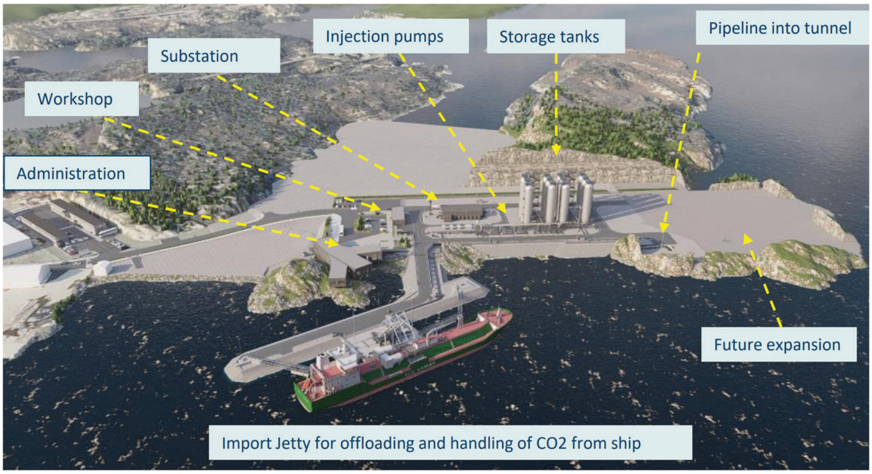

Figure 10.3 Receiving terminal (*Source*: Northern Lights).

Offloading CO_2 will involve the aid of offloading arms (capacity of 800 m^3/hour). Cold and liquid CO_2 is stored intermediately before it is pumped 100 kilometers through an export pipeline for injection and permanent storage 1,000–3,300 meters under the seabed on the continental shelf: to be precise, in one or more new injection wells in suitable geological reservoirs in the Troll field located in the North Sea (see Figures 10.2 and 10.3). As a representative of the Northern Lights project explained:

> *It matters a lot for large industrial emitters, as they can be located anywhere and can still utilize this technology. They don't need to be located close to storage resources. That is important. For instance, many big emission sources in Norway are in the southeastern part of Norway, like the Norcem cement plant and Oslo Fortum Varme (the largest district heating supplier). That means these types of large emission sources will have access to CO_2 storage despite being hundreds of kilometers, maybe thousands in some instances, away from the storage complex. Building a pipeline from these remote locations to where the storage facilities are available on the western side of Norway would be extremely expensive and not feasible for several reasons.*

It is assumed that CO_2 transport is a key component in connecting industrial emitters in Europe to suitable and safe CO_2 storage sites such as the one operated by Northern Lights in the North Sea (see Figure 10.4). Many of these European emitters are located far away from storage resources, extremely limiting access to them. While storage capacity is unevenly distributed across Europe, Norway has approximately one-third of the European overall storage

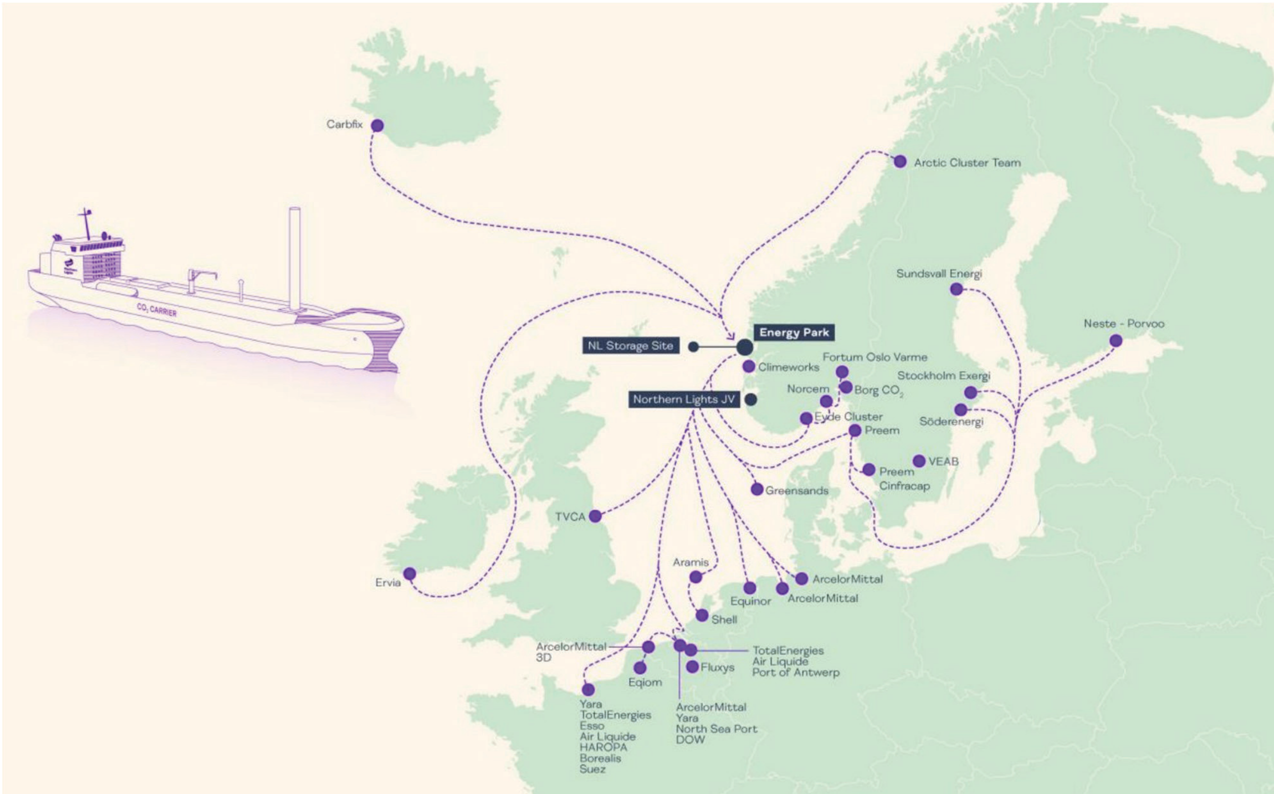

Figure 10.4 Potential CO_2 market (*Source*: Northern Lights).

capacity because of the geological characteristics of the Norwegian continental shelf. The sectors that the main focus is on include cement, chemicals/refineries, waste incineration, biofuel/bioenergy, direct air capture and steel, which have different levels of experience and maturity with respect to CCS projects. For example, chemical refineries are expected to be ready in 2025–2026, and the cement industry was initially expected by 2026–2028, but is going to be ready in 2024. Many of these emission sources that are big industrial facilities have relatively small overall emissions that could not necessarily defend making such an investment on their own. So, an intention to build large emission hubs as many large emitters concentrate around the port area can hardly be feasible in Europe in the nearest decade. It would be expensive to use the CO_2 pipeline in Norway. As a representative of Northern Lights stated:

> *The shipping solution, first of all, provides flexibility for the emitters across Europe, meaning that they don't need to commit to one storage operator. But they can actually also ask for more storage capacity to be developed across Europe, which is between storage operators. In such a way, we're creating a CO_2 market. It will help create competition among storage operators that will be important in terms of price development and capacity development overall over time.*

In pushing full-scale CCS projects, shipping is considered a scalable CO_2 transport solution that is well-suited to sailing distances in Europe. Developing a flexible shipping solution as part of the world's first cross-border CO_2 transport and storage network that helps overcome challenges and issues for European industrial emitters, "Northern Lights" seems to contribute to the development of a new market for CO_2 storage.

The background to why large industrial emitters can become interested in CCS is linked to the European Emission Trading Scheme (EU ETS). Industrial businesses have to pay for the CO_2 that is emitted. The ETS price has been fluctuating; for instance, on 25 December 2021, the ETS price was €98.97, and on 11 May 2022, it was €87.52. It is expected that the price may go up to €100 or higher by 2030. However, if they can utilize CCTS technology like "Northern Lights", they will be emission-free. As a "Northern Lights" representative explained:

> *I suppose the EU's goal is to reduce emissions by 55%. So that means many of these industries are not able to decarbonize without engaging in CCS. The cement industry, for example, cannot use solar or wind power in order to reduce their overall emissions. Although this industry is responsible for between 6 and 8% of global emissions, the emissions have nothing to do with energy use. It happens since the limestone used in cement production naturally contains CO_2, which is released in the operational cycle. I mean, many large industrial emitters will always have CO_2 emissions and cannot get rid of them in any other way. We also need to capture CO_2 from the air or use biogenic or bioenergy with CCS in order to reach our climate goals.*

At the same time, another respondent objected to this opinion:

> *Scientists have repeatedly proven that only trees can actually absorb huge amounts of CO_2. This is a natural technology and also very cheap. Why invest such huge injections in new industrial objects, like capture facilities, which also can put a negative strain on nature?*

It is worth adding that the European Commission highlighted the need to geologically store between 3,600 million tons of CO_2 per year by 2050. For instance, the Northern Lights project is able to store 1.5 million tons of CO_2 per year; in the future, the volume can be increased to 5–7 million tons of CO_2 per year. According to several of our respondents, the EU's goals require more storage capacity and more CCS projects like Northern Lights. The ambition of the actors involved is to keep costs leveled down and continue innovating to make technologies affordable for industrial emitters across Europe. Thereby, it is important to reach a balance between the cost level and the tariff level, so that the overall costs for transport and storage components are below 100 euros. But now, there is still a need for subsidies and incentives from the European Union and national governments in implementing CCS projects.

One of the biggest concerns is the safety of such projects, for both marine life and nearby coasts. Under Article 195 of United Nations Convention on the Law of the Sea (UNCLOS), states must not transform a type of pollution into another type of pollution or shift pollution from one area to another. It is assumed that, if carbon dioxide, which is essentially a source of atmospheric pollution, is placed on the seabed, and these technologies do not create a new source of pollution, then this is an acceptable solution. However, several of our respondents emphasized that only preliminary safety assessments are available at the time of the ongoing construction of the "Northern Lights" infrastructure facilities. The official project reports identify a risk of potential migration and leakage routes for CO_2 that can theoretically occur through geological strata and faults or via wells (Northern Lights, 2019; 2021). As a representative of "Northern Lights" informed us:

> *Leakage is obviously a very important thing to avoid altogether. The CO_2 storage complex is a well 2,600 meters deep on the seabed. What we are looking for in the storage complex – and what we have when we identified this particular storage complex – is a saline aquifer. So, it's basically a sandstone formation. This sandstone formation is very porous and has excellent properties for storage of CO_2. Above the storage complex is a primary seal. It's a caprock of shale, 75 meters thick. Drillers have long known that gas is released only when shale beds are penetrated, but the pores in the rocks are so small that they hold onto any gas tightly. It's the same principle for foiling mass. We have modelled CO_2 migration, and our analysis showed the migration will happen over thousands of years. Potentially, while leaking, CO_2 might reach*

> *an area where it will become trapped again. So, we predict this is a safe storage complex.... […] Actually, we are liable for the region, the Norwegian authorities and the European Commission. I mean if CO_2 leaks out, we need to pay the equivalent of the ETS price at the time of leakage, and that's a huge cost.*

Another respondent representing an environmental organization expressed doubt:

> *This is more like a patch in the context of climate change decisions. And most likely for some short period. Indeed, this is necessary. But no one can say that such initiatives are absolutely safe and that all risks are foreseen. Everyone just hopes that it is safe.*

Concluding Remarks

In our chapter, the implementation of CCTS projects, including future projects in the Arctic seabed, has been described from the perspective of the SCM's role in implementing new environmental and climate-resistant strategies. The idea of the "Longship" CCTS project in Norway is rooted in the past, as a consequence of quite long technological experience with carbon capture and storage since 1996. Through its translation into actions and large industrial objects, the idea manifested itself as a strategic continuation, under pressure from the EU and Norway's initiatives and regulatory amendments in favor of green technologies, causing organizational and institutional change. Of greatest interest is that the "idea" of the Longship project has only been made feasible by the transport component and management of CO_2 supply chains, which has proved to be innovative.

CCTS projects are viewed as a breakthrough in developing climate-resilient carbon cycles and are specifically implemented as an effective mitigation solution to climate change. However, there is a critical need to analyze whether the effect is sustainable, especially since it is argued in the literature that our present knowledge is not sufficient to create truly sustainable supply chain practices (Pagell and Shevchenko, 2014). For this purpose, we attempt to look at the possibilities for the deployment of CCTS in terms of three aspects of sustainability: economic, environmental, and social.

Weber (2021) argues that, while there are no legal hurdles to transferring CO_2 by ship in principle, international and European law are not yet prepared to accept CO_2 transit by ship. First, the approach for circumventing the Article 6 barrier of the London Protocol reflects what has been politically feasible, not what is legally desirable. Second, considering the future Fund for the Convention on Hazardous and Toxic Substances, the article contends that CCS is a particular circumstance and that specific concessions are justified. However, evaluation of compliance with Articles 195 and 196 of the United Nations Convention on the Law of the Sea (UNCLOS) when implementing

CCTS projects is paramount. According to Article 195 of UNCLOS, "Duty not to transfer damage or hazards or transform one type of pollution into another", in order to prevent, reduce, and control pollution of the marine environment, States shall act in such a way as not to transfer, directly or indirectly, damage or hazards from one area to another or transform one type of pollution into another (UNCLOS, 1982). Article 196 of UNCLOS concerns the use of new technologies and the introduction of new species; in the context of the adoption of new technology and transboundary shipping of CO_2, it becomes increasingly important to adhere to this article, whereby

> *States shall take all measures necessary to prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control, or the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes thereto.*

This indicates that regulatory mechanisms and pressure from the EU are focusing on the development of so-called green technologies. In contrast, UNCLOS cautions that such mega-industrial projects can have unexpected adverse effects on the environment. These CCTS projects can be very dangerous for the environment and require guaranteed, reliable technologies for safe and cost-effective CO_2 supply chain operations. Therefore, this finding is consistent with the findings of Tsvetkova and Gammelgaard's (2018) study that institutional mechanisms and factors may play a role in how supply chain strategies evolve and that such strategies are not (only) objective, rational processes of goal-setting and activity planning.

The need for long-distance transportation and the lack of existing infrastructure, e.g., CO_2 storage facilities, mean significant investments and large costs. The decision to create a carbon market by increasing the price of CO_2 emissions is twofold. On the one hand, this creates financial guarantee incentives by involving a large number of industry stakeholders. On the other hand, it can appear that this does not stimulate CO_2 emitters to reduce CO_2 emissions by setting environmentally friendly devices, e.g., distillatory filters. There is also a growing concern among decision-makers and strategists about the negative environmental and social effects of the fast-paced industrial growth of CCTS projects. The negative environmental and social aspects are overlooked in the narrative that promotes the benefits of CCTS. In 2022, over 500 organizations across the United States and Canada expressed grave concerns regarding the U.S. and Canadian governments' support for CO_2 carbon capture and storage and carbon capture and sequestration due to its negative impact on coastal communities, Indigenous Peoples, and the diverting of funding from transitioning to renewable energy solutions (CIEL, 2022).

Further, it remains unclear whether such rapid implementation of CCTS is more likely to be accepted or rejected by society in the future. Given the wide range of technological options and the resulting societal implications, the phenomenon of such sustainable initiatives also appears to be non-trivial. Moreover, a methodological concept for analyzing CO_2 leakage and safety in the case of potential accidents is still lacking, even though the project owners have vast experience, and some scientific research provides a starting background. This represents a difference from the debate in perceptions of the societal benefits of CCTS. We suppose that the population may expect safeguarding or even increasing economic performance in their local environment with the use of CCTS. It is worth adding that previous research findings illustrate that societal benefits have either the same or slightly higher explanatory power for CCS acceptance than societal risks (Kraeusel and Möst, 2012). In light of this, the study also contributes to the literature on how institutional drivers and political ambitions influence public value-creation for residents in response to social needs (see Tsvetkova, 2021b). Whether this is also valid for the implementation and subsequent application of CCTS in the Arctic Ocean remains to be investigated.

Note

1 Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom.

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11 Dynamics and Constraints in Arctic Routes

Evidence from the Russian and Canadian Shipping

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Introduction

Climate change does impact sea ice, with a significant reduction in its extent and thickness. Climate change thus would appear to facilitate navigation, without however making it easier, and indeed has contributed to the expansion of traffic in the Arctic, with a fivefold increase since 2000. However, there is a discrepancy between expectations that the melting of sea ice triggered and actual levels of shipping, especially regarding transit volumes. This can be accounted for by the fact that drivers of shipping in the Arctic are linked to the development of natural resource extraction and the perception that Arctic shipping markets may not readily fit into global strategies adopted by shipping companies. The development of Arctic shipping does not boil down to the melting of sea ice: companies must take into account logistical and market constraints when trying to develop sustainable activities.

Besides transit and resource extraction, a third engine of growth, community resupply, is indeed expanding, but so far companies have increased vessel size rather than the number of voyages. In other words, potential economic drivers of Arctic shipping, extraction, and transit, are related to the insertion of the region into globalized markets and solutions shipping companies. It is notably this very insertion of Arctic shipping in the global economy that highlights the issue of its sustainability, which is increasingly debated in the frame of the definition of climate change mitigation strategies (Toscano and Murena, 2019). Sustainability certainly goes well beyond greenhouse gas reduction but also includes the management of environmental and social impacts of their activities along the supply chain. Companies and governments are aware of the need to tightly control these impacts, especially in fragile ecosystems like the Arctic. This need is invoked notably by Canada to justify the enactment of severe regulations framing navigation in the Canadian Arctic despite the enforcement of the Polar Code since 2017. Tight regulations are also readily accepted by most shipping companies as a necessity to protect the environment and take into account concerns voiced by Arctic communities, although they may also be perceived as a barrier to entry into the Arctic market by outsiders

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(Pic et al., 2021). However, given the difficult operational constraints, the quest for sustainability in Arctic logistics remains a challenge for shipping companies. There must be high enough margins to afford adopting costly solutions, such as constructing high ice-class vessels with a high degree of winterization to transport Arctic commodities. Therefore, only very profitable businesses can afford risk mitigation and sustainability measures (Gunnarson and Lasserre, 2023). Thus, this chapter *endeavors to provide deeper insights into Arctic shipping along the Canadian and Russian coasts, their constraints, challenges, and dimensions, including in terms of logistics operations and sustainability goals.*

This chapter relied on several sources of information. Climate change data is mainly drawn from analyses provided by the National Snow and Ice Data Center (NSIDC). Traffic statistics were compiled and formatted by the author based on datasets provided by the Center for High North Logistics (CHNL) for Russian traffic; and for Canadian traffic, by NordREG, the Canadian Coast Guard division responsible for the supervision of marine traffic in the Canadian Arctic, and Xpert Solutions Technologiques Inc. Statistics were completed by several interviews with companies' officers, reports and press releases, as well as papers from the professional literature.

There are various definitions of the Arctic, whether climatic (July 10°C isotherm or permafrost zone), astronomical (Arctic Circle), or biological (tree line). All these definitions shape different zones. For the purpose of this research, the Canadian Arctic encompasses Nunavut, the Northwest Territories, the north slope of the Rockies in Yukon, and the shores of Hudson Bay.

This chapter is organized as follows. The next section depicts Arctic routes and their navigability in the context of climate change, as well as an introduction to traffic and the regional markets. The chapter then pictures the possible advent of transshipment hubs and analyses logistical constraints and adaptative measures in the Canadian Arctic.

Arctic Routes and Navigability under Climate Change

Since 1979, the minimum yearly extent of sea ice in the Arctic has decreased by about 55%, from 7.2 million km^2 to 3.41 million km^2 in 2012 and 4.67 million km^2 in 2022 (NSIDC, 2022a; 2022b). Sea ice is also displaying a significant decline in age and thickness. In March 1985, ice more than four years old represented 33% of Arctic sea ice; the share dropped to 4.4% in March 2020 (Perovich et al., 2020). In 1980, the ice averaged 3.64 meters in thickness, while the figure dropped to about 2 meters in 2018 (Kwok, 2018). This general trend toward a thinner and less extensive Arctic sea ice makes navigation feasible with ice-classed vessels and has often been heralded as the beginning of a fast expansion of Arctic shipping, especially transit shipping (Borgerson, 2008).

The reality of Arctic sea ice, however, needs to be nuanced. Significant variations can be observed regarding the minimum sea ice extent. Several conclusions can be inferred from the non-linear evolution of the September minimal sea ice extent. Indeed, the extent of Arctic sea ice at its minimum is decreasing, and this trend is accelerating since the slope of the regression lines is more pronounced for recent periods. Second, a significant year-to-year variation is apparent: despite the general declining trend, there are years with more ice than the previous years, which makes the year-on-year change unpredictable.

The spatial distribution of the September minimal sea ice (Figure 11.1) reveales two facts: first, the Siberian coast is much more ice-free than the Canadian archipelago, providing longer periods of relatively ice-free shipping routes; and second, despite the general trend toward a shrinking sea ice cover, significant interannual variability in sea ice distribution remains, with some areas being open waters some years, but not others.

This spatial interannual variability in sea-ice extent and in the calendar for the melting (in spring) and formation of sea ice (in fall) implies makes logistical planning difficult despite the long-term reduced sea ice trend (Blacquière, 2018; Dorais, 2021; Paquin, 2018). Scheduled sea service is decided several months ahead of the shipping season but the openness of sea lanes can only be assessed in probabilistic terms, an element liner shipping companies fear as they sell just-in-time services (Lasserre et al., 2016). Variability of navigability in Canadian Arctic Archipelago straits, along which the several channels of the Northwest Passage (NWP) unfold, is typically more pronounced than in the Northern Sea Route (NSR) and the Northeast Passage (Wagner et al., 2020). The NSR is the section of the Northeast Passage between the Kara Gate and the Bering Strait (see Figures 11.2 and 11.3) – an important element inasmuch as Russian traffic statistics are often calculated for the NSR and thus display movements presented as transit but that actually end or depart from Russian Arctic ports like Murmansk or Arkhangelsk.

Ice dynamics remain complex despite the trend toward melting. Thinner and less concentrated ice is more mobile and more susceptible to the effects of winds and currents, increasing mobility-induced variability. Straits ice-free at a certain day can therefore be completely ice-clogged a week later (Blacquière, 2018; Paquin, 2018). Besides, in the shoulder seasons (spring and fall), when a complete ice-cover has not formed yet, ice sheets moving in conflicting directions may form compact ice pressure ridges that may reach up to 10 meters high, most of it submerged. Pressure ridges are accumulation of ice forced up by colliding sea ice floes, driven by currents or wind (Leppäranta, 2011). As ice sheets are thinning, the height of such pressure ridges is reduced (Wadhams, 2012); however, scientists point out that pressure ridges are likely to occur more often in the Arctic because of the increased ice mobility of thinner sea ice (Kwok et al., 2013). As pressure ridges are of great concern to mariners in the area, their increased frequency will present new challenges for navigation. Ridges resulting from ice deformation are major barriers and barely passable, even with strong icebreakers (Bourbonnais and Lasserre, 2015).

It thus remains potentially difficult to navigate Arctic waters, especially in shoulder seasons. For instance, several cargo vessels experienced this

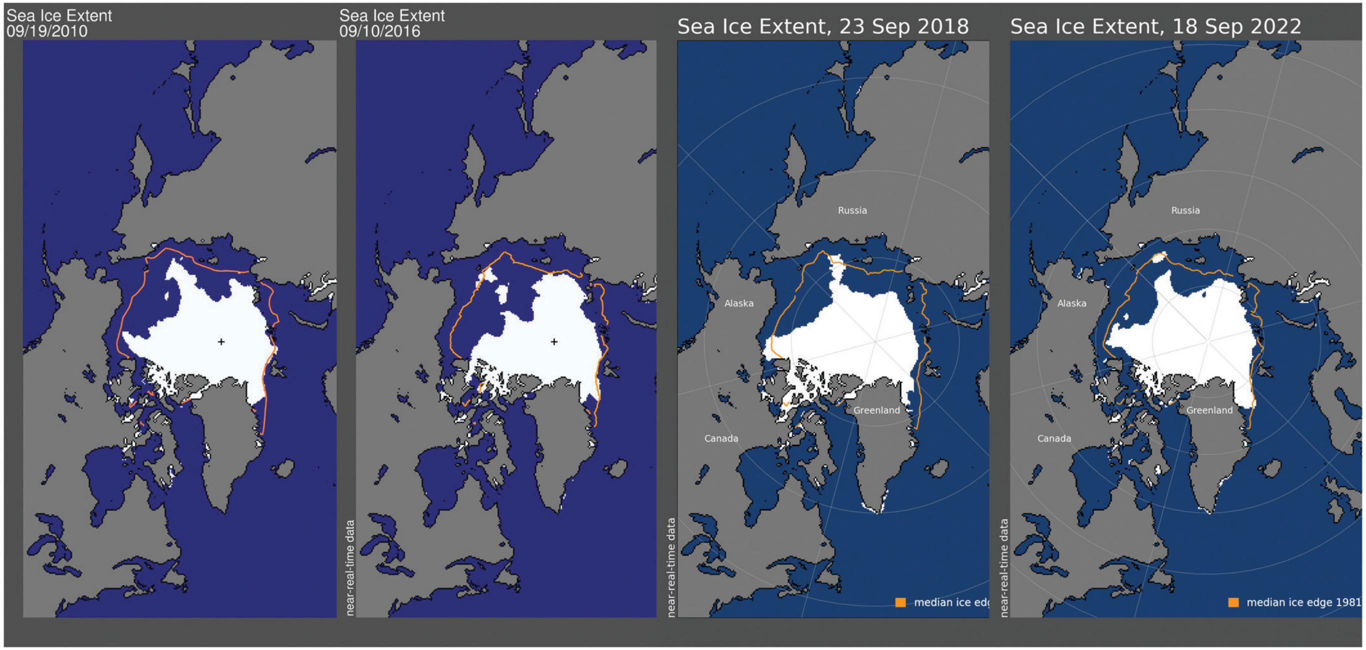

Figure 11.1 Extension of Arctic sea ice at its summer minimum, 2010, 2016, 2018, and 2022 (*Source*: adapted by the author from NSIDC (2022a; 2022b), with permission).

Figure 11.2 The Northwest Passage. The passage connects the Beaufort Sea to the Baffin Bay (*Source*: the author's elaboration).

unpredictability along the Northern Sea Route when they got trapped in fast-reforming ice in November 2021 (Staalesen, 2021a).

Contrasted Evolution of Sea Traffic

Given this evolution of sea ice in the Arctic, presenting major year-on-year variability and contrasted trends depending on the region, what can be said about the evolution of Arctic shipping? Traffic volume has grown significantly in the Arctic, both in general (PAME, 2020), along the Northern Sea Route and in the Canadian Arctic (PAME, 2021). In the Arctic as a whole, the number of single vessels entering the area increased by 25 % between 2013 and 2019 (Ibid.).

The Northwest Passage in the Canadian Arctic

As seen in Tables 11.1 and 11.2, vessel voyages are definitely increasing in the Arctic. From 2009 to 2021, traffic multiplied by 1.97 in the Canadian Arctic,

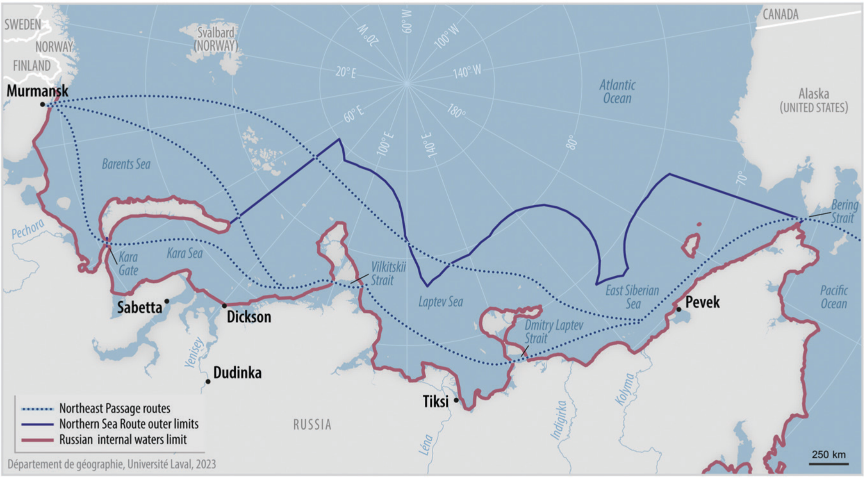

Figure 11.3 The Northeast Passage and the Northern Sea Route (*Source*: the author's elaboration).

and by 1.7 between 2016 and 2020 in the waters of the Northern Sea Route. This section pictures traffic in the Canadian Arctic.

A voyage is the movement of a vessel within a specific zone between its entry point and its exit point. Here the area is the NordREG zone, Arctic waters above 60°N and the limit of the Canadian EEZ. Destinational traffic, as opposed to transit traffic where ships are merely transiting and not stopping, represents vessels that go to an Arctic destination, stop over to load or unload or perform economic activity, then leave for another destination. As they stop over, they place themselves under the state of the port legislation. The term transit is interpreted differently by the various administrations that publish figures describing transit along Arctic passages. In Canada, figures are collected by the Canadian Coast Guard. The definition used for transit is a movement between the Baffin Bay to the Beaufort Sea. In Russia, a transit is a voyage between the Bering Strait and the Kara Gate. Thus, a ship from Kamchatka to Murmansk will be counted as a transit despite the fact the ship is still in Russian Arctic waters.

In the Canadian Arctic, 2020 was marked by a decrease in traffic (–20%), largely attributable to the drop in traffic of pleasure craft and cruise ships, which were banned from entry due to the COVID-19 pandemic. The number of merchant ships has decreased, but the total tonnage has increased, indicating the arrival of larger ships to serve operating mining sites like Mary River on Baffin Island or Raglan and Jilin Jien in northern Québec. For 2021, the ban on tourism-related traffic (cruising and yachting) was still enforced, but fishing traffic recovered while commercial traffic exploded, increasing 43.5% from 2020 and 19.7% above 2019 figures.

Table 11.1 Vessel movements in the Canadian Arctic, number of voyages, NORDREG zone

	2009	*2011*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022**
Ship tonnage, million tons (dwt)	na	1.28	1.39	1.43	1.8	2.79	3.54	4.38	5.16	7.6	14.6	12.2
Voyages	225	319	348	302	315	347	416	408	431	345	444	430
Of which:												
Fishing boats	65	136	137	119	129	131	138	139	137	132	134	111
Cargo or barges	109	126	127	108	120	147	188	197	223	183	289	233
Of which:												
General cargo	23	38	35	32	34	36	50	48	59	41	55	50
Tanker	23	30	28	25	27	23	24	29	28	31	36	28
Dry bulk	27	23	27	33	36	53	72	89	106	91	167	146
Tugs and barges	36	33	36	18	23	35	42	31	30	20	31	9
Pleasure craft	12	15	32	30	23	22	32	17	19	2	1	12
Cruise/passenger	11	11	17	11	18	20	19	21	24	0	0	44
Government vessels (icebreakers, navy)	21	20	17	23	16	20	22	18	20	21	11	14
Research vessels	7	11	20	10	9	6	13	13	8	4	3	12
Others	–	–	–	–	3	3	6	3	–	3	6	4

* All the figures compiled by the author from data submitted by NORDREG (Iqaluit) and by XST Xpert Solutions Technologiques Inc. and presented up to November 15, 2022.

Table 11.2 Transit traffic along the Northwest Passage, 2006–2022

Vessel type	*2006*	*2010*	*2011*	*2012*	*2013*	*2014*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022**
Icebreaker	2	2	2	2	2	4	3	2	2	1	1	1	1
Cruise	2	4	2	2	4	2	3	3	0	5	0	–	8
Pleasure craft	–	12	13	22	14	10	15	22	2	13	1	–	4
Tug	1	1	–	2	–	–	–	3	1	1	–	–	-
Cargo ship	0	0	1	1	1	1	1	2	0	3	5	3	7
Of which:												-	-
Bulk	–	–	–	–	1	1	–	–	–	–	1	–	-
Tanker	–	–	1	1	–	–	–	1	–	–	–	–	-
General cargo	–	–	–	–	–	–	1	1	–	3	4	3	7
Research	1	–	1	1	1	–	–	1	–	–	–	–	
Other	–	–	–	–	–	–	1	4	–	–	–	1	-
Total	6	19	18	30	22	17	23	33	5	23	7	5	20

* All the figures compiled by the author from data submitted by NordREG (Iqaluit) and by XST Xpert Solutions Technologiques Inc. and presented up to 15 November 2022.

Despite the general and substantial increase in vessel traffic observed in the two areas, contrasting trends can be observed from these figures. In terms of the number of voyages, fishing vessels experienced a steady expansion between 2009 and 2011, going from 65 to 136 voyages, but fishing traffic has since experienced moderate growth. The increase in traffic was due to cargo ships activity (+145 % from 2009 to 2021), of which dry bulk experienced the largest expansion (+518.5 %), driven by mining activities, and general cargo (+ 139.1 %), driven by community resupply. Part of community resupply is also performed by barges pushed by tugs, from Hay River on the Great Slave Lake and then down the Mackenzie River, or from the port of Moosonee to northern Ontario communities. Significant growth in tonnage is largely due to the expansion of bulk cargo traffic, growing from 1.28 million dwt in 2011 to 14.6 million dwt in 2021 (+1,040.6%) and 12.2 million dwt for the first ten months of 2022.

Bulk traffic has benefited from the exploitation of Arctic and Subarctic mines, such as Voisey's Bay (Labrador), Raglan and Canadian Royalties/Jilin Jien (Québec), and Mary River (Baffin Island, Nunavut). This expanding traffic volume has largely compensated for the dwindling traffic to and from Churchill – there were only four voyages of grain-carrying bulk vessels in 2019 and three in 2020. For instance, Baffinland Iron Mines shipped 920,000 tons of ore from its mine in Mary River through its port of Milne Inlet in the first year of activity in 2015, then 4.1 million tons in 2017 (Ryan, 2018) and 5.6 million tons in 2021 (Baffinland, 2022). The company intended to eventually rech an annual volume of 12 million tons in the next few years, and eventually 30 million tons (ibid.; Venn, 2021), which would have improved the profitability of the project while justifying the construction of a railroad between the mine and the port, as well as the construction of a second wharf at the port of Milne Inlet. However, on 16 November 2022, the federal Minister of Northern Affairs, Daniel Vandal, rejected the mine expansion permit application (Venn, 2022).

Other active gold mines north of Rankin Inlet also generate traffic related to the logistics of mining operations. In the Canadian Archipelago, Fednav operates ice-strengthened Polar Class 4 vessels (*Arctic*, *Umiak*, *Nunavik*, *Arvik*) capable of navigating in winter, servicing the two mines near Deception Bay in northern Québec. The company may develop a business model in partnership with mining companies for year-round shipping to Deception Bay and Milne Inlet (operational) as well as Steensby Inlet (projected). The logistics of mining activities are dominant in terms of tonnage in the Canadian Arctic: in 2020, the capacity of bulk carriers servicing mines (measured in cumulated vessel dwt), at 6.1 Mt, accounted for 77.3% of the tonnage capacity of traffic (measured in dwt); in 2021, at 12,32 Mt, it accounted for 84.4%. Large, powerful dry bulk carriers transport ore from the maritime terminal built to service the mines: the construction of deepwater docks is required for base-metal mines that ship large quantities of ore, as is the case at Milne Inlet (Mary River) and Deception Bay (Raglan and Jilin Jien).

Northeast Passage and Northern Sea Route

In Russia, total traffic experienced significant growth in recent years, mainly fueled by the expansion of natural resources extraction or shipment, in the past from multipurpose ports like Murmansk, Arkhangelsk or Dudinka, the latter having experienced a strong development impetus with the creation of the Norilsk Nickel enterprise in 1935.

Tanker traffic along the NSR increased by 147.8% between 2016 and 2021 (see Table 11.3). LNG tanker traffic went from nil to 528 voyages, and ice-breaker voyages increased by 510%. Tanker traffic experienced sustained growth due to the oil and gas developments in the Kara Sea (Prirazlomoye and Varandey oil terminals) (Agarcov et al., 2020) and on the Yamal peninsula and Ob Bay, with Sabetta and Novy Port the main terminals and the impending opening of an Arctic LNG 2 terminal (Katysheva, 2020). The scheduled opening of new oil fields (Vankor in particular) in the Taymyr peninsula, east of the Yenisei delta, should contribute to the expansion of traffic: the Vankor field alone should produce 30 million tons from 2024 on. With the programmed opening of coal, lead, and zinc mines, and more ore shipments from the port of Murmansk, bulk traffic should experience sustained growth in the Russian Arctic as well. Nickel ore is shipped in containers from the port of Dudinka, and the apparently high container traffic reflects shipments of mineral and metallurgical semi-transformed products, in addition to limited reefer shipments of fish from Kamchatka to Arkhangelsk and St. Petersburg. Fishing, concentrated in the Barents and

Table 11.3 Vessel movements in NSR waters, number of voyages

	2016	*2017*	*2018*	*2019*	*2020*	*2021*	*2022**
Volume transported, million metric tons	7.265	10.713	20.18	31.53	32.97	34.85	34**
Voyages in NSR waters	1,705	1,908	2,022	2,694	2,905	3,227	na
Of which:							
Tanker	477	653	686	799	750	705	
LNG tanker	–	13	225	507	510	528	
General Cargo	nd	nd	nd	nd	49	800	716
Bulk	519	515	422	546	710	94	
Container	169	156	150	171	171	177	
Icebreaker	58	101	232	231	220	354	252
Supply	–	57	104	169	264	156	na
Research	91	87	85	93	114	138	na

Source: CHNL data, compiled and adapted by the author, https://arctic-lio.com/ and personal communications from CHNL; PortNews.ru, 15 Dec. 2022, https://en.portnews.ru/news/340193/.

* Figures for the first five months of 2022.

** Preliminary figures.

Bering Seas, as well as passenger traffic, do not appear in these statistics (25 voyages for fishing in 2021 and 1 voyage for passenger's vessels).

Transit traffic is more significant along the NSR than along the NWP. However, both in terms of voyages and tonnage, transit represents a small share of total traffic along the NSR, despite the recent increase in transit voyages and tonnage since 2018, with transit tonnage increasing to 1.2 Mt in 2020 and 2 Mt in 2021 (see Table 11.4). In transit traffic, cargo vessels are more diversified than in the NWP; between 2010 and 2014, tankers dominated transits, with general cargo vessels dominating since 2015. Bulkers were a significant share of vessels in 2012, 2013, and again in 2020 and 2021. As far as tonnage is concerned, bulkers represented the largest component of transit in 2020, with 1.004 Mt of iron ore shipped from Murmansk (78.4%) being largely responsible for the rapid expansion of transit that year. In 2019, crude oil represented 43.3% of transiting cargo and iron ore 21.5%. It is noteworthy that these shipments of iron ore from Murmansk represent transit from an Arctic port and thus can be considered Arctic destinational traffic, a destination methodological point discussed above.

Transit traffic along the NSR was initially very modest. It expanded to a high of 71 voyages in 2012, collapsed to 18 in 2014, and recovered gradually to 37 in 2019 and 74 in 2021. It may be that the increase will be an ongoing process, but that does not hide the fact that transit traffic remains modest, especially when compared to destinational traffic along the NSR, and when compared to transit traffic along major straits or canals like Malacca, Suez, or Panama (Lasserre and Têtu, 2020a). This transit level is clearly out of step, with media forecasts announcing the advent of heavy traffic along Arctic routes (Lasserre et al., 2016). Transit however appears to have experienced a severe decline in 2022, with very few international transits. Transit traffic seems to have collapsed following the Western and Japanese sanctions, since even the Chinese company COSCO, which had performed seven transits in 2019, 14 in 2020, and 14 in 2021, seems, according to the available data, to have provided only two in 2022. Contrary to news from certain specialized media, there were a few transits carried out by foreign companies in 2022 (at least four out of five identified transits), but much less than in 2021 (75 out of 85 transits) or 2020 (42 out of 64 transits). Could Russian shipping companies have taken over and provided a significant number of transits in the summer of 2022? It is difficult to say, and this implies that they would have been able to redeploy vessels to quickly take over the transits planned by foreign companies. In the short term, it is assumed that transit traffic along the NSR will contract significantly.

Comparative Analysis: The Advent of Transshipment Hubs as a New Business Model?

In Canadian and Russian Arctic traffic, there is a definite trend toward expansion, but with differentiated histories and compositions. Transit numbers across

Table 11.4 Transit traffic along the NSR, 2006–2021

	2008	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*
Icebreaker	–	–	2	3	2	2	1	2	–	1	–	2	–
Government ship	–	–	1	0	1	1	3	1	–	–	–		–
Cruise	–	1	1	0	1	3	1	1	–	–	–	1	1
Tug, supply vessel	1	4	4	5	1	1	4	4	1	2	–	5	–
Cargo ship	2	6	31	38	64	24	15	11	24	23	32	51	84
Of which:													
Bulk	2	–	5	10	16	1	–	–	–	2	3	16	28
Tanker	–	3	17	27	33	14	2	–	5	3	9	7	8
General cargo	–	–	2	–	14	8	4	9	11	12	14	26	36
Container	–	–	1	–	–	–	–	–	–	1	1	2	1
Reefer		–	6	1	1	–	4	2	3	2	5	–	3
Heavy lift		2	–	–	–	1	1	–	5	3	–	–	8
Research		2	2	0	2	0	0	–	–	–	2	–	
Fishing		–	–	–	–	1	–	–	2	1	3	5	
Total official transits	3	13	41	46	71	31	18	19	27	27	37	64	85
Volume transported, million metric tons		0.11	0.82	1.26	1.18	0.27	0.04	0.21	0.19	0.490	0.697	1.281	2.027
Total volume handled in the NSR, million metric tons	2.219	2.085	3.225	3.75	3.914	3.98	5.432	7.265	10.73	20.18	31.53	32.97	34.85

Source: CHNL data, compiled and adapted by the author, https://arctic-lio.com/ and personal communications from CHNL.

the Northwest Passage were higher at the beginning of the period, experienced growth until 2012, witnessed a moderate decline, expanded again until 2017, then collapsed in 2018, only to recover in 2019 and then collapse because of the ban on cruise and pleasure craft transits. Transit in the NWP was largely composed of pleasure boats as opposed to between zero and two commercial vessels. This may be about to change: three transits were made by cargo vessels in 2019, five in 2020, 3 in 2021, and seven in 2022. Vessels from the Dutch shipping company Royal Wagenborg accounted for two of the transits in 2019, all five in 2020, all three in 2021, and seven in 2022. The company openly advertises the voyages, hinting it may attempt to develop this market in the future (Wagenborg, 2019). As far as cargo vessels are concerned, tankers and bulkers were prevalent among the few transits before 2017; now general cargo vessels dominate. It is interesting to note that the expansion of mining in the Canadian Arctic does not support transit expansion, despite the fact ore is at times delivered to China. In 2014, a Fednav vessel transited the NWP to deliver nickel ore to China from the Raglan mine; however, in 2018 (two transits), in 2019 (one transit) and again in 2021 (one transit), shipments of iron ore from the Mary River mine to China transited across the NSR (Staalesen, 2019, 2021b). In 2013, the Baffinland CEO made it clear that the company would not use the NWP for transit to Asia (Waldie, 2013); the company somewhat softened its stance in 2019, but apparently has yet to use what it considers an "alternative shipping route" (Anselmi, 2019).

It is apparent that the main driver for the expansion of shipping in both the NWP and the NSR is natural resources exploitation, including mining, oil and gas, and fishing to a lesser extent, in Baffin Bay in Canada and the Barents Sea in Russia. Resource extraction relies on bigger ships that account for a rapid increase in transported tonnage, especially along the NSR where resource extraction is more active than in Arctic Canada (Lasserre and Pic, 2021). Presently there is more activity in the oil and gas sector along the NSR, whereas mining is the leading extractive sector in the Canadian Arctic – there has been no more oil and gas exploration since 2016 following a moratorium from the federal government (Government of Canada, 2019; 2021). Community resupply in Canadian waters also experienced sustained growth, with a temporary dip in 2020 due to the COVID-19 pandemic.

Although traffic has experienced real growth both in the Canadian and the Russian Arctic, and in both regions transit traffic remains far short of past expectations. The composition of transit traffic differs along the NSR and the NWP. Commercial cargo ships represent the largest share of transit traffic along the NSR, whereas transit along the NWP is largely composed of pleasure boats, with commercial vessels comprising between zero and two units until 2019. One element that explains this weak interest in transit traffic along the NWP is a higher ice concentration in summer (NASA, 2021), the absence of promotion of the NWP as opposed to a very proactive stance in Russia, and a higher level of equipment and infrastructure along the NSR, including ports that could harbor a damaged ship (Lasserre et al., 2016). Icebreaker support also varies greatly, with Canada having only nine Arctic-capable icebreakers as opposed to Russia's five nuclear and 37 diesel icebreakers.

This comparison between total and transit traffic also underlines the fact that destinational traffic (ships going to the Arctic, stopping there to perform an economic task and then sailing back) remains the driving force in Arctic shipping along the NSR, but all the more so in the NWP where commercial transit was until recently very low and still is limited. This destination traffic is fueled by the servicing of local communities. However, traffic is growing significantly due to the expanding exploration for and exploitation of natural resources, including mining, oil and gas, and fishing. Natural resources extraction is by far the strongest driver in Arctic shipping, whether in the Russian Arctic, or the Canadian Arctic with mining only since oil exploration is halted in because of the moratorium decided in 2016.

While some natural resource discoveries are promising in Alaska, Canada, and Russia, the large-scale development and operation of these projects remain uncertain in North America, whereas Siberian projects are benefiting from the Russian government's willingness to push for the expansion of extraction of resources. These ventures remain risky, since operating costs are high, but also because the industry remains very sensitive to world prices (Lasserre, 2021). The high volatility that marked 2020, between the pandemic and price wars, has had a definite impact on current projects, and it remains to be seen what the impact will be in the long term. Nevertheless, the moderate but ongoing expansion of cargo transit traffic and the strong expansion of destination traffic fueled by resource extraction attest to the influence of the ongoing globalization of the Arctic, and Arctic economic expansion that is largely fueled by markets from outside the region.

The Russian government is aware of the reluctance of shipping companies to develop transit traffic along the NSR, let alone the NWP. Shorter routes are proving to be a poor incentive when considering the constraints of Arctic shipping. In order to attract the interest of forwarders, a new business model is gradually emerging, based on a proposed synergy of regular shipping routes with open-water (OW) vessels with Arctic transshipment hubs and high-ice class shuttle vessels that could offer year-round service. Advocates of transshipment hubs are trying to attract traffic, not through the transit of medium ice-class vessels, but through the construction of transshipment hubs: OW vessels offload cargo in these hubs, then dedicated shuttle vessels carry it to another Arctic gate where cargo is loaded onto another OW vessel. The advantage of this business model rests in the possibility for shipping companies to benefit from a year around service and thus regular service permitting, in theory, just-in-time delivery without having to invest in costly high-ice class ships. This model implies the construction of sets of port hubs, one at each entrance of the Arctic routes, and relies on the advantage of shorter routes outweighing the need for two transshipments.

As it became apparent shipping companies were poorly interested in Arctic transit, transshipment hub projects have blossomed in recent years across the Arctic, with proposed sites in Iceland (Finnafjord), Norway (Kirkenes), Russia (Murmansk, Arkhangelsk, and Indiga on the Atlantic and Vladivostok, Zarubino, and Petropavlovsk on the Pacific), Japan (Tomakomai), South Korea (Busan), Alaska (Nome), Maine (Portland), Greenland (Nuuk), France (St-Pierre, south of Newfoundland), and Canada (Halifax, St Anthony, Churchill, Iqaluit, Nanisivik, and Qikiqtarjuaq) (Cyr, 2021). It is unlikely, given the required investments in port infrastructure and shuttle vessels, that all these projected Arctic hubs will ever be built. Some projects appear to be ahead in the developing competition between all these projects, with the support of local and national authorities. Other projects have had setbacks, like Kirkenes, which suffered a major blow when the projected railway between Kirkenes and Rovaniemi that would have connected the port with the European railway network was blocked by the Lapland Regional Council (Nilsen, 2021a). Several other projects have not even received the formal approval of regional authorities.

In this struggle to establish Arctic transshipment hubs, Russia definitely appears to have the lead. It has already experimented with transshipment of oil and gas in Murmansk (Lasserre and Têtu, 2020a). The Russian government seems willing to set up and subsidize a dedicated container shuttle company between Murmansk and Kamchatka, very likely Petropavlovsk or Vladivostok. It may even subsidize directly foreign shipping companies that opt to use this new shuttle service along a planned Northern Sea Transport Corridor (Staalesen, 2021c). Further, construction for the expansion of the port of Murmansk in underway, with the Lavna terminal being dedicated to the planned expansion of coal exports as well as containers (Nilsen, 2021b). With Arctic ports already in place facing the Atlantic and the Pacific, and with the Russian government's willingness to set up the shuttle company, there may be little room for hub projects along the NWP, which already suffers from a higher ice concentration. The port of Iqaluit, which was set to begin operations at the end of 2022, is merely a wharf with little equipment (Lasserre, 2022). The idea of building a port in Qikiqtarjuaq stemmed from the desire to support the fishing industry (Qikiqtaaluk Corporation, nd), but also from the vision of developing a "little Singapore of the Arctic" with the help of "Chinese investors" (Zerehi, 2016) whose identity remains elusive (Blacquière, 2021). This project is reportedly stalled, especially as Chinese investors may not be welcome anymore in the context of tense Sino-Canadian relations. Senator Patterson recently included the Qikiqtarjuaq port in his budget recommendations for Nunavut's development, but the Canadian federal government does not seem to have followed suit (Ritchot, 2021). Halifax may be better positioned as it boasts functioning infrastructure and a solid reputation, but the Arctic hub project seems preliminary, as is the case for St Anthony in Newfoundland (Cyr, 2021).

Arctic Shipping Companies Adapted to Structural and Regional Constraints

This comparative analysis of Arctic shipping, presented in the section above, reflects the effect of constraints on the development that do not merely boil down to ice. Companies already involved in Arctic shipping have adapted to the navigation challenges imposed by ice and Arctic climate, and so have the few that recently entered the market. Despite climate change, ice will always form in winter, temperatures will dip to –40°C with blizzards and the polar night will prevail for several months (Lasserre, 2021). Navigation challenges are constraints that crew experience, equipment, ice-classed vessels, and azipods on double-action vessels can overcome, as attested to by LNG carriers exploited by Sovcomflot for instance, or bulk carriers run by Fednav that can navigate in Arctic waters for most of the year. Double-action ships are vessels that can navigate in open water or light ice bow ahead, but that can also move stern first thanks to orientable propellers on azipods, with a profiled stern that crush the ice (like an icebreaker, relying on its weight) and thanks to the turbulence of the propellers that break thick ice (Niini, 2006). Risks remain high, and this is why insurance companies demand higher premium and, above all, often refuse to insure shipping companies that have no experience in Arctic shipping, thereby acting as barriers to entry into the market (Sarrabezoles et al., 2016).

Beyond these natural, physical constraints are structural and market constraints that limit business options for shipping companies. Ro-Ro vessels and especially container vessels, for instance, are usually exploited in a liner mode: they must respect schedules published several months ahead and must fit into the just-in-time industrial mode now adopted by most manufacturers. However, just-in-time proves complicated to enforce given the recurring variability in sea-ice extension and calendar of melt and refreeze: it is, as exposed above, difficult to reasonably assume navigable channels will be sufficiently ice-free six months ahead. Two surveys underlined the lack of interest among the liner shipping sector for Arctic shipping (Lasserre and Pelletier, 2011; Lasserre et al., 2016).

Another constraint for the liner sector is the absence of intermediate ports to load and unload cargo, with a view to improving the load factor. There are few large ports in the Arctic that can accommodate container vessels. Greenland villages can harbor small container vessels between 480 and 2134 TEUs from the Royal Arctic Line (Royal Arctic Line, 2022). Most Arctic Norwegian or Russian communities are equipped with one wharf that can harbor medium-sized vessels (Murmansk, Arkhangelsk, and Dudinka being exceptions), but they often lack transportation systems that could provide them with a hinterland (Faury et al., 2019). In Canada, villages have no wharves and supply is performed by general cargo ships (see below). The consequence of this lack of port infrastructure and land or river connection to a hinterland is that there are few ports that could provide shipping companies with intermediate markets. Distances are so large between villages that it is difficult to consider sharing resources overland or by sled over ice, except for a few pairs of not too distant villages like Arviat and Whale Cove (148 km) or Ivujivik and Salluit (120 km). High costs are also a powerful incentive to keep hunting, fishing, and harvesting traditions and skills alive (Gomez Sarmiento, 2019).

Bulk shipping companies are not submitted to the just-in-time constraint. They however often work in a tramp mode, meaning they do not follow schedules and vessels pick up cargo where they can find a contract and deliver it where the forwarder wants the cargo to be delivered. This management system makes it difficult to allocate a vessel to a specific area: the shipping company has no guarantee a vessel will ply Arctic waters. This proves a problem when the possibility to invest in an ice-classed vessel is raised. More expensive to buy and to run (Lasserre, 2014), running an ice-classed vessel may prove loss-making if no service is sold in Arctic waters with their higher freight rates. This is why many bulk shipping companies are also reluctant to develop Arctic shipping: they wish to guarantee they will be able to amortize the higher capital and running costs incurred by an ice-classed vessel, with long-term contracts in the Arctic. Without these, it may prove a risky venture to acquire ice-classed vessels. This is apparent in the profile of companies that service Russian Arctic oil and gas projects, or Canadian mining sites. In Russian waters, more than 30 Russian companies participate in the logistics of extraction sites; however, when considering voyages performed by oil or LNG tankers, out of the 1,024 voyages in this sector performed by 15 companies in 2020, 865 (84.5%) were carried out by five companies – Dynagas, Dynacom Tankers, Teekay Shipping LNG, SCF, and GaspromNeft – to service oil and gas extraction sites. In 2022 in Canadian waters, five companies (Thome Singapore, Nordic Bulk, Fednav, Arcelor Mittal, and Oldendorff) accounted for 113 of the 146 voyages (77.4%) performed by dry bulk cargo vessels (NordREG data compiled by XST and the author). This present-day high concentration appears to reflect this strategy of seeking long-term contracts by bulk shipping companies with their customers from the extraction sector, resulting in the active presence of few shipping firms in the Arctic market.

Social Implications for Local Communities

Project-oriented ports were built like Sabetta for the Yamal LNG project. The ongoing Russian resources development projects in Siberia, like Arctic LNG 2, Vostok Oil (with and LNG component), or the Syradasaysky coal mine, each include the construction of new terminals for the production to be loaded on large vessels (Lasserre and Pic, 2021; Government of the Russian Federation, 2022). In Canada, active Arctic mines also required the construction of dedicated ports, like in Deception Bay for the two nickel mines of Raglan and Jilin Jien, or in Milne Inlet on Baffin Island for the Mary River iron mine. But all these ports are single-purposed and do not service communities – and are ill-equipped to be turned into transshipment hubs as well.

The strategic importance of community resupply for Arctic villages must not be understated in the Canadian Arctic: distances and the absence of land transportation imply that all goods consumed in the communities must be delivered either by air or by sea. Sea transportation is preferred of course as costs are much lower than for goods carried by plane. Community resupply is the second most important segment of commercial shipping in the Canadian Arctic. It involves the shipment of fuel as well as consumer goods to communities, fresh food products, and high value-added consumer goods being also shipped by air, a situation that accounts for high retail prices experienced in Arctic communities.

The melting of sea ice due to climate change could theoretically present an opportunity for expanded service to communities through increased transportation capacity, either through more voyages (increased frequency of calls) and/or increased capacity of vessels (Stewart, 2018). Shipping to Arctic communities is all the more important as food insecurity is a significant problem, affecting 36% of households in Nunavut in 2012 – a figure that reached 42% in 2014 (Harvey, 2020) and that may have expanded because of the restrictions imposed during the COVID-19 pandemic – as opposed to a national average of 8.3% (De Meulemeester, 2018). Food insecurity in Nunavut is largely linked to high food prices that directly stem from transportation of food items (Harvey, 2020). Housing difficulties in most Inuit communities in the Canadian Arctic also stem from high costs of delivering construction materials (Butterfield, 2022).

Improved shipping is also paramount for the diversification of the economy. The Canadian Arctic is largely relying on the public sector, on mining and, to a lesser extent, on a burgeoning tourist industry. Diversification implies the possibility to sell locally produced goods to southern markets given the very limited base in Arctic communities. Fostering the development of local businesses implies the improvement of shipping from northern communities southward (Stewart, 2018), a development that would be welcomed by shipping companies that usually see their vessels return empty after servicing communities.

The Russian, Norwegian Arctic, or Greenland communities benefit from the presence of small ports except for Murmansk and Arkhangelsk, with wharves that can accommodate medium-sized vessels (Faury et al., 2019). There are, however, no community ports in the Canadian Arctic with the exception of Churchill in Hudson Bay, only havens where barges can land. The logistical solution to this situation was either to develop a service of large barge convoys pushed by tugs, as in the Western Canadian Arctic, or to use ice-classed general cargo vessels equipped with self-loading cranes, loading in Montreal, that anchor offshore and unload cargo on barges that are then pushed by small local tugboats onto the beach where cargo is then offloaded on trucks and dispatched: this approach was developed by shipping companies Desgagnés

Transarctik and Nunavut Eastern Arctic Shipping (NEAS), both based in Montreal (Québec). For fuel products, the ship is similarly anchored offshore and extends a long pipe that fill ups tanks (Lasserre, 2022). Desgagnés operates its PetroNav subsidiary from Montreal, while Woodward Group operates Coastal Shipping Limited (CSL) from St-John's (Newfoundland). Given the logistical constraints, the shipping companies developed a specific expertise that has the indirect benefit of limiting competitors entering the market, as several experts requesting anonymity explained. However, despite extensive experience garnered by shipping companies, efficiency is definitely hampered with this operating mode. The specific unloading procedure has also long forced cargo to be handled in the form of pallets rather than containers, in stark contrast with containerization effective in Greenland where small container carriers can dock on wharves in villages.

In the western Canadian Arctic, resupply is performed by the Northwest Territories Government-owned Marine Transportation Services (MTS), formerly Northern Transportation Company Ltd (NTCL) until its bankruptcy in 2016. Its base port is in Hay River on the Great Slave Lake shore, which is serviced by rail. Churchill was also used to resupply communities in the Western Hudson's Bay area, with a traffic volume that reached about 35,000 tons in 2002 (Prolog, 2011). From the Hay River terminal, convoys navigate along the Mackenzie River and then visit western Arctic communities – they in the past also serviced communities in Alaska. This logistical mode prevented NTCL from operating large vessels, the depth of the Mackenzie River being too shallow. Instead, the company operated tugboats and barges joined in convoys.

Churchill is currently the only Canadian Arctic community with a deepwater port and a wharf. Built in 1931 as a maritime outlet for the grain produced in the Prairies, it is connected to the North American railway network, a theoretical advantage that made Churchill a potential gateway to the heart of the continent. The Arctic Bridge sea route, connecting Churchill to the Russian port of Murmansk, never materialized into significant traffic. In 1997, the port was privatized to OmniTrax, which decided to close it down in 2016. Sold to the Arctic Gateway Group, it reopened in 2019, but experiences very little export traffic. It is currently also used as supply hub by Desgagnés (occasionally) and by NEAS, besides their Montreal base (see Figure 11.4).

Attesting to the desire to increase service to communities, the project of building a deepwater port in Iqaluit, discussed for decades and relaunched in 2005, has finally come to fruition: work started in 2018 and was to be completed in 2021, with service beginning in 2022 (City of Iqaluit, 2005; Lochead, 2022). Faster and more reliable service could prove particularly useful, not only to meet expanding community needs in resupply, but also to ship locally produced goods. Ways to diversify links with a view to improving supply and shipment possibilities were explored by the Chamber of Commerce of Baffin Island in 2006. Considered were links between Goose Bay (Labrador) and Iqaluit as well as between Iqaluit, Nuuk, and Reykjavik with service provided by the Danish

Figure 11.4 Cargo capacity offered to communities serviced by NEAS in 2022 (*Source*: NEAS schedules, compiled and adapted by the author*).

* There is no public data about cargo traffic for each community. As a proxy and to reflect the service the shipping company offers to each village, this map pictures the sum of capacities of vessels calling at a community.

company Royal Arctic Lines and the Icelandic company Eimskip (Brooks and Frost, 2012). These projects, however, never came to fruition.

The impact of the melting of sea ice gave way to the idea shipping companies servicing communities could increase the frequency of port calls as the navigable season expanded. It appears shipping companies decided to bank on economies of scale for each vessel rather than expanding the fleet with several small units. Fleet expansion was thus real but not major, remaining at four vessels for CSL, going from four to five vessels for NEAS and from 6 to 8 vessels for Desgagnés. However, capacity increased significantly, the largest vessels going from 9,635 dwt in 2007 to 15,312 in 2020 for CSL; from 9,246 dwt in 2008 to 12,752 in 2020 for NEAS; from 11,010 dwt in 2008 to 13,961 in 2020 for Desgagnés. CSL and NEAS clearly bet on increased vessel size, while Desgagnés opted for a mixed strategy of expanded fleet with a modest size increase.

NEAS somewhat expanded the number of voyages (see Table 11.5), while Desgagnés remained at 21 and then expanded in 2022 to 28. Given that NEAS operates five vessels (four in 2008) and Desgagnés 8 (from six in 2008), the average number of voyages per vessel actually decreased or remained stable. Clearly, the strategy of these companies is not an expanded frequency from their Montreal/Valleyfield base, but rather a larger vessel capacity that enables each vessel to service more communities or carry a larger cargo load. CSL performed 14 voyages in 2010, and 19 in 2020 and appears to rely on both increased frequency and larger vessel capacity. Figure 11.4 depicts the geography of serviced communities by NEAS, the company having a clear focus on the Eastern Arctic, but expanding westward along the NWP and also expanding its carrying capacity thanks to the introduction of larger vessels.

Sustainability clearly is an issue for shipping companies, especially those dedicated to community resupply. Communities need to import all their consumer goods, fuel, and construction material by sea. The logistical constraints and the small markets make transportation costly and that explains the very high prices that prevail in Northern communities. If communities clearly expressed the desire to see community resupply improved, the impact on the environment is also a concern and was voiced both for traffic generated by mining activities and for community servicing (Pic et al., 2021; Lasserre, 2022), leading the federal government to refuse to grant permission for the expansion of the Mary River iron mine that would have generated increased traffic by heavy bulkers around the port of Milne Inlet (Venn, 2022). The federal government is also developing, in coordination with local communities, low-impact shipping corridors in the Canadian Arctic waters, with the goal of encouraging marine shipping to use routes that pose less risk with a view to minimizing the impact on communities and the environment (Dawson et al., 2020). Conversely, the decision by the federal government momentarily not to proceed with the IMO's ban on heavy fuel (HFO) decided in 2021 (Humpert, 2022) reflects the debate among shipping companies and communities. If Desgagnés readily

Table 11.5 Resupply voyages to scheduled destinations, 2008, 2020, and 2022

	NTCL/MTS	*NEAS*	*Desgagnés*	*CSL*
2008	22	11	21	14 (2010)
2020	11	13	21	19
2022	8	13	28	na

Source: Companies' timetables and direct communication with companies.

accepted the ban and said it is already phasing out its older vessels for new ones burning much-less polluting MDO (Blacquière, 2021), NEAS was reluctant to proceed as it would reportedly significantly increase its costs and thus eventually the cost of goods shipped to communities (Paquin, 2018).

Land Connectivity as a Way to Support Shipping?

As a way to improve community resupply and the logistics of mining operations, a synergy between shipping, port management, and land infrastructure is considered in the Canadian Arctic.

Several inland mining projects are considered for development in the Canadian Arctic. Notably, gold mining projects held by Blue Star Gold Corp. are seriously considering the construction of a road and a port located on Grays Bay, but the project is costly. This situation sums up the dilemma faced by several inland mining project: is it preferable to construct a year-round land road reaching south and connecting to the road and rail network despite high costs or is it more profitable to build a shorter road northward connecting with a haven or a port, with a navigable season bound to expand in the future but still limited to a few months per year? (Lasserre and Têtu, 2020a). The impacts of climate here too play are significant, as higher temperatures shorten the duration of the winter road season, the backbone of land logistics in the continental Arctic. Winter roads take advantage of deep-frozen lakes, rivers, and land to enable heavy trucks to service communities and mining sites; they are inexpensive to set up but are seasonal. However, climate change has impacted fall freeze up and spring thaw dates, which in turn has delayed the opening dates of ice bridges on all-weather highways and reduced the operating window of the winter road system (Prolog, 2011; Dong et al., 2022). The declining reliability of winter roads, the gradually increasing number of mining projects in the continental reaches of the Canadian Arctic, and the possibility to develop synergies between land infrastructure and shipping support the idea of expanding north the road network at a cost, especially as the melting permafrost, force engineers to compensate for the unstable ground (Lasserre, 2022). The all-season road network is expanding, as the Dempster Highway was pushed up north to Inuvik (in 1979) and then Tuktoyaktuk (in 2017).

Could land transportation developed in the frame of northern transport corridors (Sulzenko and Fellows, 2016) help develop a synergy between maritime and land logistics in the Canadian Arctic? In the past, shipping companies have already used resupply hubs connected to the rail network like Hay River, Moosonee, or Churchill for community resupply. Hay River is still the main hub for service of MTS, and Churchill has been used recently by NEAS (Desgagnés in 2008 as well). An extended land transportation service could promote the creation of logistical hubs for shipping companies that could then use them for the supply of coastal mining projects and for community resupply and thus improve the servicing of Arctic communities, for ships would not

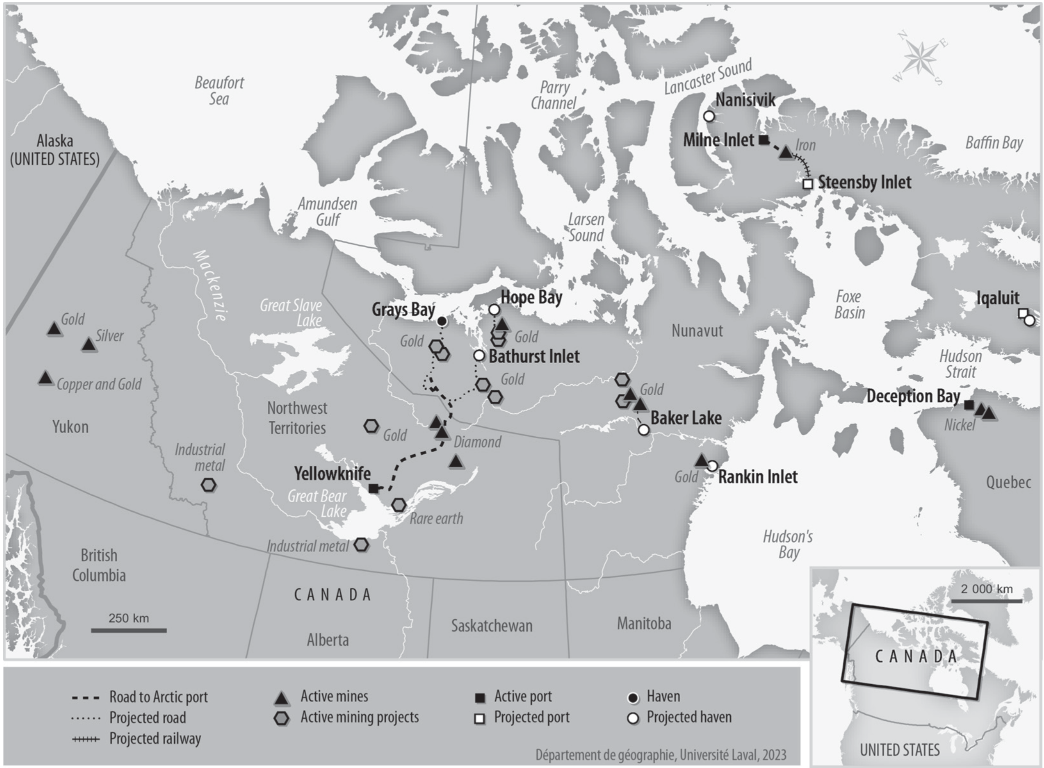

Figure 11.5 Major mining operations and projects in the Canadian Arctic, 2019 (*Sources*: set up by the author from Governments of Nunavut, NWT and Yukon; professional mining websites).

have to return to Montreal for reloading at the end of every run. The idea is being debated, for instance in Québec in the frame of the Plan Nord (North Plan) (Brun et al., 2017), but so far proved too costly for governments and corporations to go ahead.

Railway construction in the Arctic used to be associated with the exploitation of natural resources. In Canada, the railroad to Hay River on the shore of the Great Slave Lake was completed in 1964 to service the lead and zinc Pine Point mine. The Alaska Railroad was developed to facilitate mining. Iron ore exploited from northern Sweden is largely shipped by rail to the Norwegian port of Narvik.

In Russia, several rail lines were similarly developed to facilitate the exploitation of natural resources, to Murmansk in 1917, to Vorkuta in 1941. The town of Norilsk boomed after 1935 with the exploitation of the nickel mine connected by a railway to the seaport of Dudinka. In 1947, the Soviet government began the construction of a railway line between Obskaya toward Igarka, the Transpolar Railway, with a view to connecting mining developments in Siberia (Pastusiak, 2016). Here, strategic objectives of territorial control mixed with economic drivers to promote the exploitation of Siberian lands. The projected railway, built with gulag workforce, was abandoned in 1953 (Lasserre and Têtu, 2020b).

Railway development experienced a second impetus recently. The connection from the Baikal–Amur Magistral railway in southern Siberia, up to Yakutsk but on the other shore of the Lena, was completed in 2019. In Siberia, there are efforts to diversify the connections between mines and oil and gas fields to river and seaports. These connections would accomplish several objectives: facilitate the logistical servicing of these ventures, offer transportation alternatives, and help develop the NSR with diversified cargo that will come only if Arctic ports are connected to a hinterland (PortNews, 2013; BNE Intellinews, 2018). Russia is also actively promoting the revival of the Belkomur project, launched in 1995 and aimed at connecting Arkhangelsk to the TransSiberian mainline (Staalesen 2017) (see Figure 11.6).

Thus, several Arctic land transportation projects are currently being promoted. The Northern Latitudinal Railway, the Belkomur Railway, the port of Sabetta, the Murmansk Transport hub are considered part of the Arctic Transportation Corridor, a large set up of transportation infrastructure projects aimed at developing transportation capacity between the Russian Arctic and the world (PortNews, 2013). Finland and Norway are also keen on developing rail infrastructures to the Arctic to foster the development of northern mining projects and to promote the integration of their northern regions into large logistical schemes that could diversify their economies.

Similar views expressed the idea that river transport along the Ob, Yenisei, and Lena rivers could be used to connect Russian Arctic ports to inland communities, Pevek with the Kolyma River, Tiksi with the Lena, Dudinka, Igarka and Dickson with the Yenisei, and Yamburg and Novi Port with the Ob (Lasserre and Têtu, 2020b), but also to further develop business opportunities through the

Figure 11.6 Railways in Scandinavia and Russia, 2019 (adapted by the author from Lasserre and Têtu, 2020b).

connection of these rivers to railway corridors further south and the silk road projects under development (Kenderdine et al., 2021). The feasibility of such schemes remains debatable but underlines that synergies are sought between sea shipping and inland transportation, whether river, rail or road.

Conclusions, Limitations, and Future Research

This study largely rested on interviews conducted with shipping companies, on data and reports they publish and on raw traffic statistics provided by the NSRA and NordREG and then processed by XST and CHNL. Some companies agree to answer and some do not. Besides, the outbreak of the conflict in Ukraine dried up the production of traffic figures by CHNL – attesting to the dependence of research on political events.

The shipping market in the Arctic has long been dominated by community resupply and modest fishing activity. With increasing impacts from climate change and renewed interest in natural resources extraction, actively supported by the federal state in Russia or pulled by market forces in Norway, Greenland, and the North American Arctic, the picture of shipping is transforming in the Arctic. Similarities, but also major differences, have emerged between the Canadian and the Russian situations.

In Canada, pleasure craft and cruise ships dominated the gradually expanding transit traffic before being halted by public health measures put in place due to the COVID-19 pandemic. Increased commercial transit traffic could be in the making with the initiatives of the Dutch shipping company

Wagenborg. In Russia, transit voyages, pushed by the Russian government, represent a modest but expanding commercial activity where foreign shipping companies are active until 2022, contrary to past transit traffic that was largely composed of Russian vessels to or from Murmansk.

Traffic is expanding in both the Canadian and the Russian Arctic, albeit more so in the Russian Arctic. Both regions are witnessing the expansion of a largely destinational traffic generated by natural resources extraction and the increased participation of foreign shipping companies, attesting to the accelerating globalization of economic activity in the Arctic. Russia is displaying significant efforts to promote and advertise shipping along the NSR, notably through the development of an alternate business model of transshipment hubs. This model is also discussed in Canada, but it remains at very preliminary stages when compared to Russia, Iceland, or Norway. Other options include the development of synergies between land and sea logistics with the development of railway or road infrastructures, but these remain costly in remote areas affected by the melting of permafrost. Arctic logistics thus remain reined by natural conditions, remoteness, high costs, and structural constraints, forcing transport companies to adapt to these specific business conditions. In this context, addressing social needs – supporting the availability of more affordable consumer goods and construction material to address the housing crisis; the development of a reliable two-way service that could support small-scale burgeoning manufacturing in Nunavut with shipping to southern markets, in the frame of low-impact corridors to protect the environment – remains a dire challenge for shipping companies.

Traffic expansion in the Arctic largely rests on natural resources extraction largely fueled by markets from outside the region. From that perspective, it would be interesting to observe to what extent the conflict in Ukraine could impact the pace of resources development in Russia and NSR shipping.

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12 Adaptive Governance in Integrating Sustainability and Resilience into the Arctic Shipping Routes

The Kara Sea Case

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Introduction

Previous research on the interrelation between supply chain resilience and sustainability is relatively nascent and generally based on their mutual influences. Since there is still confusion about the terms and concepts, implementation methods, and measurements of resilient and sustainable supply chains, a recent study (Negri et al., 2021) critically examines major directions in the literature. Allegedly, supply chain resilience literature remains less mature, while there is general agreement on the theoretical foundation of sustainability. Besides, the nexus between two topics is highlighted as generally incoherent, and there is a major conflict, since resilience focuses on effectiveness, while sustainability often seeks efficiency (Negri et al., 2021).

As supply chain strategies are generally evaluated in terms of efficiency, profitability, and/or customer responsiveness, the sustainability of supply chains has also been attracting growing attention, due to globalization, increased competition, challenging markets, tighter regulations, customer pressures, and uncertainty in demands (Meixell and Luoma, 2015; Ansari and Kant, 2017). In addition to shortened product life cycles, greater demand volatility, and growing innovation rates, these recent trends have negatively affected supply chain vulnerability (Negri et al., 2021; Christopher, 2011; Christopher and Peck, 2004a). Therefore, there is a need to examine supply chain resilience in terms of preparing for, resisting, and recovering from disruptions; accordingly, the growing Arctic economic activities and their associated risks to its

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unique environment have necessitated a different point of view (Nakano and Akikawa, 2014; Tsvetkova and Gammelgaard, 2018).

Enhancing the resilience in the Arctic has become essential, as the Arctic Region has increasingly been experiencing the detrimental impacts of human-induced climate change. During the Swedish Chairmanship of the Arctic Council (2011–2013), in line with the necessity of establishing a common ground for the unification of resilience efforts, the resilience concept was emphasized as a priority, and the Arctic Resilience Action Framework (ARAF) was developed in May 2017. However, it has also been pointed out that this is a tough process, since there are "many Arctics". The sparse population and remoteness of the Canadian Arctic, the interconnected regions and relatively high population of the Nordic Arctic, as well as the combination of densely and sparsely populated regions of the Russian Arctic, indicate a multilateral Arctic setting (Josephson, 2014; Sergunin and Konyshev, 2015).

Accordingly, in recent years, amid the sustainability and resilience concerns, growing numbers of commercial maritime activities on the high seas are currently threatening both the resilience and sustainability of the region. On the one hand, the rapid melting and receding of the sea ice stimulates exploration and the exploitation of natural resources, as well as an accelerated expansion within maritime activities. On the other hand, environmental concerns related to oil pollution, marine mammal displacement, the "Atlantification" process and carbon emissions have sparked a global interest in the fundamental changes shaping and compelling legal, regulatory, and capacity-building of shipping and supply chain operations in the region (Gross, 2018; Pedro and Fraser, 2018; Downing, 2019).

Moreover, responding to a situation in a safe and timely manner within a spatially extensive region entails a comprehensive governance framework due to the considerable uncertainty and constraints. Therefore, building resilience in the Arctic shipping routes can be achieved by implementing an adaptive governance model in which sufficient national and international input can be provided by means of key actors. As a relatively new form of environmental governance, adaptive governance can be explained as a model developed to coordinate resource management while addressing the uncertainty and the complexity of environmental change (Folke et al., 2005). Further, how legal and institutional barriers would be overcome while bridges are being built from current governance structures represents a significant challenge. Therefore, focusing on the institutionalization process of adaptive governance in relation to legal and institutional barriers within the Arctic would contribute to the knowledge gap.

This study aims to investigate how supply chain resilience is built within the temporal and spatial variations in shipping in the Russian Arctic. Based on the knowledge gap, the importance of integrating resilience and sustainability into the Arctic shipping routes is also emphasized. It is constructed as a single case study based on the Kara Sea, and the data are taken from the NSR Administration and the Centre for High North Logistics (CHNL). The case is analyzed by adopting exploratory narrative processing, and the data for the case description are extracted from a range of different documents including the NSR Administration and CHNL websites (between the years of 2012 and 2019)[1], government statements, related legal documents, and press releases. Our case study analysis is based on the temporal and spatial variations and how melting and retreating variations in sea ice affect shipping activities (Duan et al., 2019). The names of shipping companies are mentioned since the main data of our case study are based on the variations in shipping activities, and internet sources are investigated to outline the nature of these activities.

After a brief introduction of the term "supply chain resilience", the theoretical framework of adaptive governance is discussed. An overview of shipping activities in the Russian Arctic is given to illustrate the background of supply chains within the region. Since the Kara Sea is selected as the case, temporal and spatial variations in shipping in the Kara Sea are examined in detail. Following the discussion of governance challenges regarding the Russian Arctic, we present the way in which supply chain resilience, in terms of sustainability, is built within the temporal and spatial variations in shipping. Consequently, our chapter concludes with significant insights from our case study about the potential for integrating resilience and sustainability into the Arctic shipping routes.

Resilience within Sustainable Supply Chains: Literature Review

A supply chain can be defined as

> *the network of companies involved in the upstream and downstream flows of products, services, finances, and information from the initial supplier to the ultimate customer.*
>
> *(Mentzer et al., 2001; Lambert et al., 2005)*

In supply chain operations, the quality and reliability of the transport bring interdependent organizations together through binding instruments transcending national borders, as well as extending the coordination capability of a single organization. Since both resilience and sustainability are critical terms for supply chains, Ahi and Searcy (2013) suggest improving sustainability performance along the triple bottom line, while it is also necessary to address increasing uncertainty and vulnerability in supply chains (Ali et al., 2017). There are studies that investigate the impact of sustainability and resilience on organizational performance and supply chains, which claim that integrating sustainability into business operations can improve performance, and resilience can be perceived as a source of competitive advantage (Pinto, 2020; Klibi et al., 2010). Besides, there is also empirical evidence stating that resilience and sustainability influence each other (Fahimnia et al., 2019). Resilience can be defined as

> *the capacity of communities and systems to recover and restore themselves from various kinds of crises and disturbances.*
>
> *(The Arctic Council Secretariat, 2021)*

On the other hand, supply chains are complex networks of organizations experiencing continual turbulence, which may lead to unpredictable disruptions. Factors that contribute to disruptions in supply chains are listed as: "global supply chains", "increased volatility of demand", "specialized factories", "technological innovations", "centralized distribution", "reduced supplier base", and "increased outsourcing" (Pettit et al., 2010, p. 2). The integration of resilience and sustainability within a supply chain context remains an underexplored field since the research streams of both terms have been investigated separately in the literature. In order to facilitate the implementation of resilient and sustainable supply chains, at the nexus of resiliency and sustainability, a sustainable supply chain is defined as

> *the creation of coordinated supply chains through the voluntary integration of economic, environmental, and social considerations with key inter-organizational business systems designed to efficiently and effectively manage the material, information, and capital flows associated with the procurement, production, and distribution of products or services in order to meet stakeholder requirements and improve the profitability, competitiveness, and resilience of the organization over the short- and long-term.*
>
> *(Ahi and Searcy, 2013)*

Moreover, traditional methods for risk management tend to lack the competence to assess the complexities of supply chains and comprehend the intricate types of threats (Starr et al., 2003). Based on empirical research, an initial framework for a resilient supply chain has been developed. According to that research, resilience can be achieved through four key principles:

1. Rebuilding through recovering from disruptions within the chain
2. Identifying and managing risks through a high level of collaboration
3. Agility to respond to unpredicted events on time
4. Implementing a risk management culture (Christopher and Peck, 2004b).

The extant literature provides 16 definitions for the term "sustainable supply chain management", most of which focus on the economic and environmental dimensions, but the identification and testing of the impacts related to culture, geography, and company size are missing. In order to bridge the gap, a new term for supply chain management was introduced, titled "World Class Sustainable Supply Chain Management". The new term underlines the development of a suitable organizational culture, increasing awareness, the use of new and innovative technologies, the involvement of top managers and employees, as well as society, while considering the adverse effects of the aforementioned practices on the environment, social equity, welfare, and ethical values (Dubey et al., 2017).

In recent years, exploration and exploitation of natural resources have renewed the interest in the reliability of supply chains within the Arctic. Increasing commercial maritime activities have spurred a number of concerns that are grouped under three headlines. The first headline consists of climatological changes, including the social and environmental consequences of enlarging supply chains (Meschtyb et al., 2005; Fan et al., 2018). The second headline deals with the economic dimension of the shipping routes, including the commercial potential of containers, liquid and bulk cargo, as well as fishery routes (Verny and Grigentin, 2009; Gudmestad and Bai, 2020). The last headline focuses on the scientific data, including satellite coverage, sea ice prediction, and navigation, in order to enhance ship construction, navigational aids, and ice classification (Stephenson et al., 2013; Pelaudeix and Basse, 2018). Concordantly, environmental changes closely embody the general framework in which supply chains have become more complex and vulnerable. Therefore, applying a network perspective is suggested, in order to address the complexities while ensuring a safe environment (Taarup-Esbensen and Gudmestad, 2022).

However, supply chain operations are highly complicated endeavors founded on command, coordination, and control structures between the Arctic states, as well as internal applications (Andreassen et al., 2019). In addition to remoteness and lack of sufficient infrastructure, frequent harsh weather and limited navigational information generate challenges during supply chain operations. While supply chain management traditionally concentrates on creating systems in which implementing suitable technology ensures the reliable and timely transfer of goods, the effects of climate change, especially on sea ice, have transformed the Arctic into a more accessible region. On the other hand, in addition to similar risks in other areas, the Arctic context presents unique hazards, grouped under four themes: safety, environmental, technical, and reputational (Afenyo et al., 2020; Smits et al., 2017). In order to develop safe, resilient, and sustainable maritime transport in the Arctic, a number of recommendations are presented in the previous body of literature (Brigham, 2011; PEW Charitable Trusts, 2016; Carter et al., 2017). Accordingly, managing supply chain hazards in the region concentrates on two essential parameters which will improve reliability and ensure greater integrity. The first parameter focuses on establishing the right balance between effective management and implementing new technology. In this case, if one connection fails, alternative ways safeguard its integrity, thereby ensuring the resilience of the overall system. The second parameter includes protective barriers that initiate improvements in emergency response coordination, enhancing business recovery, and icebreaker assistance (Taarup-Esbensen and Gudmestad, 2022).

Adaptive Governance: Theoretical Framework

Governance and its implications have different meanings in scientific and political contexts (Kooiman, 2003). In this chapter, these two contexts are combined, and the term can be defined as

> *the structures and processes by which people in societies make decisions and share power, creating the conditions for ordered rule and collective action, or institutions of social coordination.*
>
> *(Schultz et al., 2015, p. 7369)*

Since the traditional top-down and centralized governance systems fail to address ecological complexity, which is further complicated by rapid environmental change, a growing number of bottom-up governance systems have emerged, including social networks, local actors, and community leaders (Brosius et al., 2005). However, despite their effectiveness at a local scale, these types of governance systems also suffer from various problems, particularly based on coordination across complex geographies (Cosens et al., 2014). Besides, there have been serious discussions regarding their inclusiveness, especially in terms of indigenous communities (Bark et al., 2012). Hence, there is an urgent need for a new approach to confronting landscape-scale problems that is flexible enough to deal with highly contextualized socio-ecological systems, while being responsive and dynamic enough to adjust to unpredictable and complex feedback between the components of the related system.

Adaptive governance is a relatively new form of environmental governance, developed to coordinate resource management while addressing the uncertainty and the complexity of environmental change (Folke et al., 2005). There is a growing number of studies suggesting that better resilience can be achieved through implementing adequate adaptive governance (Huitema et al., 2009; Mathijs and Wauters, 2020; Feindt et al., 2019). Environmental governance systems are forced to be adaptive due to the uncertainties caused by global environmental change and the risks associated with climate change. Different points of view regarding the implementation of mandatory targets and timetables to deal with greenhouse gas emissions have also highlighted the significance of adaptive systems (Brunner and Lynch, 2010; Chaffin et al., 2014). Accordingly, adaptive governance literature mainly focuses on resilience, environmental governance, and socio-ecological systems (Cumming et al., 2006). Therefore, adaptive governance offers a flexible framework to address environment-associated risks, develop policies to deal with the unavoidable effects of climate change, and assist mitigation processes (Brunner et al., 2005).

In terms of the Arctic case, climate change is highlighted as the most significant stressor due to its detrimental effects on sea ice, which in turn have essential implications for both wildlife and human populations in the region (Arctic Council Secretariat, 2021; CAFF, 2013). Aside from climate change, other key stressors are presented as pollution and the growing number of economic activities, such as oil and gas development, shipping, tourism, and commercial fishing (Stepien et al., 2016). Since adaptive governance connects institutions and actors (individuals, agencies, and organizations) at multiple organizational levels, it may provide a common ground for unifying the concerns about resilience in relation to sustainability within the Arctic supply chains, in particular shipping and safety. Key actors assume leadership, elicit a vision, and build trust in this governance model. Then, a transformation toward a learning environment can be initiated, by drawing on experiences related to a common understanding and development of policies and various knowledge systems. Therefore, the adaptive governance model frequently self-organizes social networks with the actors in an inclusive manner (Folke et al., 2005). Besides, key actors operate through established norms, and institutional theory deals with the construction of the aforementioned norms. Institutional theory is based on the more resilient aspects of social structure, including rules, norms, and routines as authoritative guidelines (DiMaggio and Powell, 2000). Accordingly, the institutional perspective would enable a unique approach to understanding the economic, social, and political dynamics within the Arctic. As a dynamic region threatened by the associated risks of climate change, the Arctic setting has necessitated an effective adaptive governance framework in which resilient arrangements are ensured, to be able to adapt to the evolving demands for governance through time, without compromising the ability to address both existing and emerging problems (Young, 2015).

An Overview of Shipping in the Russian Arctic

In the Arctic Region, consistent and accurate data on maritime activities are essential to foresee safety conditions, develop infrastructure, plan safe shipping routes, monitor environmental and cultural impacts, as well as manage protected areas, taking sovereignty rights into consideration. However, the limited availability of longitudinal and consistent data sources, including temporally and spatially accurate maritime activities, has presented significant challenges for policymakers, planners, and researchers. Accordingly, geospatial databases of ship traffic have recently been developed to address the aforementioned challenges (Dawson et al., 2017).

Although there are three major maritime connections within the Arctic waters – the Northwest Passage (NWP), the Northeast Passage (NEP), and the Trans-Polar Passage (TPP) – there has been a significant difference in terms of commercial usage due to the harsh conditions and low level of accessibility of the NWP and TPP. Accordingly, the NEP is considered the most accessible Arctic shipping route in terms of navigational conditions (Stephenson et al., 2013). The NEP also includes the Northern Sea Route (NSR), a term which is sometimes used interchangeably with the NEP, due to its frequent commercial shipping traffic.

The NSR extends all the way to the Bering Strait, passing through the Kara Sea, the Laptev Sea, the East Siberian Sea, and the Chucki Sea (Peresypkin and Yakovlev, 2008). The route was envisioned to be 25–45% shorter in the case of regular shipping becoming possible between Eastern Asia and Western Europe. Concordantly, the NSR consists of different variants of shipping routes, ranging from shallow coastal routes to routes with a deeper draught, which also affect its length, from 2,200 to 3,000 nautical miles. Russia (formerly the USSR) has used the NSR as a shipping route for the regular delivery of fuel, goods, supplies, as well as raw materials such as timber and coal to remote settlements since the early 1930s (Østreng, 1999). Known as "northern deliveries", this type of transport occurred during the late summer depending on the sea ice conditions and involved Russian inland waterways. The official opening of the NSR to international shipping dates back to January 1991. The International Northern Sea Route Programme (INSROP), comprising more than 450 researchers from 14 states, was developed between 1993 and 1996 by Russia, in order to explore the availability of the extended use of the NSR (Ragner, 2010). In connection with INSROP, the first commercial international transit of modern times was conducted from Yokohama to Kirkenes in 1995. International transit voyages were hindered due to unprecedented changes in sea ice cover in the following years until 2007. Drastic reductions in sea ice coverage in 2007 have renewed international interest in the NSR. The Arctic Shipping Assessment by the Arctic Council in 2009 is especially significant, since it is the first official document consisting of several shipping scenarios in relation to sea ice conditions, with a specific focus on enhancing marine safety, as well as environmental protection, in the Arctic (AMSA, 2009).

In the period up to 2019, international shipping companies from several states conducted voyages via the NSR. However, as the current phase of shipping on the NSR is dominated by the transport of hydrocarbons, international transit seems to have become less central, contrary to Russia's expectations. Furthermore, the NSR was highlighted as less attractive due to the global economic turndown, reduced bunker fuel prices, declining demand for raw materials, and depressed freight rates in 2014. The Ukraine crisis and the EU and U.S. economic sanctions have further discouraged international shipping companies from involvement in long-term investments in the NSR ventures. Despite Atomflot's heavy promotion, cargo owners and shipping companies remained cautious, and, although the number of international transits increased between 2016 and 2019, this was not reflected in cargo volume (Gunnarsson and Moe, 2021).

Apart from promising future projections pertaining to the NSR, Russia cannot determine the volume of international traffic, and it is not possible to reach its aim to boost annual transit volumes to 30 million tons in 2030 (calculated as 1.3 million tons in 2020), without offering sufficient infrastructure. Accordingly, large-scale investments are planned, especially in the pipelines in which Rosatom will undertake the major role in order to ensure all-year-round navigation in the NSR. Since the international shipping industry determines the balance of factors and conditions, Russia has recently stated that new legislation, in which Russia's obligations are harmonized with international law, will be adopted (Staalesen, 2021).

Moreover, in 2017, China and Russia reached an agreement to create an "Ice Silk Road" (Xinhua, 2017). Being the only Chinese company, COSCO Shipping successfully carried out 22 Arctic voyages between 2013 and 2018. Besides, China has proceeded with major investments in the Arctic oil and gas industry of Russia, especially the megaproject of Yamal by NOVATEK (Humpert, 2019). Other states also have similar agendas concerning the NSR. It is also expected that the international shipping industry will determine whether the NSR is safe, efficient, reliable, environmentally sound, and economically viable in comparison with other routes.

Temporal and Spatial Variations in Maritime Activities in the Kara Sea

There have been several studies examining the shipping traffic along the NEP and the NWP, both comparatively and separately (Østreng, 2012; Lu et al., 2014; Lasserre and Alexeeva, 2015; Li et al., 2020, PAME, 2021). Temporal and spatial variations can be explained as how melting and retreating variations in sea ice affect shipping activities (Duan et al., 2019). While the most severe ice conditions were encountered between the Laptev Sea and the Kara Sea 30 years ago, the ice-free season increased by 82 days in the eastern part of the Kara Sea and by 65 days in Kara Gates in 2012 (Rodrigues, 2009). Besides, it is expected that old ice cover reduction will be the most rapid in the same region (Pastusiak, 2016).

In a recent study, in which spatial and temporal shipping variations in 10 ship types (tanker, general cargo, icebreaker, bulk carrier, fishing vessel, heavy lift, research and survey vessel, tug, and dredger) are separately investigated, Li and Otsuka (2019) found that shipping activity related to all ship types presents a clear spatial and seasonal variation in the Kara Sea (specifically in the southwestern part from July to October). In the same study, shipping activity mainly occurred in the Kara Sea, including most ship types. General cargo, bulk cargo, and tankers are found to be the dominant types, while the Chukchi Sea stands out for passenger ships, in terms of spatial variation. There has been a gradual increase in the number of sailed ships (especially large ships) from 2013 to 2017. Since supply chain development within the Kara Sea is primarily associated with maritime transportation (frequent supply chain vessels in the Arctic region are noted as transiting container ships, tankers, and bulk carriers) (Eguiluz et al., 2016), these numbers indicate a steady increase, accordingly.

As argued by Li et al. (2020), the main drivers for maritime traffic in the NSR are essential natural resource developments in the Kara Sea (crude oil, natural gas, hard minerals of copper, nickel, and palladium), particularly in the

Western Water Area. Since the NSR activities mainly take place in the Kara Sea water area to Sabetta, our study also focuses on the Kara Sea. When the statistics on shipping in the Kara Sea between 2013 and 2018 are examined from a closer perspective, it is found that voyages to Sabetta, Dudinka, and Novy Port are predominant compared to those to Dikson and other ports.

It is noteworthy that, in the warm season (from July to October), both ship numbers and mean deadweight tonnage (DWT) are relatively high, and there has been an increase in the amount of annual DWT to Sabetta (with the exception of 2017). DWT is mainly carried by dry cargo ships from Europe and the Pacific; oil tankers, mainly from European ports and Murmansk; and LNG carriers, generally from Europe, with minor amounts from the Pacific. Furthermore, most of the DWT was carried from Europe to Novy Port by oil tankers. The main reason behind the increase in tanker shipping activity was stated to be crude oil transport, and shipping activity increased mainly in the south-western region of the Kara Sea (Li and Otsuka, 2019).

In the case of Dudinka Port, which is the industrial complex located in Norilsk, the DWT is mainly carried by cargo ships from Europe and Sabetta, with some carried by oil tankers from Europe (mainly), Sabetta (partly), and less from other water areas. Taarup-Esbensen and Gudmestad (2022) assert that the tripling of ship traffic in the Arctic between 1990 and 2015 is a challenge to choose suitable preventive and protective barriers, which will ensure reliability and improve supply chain resilience. Since the resilience of supply chains depends, in the Arctic case, on investments in port facilities, ice class ship designs, and communication installations, they further investigate the effective coordination of organizational resources to properly manage protective barriers.

Furthermore, since the early 2000s, river tankers have been delivering crude oil to terminals in the Kara and Laptev Seas by the Lena and Ob Rivers. Yenisey River is another significant location due to the Dudinka Sea and River Port being used as the main transport facility by Norilsk Nickel; gas condensate is frequently exported via the NSR and the Barents Sea. In Ob Bay, Gazprom Neft managed to conduct the first winter oil-offloading operation in 2015. In the long term, it is expected that the huge Kara Sea and Yamal oil/gas resources will be transported to the Asian and European markets, since the South Kara Sea is rich in hydrocarbon resources, as well as undiscovered gas (estimated 1.64 billion tonnes of gas and oil and 26.5 trillion cubic meters of natural gas) in the Arctic (Bambulyak et al., 2015), as a driving force for prospective industrial development. Therefore, Russia's future gas production is closely linked to the Kara Sea and the Yamal Peninsula.

Accordingly, in addition to the existing Gazprom–TotalEnergies alliance, Rosneft has also started to explore the continental shelf, in alliance with ExxonMobil. Moreover, Novatek is proceeding to cooperate with TotalEnergies and China National Petroleum Corporation on the Yamal LNG Project (TotalEnergies, 2021). The construction, in 2009, of a 560-kilometer-long pipeline, connecting Vankor–Purpe with the Transneft trunkline system, as an extension of the Tagulskoye field development, has enabled the exportation of crude oil from Vankor eastward. The main objective of the project is to establish the Vankor cluster as a major hub for oil production. The Tagulskoye field development is further nourished by oil transport via the Vankor–Purpe pipeline, power supply, and gas monetization arrangements supplied via the Vankor field to Gasprom's infrastructure (Rosneft, 2017). The establishment, in 2012, of the Independent Petroleum Company (to explore and produce oil and gas) has further highlighted the significance of the Yenisey River (Bambulyak et al., 2015).

Moreover, spatial effects of the projects within the region rely on both existing and planned Arctic projects, particularly in Yamal-Nenets Autonomous Okrug. In addition to Yamal LNG and the development of the Novoportovskoye, Bovanenkovo, and Yaro-Yakhinskoye fields in Yamal-Nenets, the group of Messoyakha deposits indicates a rising trend in spatial effects. Moreover, Arctic LNG-2 and the planned development of both the Lavayozhskoe and Vaneyvisskoe would assist the rising trend (Pilyasov and Putilova, 2020).

Possessing the second longest railway network after the United States, Russia also has 933,000 kilometers of roads in total (Federal Statistics, 2010). According to Federal Statistics (2010), railways undertook 42.7% of the total freight turnover. When pipelines are excluded, the turnover increases to 85.2%. Therefore, in order to develop the hinterland, improve accessibility, and benefit from its road and railway infrastructure, the Government of Russia (2008) announced the "Strategy for the Development of Railway Transport in the Russian Federation Until 2030". In order to enhance freight transportation via railways, a number of priorities are determined: railway engineering modernization, transport infrastructure improvement, improving and ensuring the safety and quality of freight transportation, transport cost reduction, achieving mobility, and boosting the country's transit potential. Furthermore, approval of the long-term railway development program until 2025 and the renewal of the locomotive fleet, as well as increasing the volume of transportation of both the Trans-Siberian and the Baikal-Amur railways, have become concrete steps to enhance the resilience of supply chains. In addition to existing railway projects, the revival of the Northern Latitudinal Passage (NLP), including a railway connecting industrial settlements of the region to the Kara Sea, is another key development to improve the resilience of the supply chain networks.

The railways are expected to transport at least 9 million tons of goods and implement a new export route to carry natural resources from Yamal via the NSR. The NLP consists of two parts: an east–west connection extending to the Ob, which connects the line between Tyumen and Nadym, as well as the Northern Line from Arkhangelsk. The other part extends 170 kilometers through Bovanenkovo (using Gasprom's current railway) to Sabetta (Staalesen, 2021). Therefore, in addition to a railway junction, linked with the Polar Road including the Nadym–Salekhard region, the planned railway would link two essential railway lines within the Russian Arctic.

Since the existing road and railway networks have proved to be insufficient in the Russian Arctic, the development of transport infrastructure (shipping, road, and railway networks) has a high potential to maximize the NSR and its associated supply chain networks' capacities (Elyakova et al., 2019; Zamyatina and Pilyasov, 2018; Buixade et al., 2014). While the Trans-Siberian Railway remains vital, owing to its vast transit capabilities, a new large-scale project, called "Siberian Meridian", was proposed in 2019. Including the Northern Latitudinal Railway (NLR) will provide cargo railway connection between the ports of the NSR and China, covering large parts of Siberia by 2035. If the project is implemented, a ring railway, Salekhard-Nadym-Urengoy-Surgut-Tyumen-Yekaterinburg-Perm-Yaroslavl-Ob-Salekhard, will be constructed (Chirkova, 2016).

Developing infrastructure in the coastal region of the Kara Sea and building an atomic icebreaking fleet have long been among the priorities of the Russian government (Moe and Brigham, 2017). Implementation of the North–South axial Northern Corridor, which connects the Asian states (Uzbekistan, Kazakhstan, Kyrgyzstan, and Tajikistan) to the Kara Sea, will further boost the economic development within the region, as a major economic vector for Central Asian economies. Herein, Sabetta port becomes prominent as a multi-functional trade terminal, as it is the essential gateway of the NSR to Asia, America, and Europe for all Russian territories (Yvarova, 2019; Sibileva and Kontorusova, 2020). In addition, a decree was signed to construct new infrastructure, including the new Sever Port as a key logistical hub at the southwest of Dikson (Staalesen, 2020). Since the project contains a 770-kilometer oil pipeline and about 100 drilling rigs, it is envisioned that infrastructure within the Taymyr region will be improved. Besides, Rosneft initiated a major research expedition in the northern part of the Kara Sea in 2020, drilled the first geological wells in the Laptev Sea to collect core samples, and revealed its stratigraphic drill plans for 2022 in the Chukchi Sea (Rosneft, 2021). Furthermore, it is even anticipated that the Novaya Zemlya archipelago can be used as a cluster base. In this case, the whole region of the western Kara Sea and the eastern Barents would be developed, as long as a "unitization principle" is implemented to improve field development. In line with that point of view, the building of an LNG plant, a port for LNG tankers, and a pipeline system is proposed (Efimov et al., 2014).

Governance Challenges of the Arctic Shipping Routes

Emerging economic opportunities in the Arctic are expected primarily within two main domains: the opening of shipping routes and the growing access to natural resources empowered through technological advancements (Moe and Brigham, 2017). Both domains are inherently linked with the use of fossil fuels, production, and transportation. Since tanker traffic, offshore drilling, and other maritime activities tend to increase, the risk of accidents and oil pollution is also expected to threaten the sustainability of the region.

On the other hand, improvement in infrastructure facilitates connection, access, productivity, and inhabitation, therefore enabling human engagement. Since infrastructure is the key to the facilitation of supply chain operations in the Arctic, how sustainable infrastructural development will be ensured and the integration of resilience, accordingly, will become significant discussion matters (Malindretos and Binioris, 2014).

The exceptionally low extent of the sea ice in the Arctic Ocean, firstly in September 2007 and subsequently in 2012, have stimulated major discussions, ranging from environmental protection to emerging economic opportunities based on navigation. The reduction in the thickness and extent of ice cover has shown a tendency to accelerate, and even vessels without ice strengthening are able to navigate during the summer season. In a recent study, the available knowledge and predictions related to the NSR are systematized from a scientific point of view, including environmental and technical conditions, as well as hydrological and climatic conditions (based on IPCC models) (Pastusiak, 2016). It is found that an increasing amount of shipping has accompanied the development of fossil fuel extraction in the Kara Sea and the Yamal Peninsula, which overlaps with the findings of another study by Peresypkin and Yakovlev (2008).

Above all, there have been more than 500 maritime accidents reported in the Arctic over the last decade. In order to enhance navigation safety "for ships operating in polar waters" and mitigate the associated risks of Arctic shipping, the Polar Code was put into effect in January 2017 by the International Maritime Organization (IMO). A decision tool, titled the Polar Operational Limit Assessment Risk Indexing System (POLARIS) was developed through risk classification and proceduralization by the IMO (Fedi et al., 2018).

However, a recent study has highlighted the reasons why both the Polar Code and POLARIS are currently insufficient to govern the risks associated with Arctic shipping as a holistic framework. Although both the Polar Code and POLARIS constitute a significant decision support tool, as well as a suitable mitigation response related to ice risk, the officers' skills and experience and the capacity of the vessels are also underlined as vital, since there have also been accidents while sailing in safe areas, as in the cases of the *Inger* (general cargo ship) accident in 2006 and the *Chukotka* + (tanker) delay in 2017 (Fedi et al., 2020).

Supply Chain Resilience in Terms of Sustainability in the Kara Sea Region

In recent years, Arctic shipping has been evolving at a rapid pace, owing to the emerging opportunities for resource extraction, fishing, and tourism, as well as the needs of government agencies and communities, reflected in shipping patterns. The regulatory mechanisms have been updating provisions in line with the changing environmental conditions (Dawson et al., 2014, 2016; Porta et al., 2017). In terms of supply chain, although cooperation with the Russian Railways was generally pointed to as positive, a number of problems were also indicated. Herein, the lack of cooperation among supply chain partners was particularly highlighted, and intermodality was found to be troublesome (Laisi, 2010).

Firstly, the evolution of the traffic patterns in the Arctic and the long-term trends are highlighted as vital to define the needs for oil spill response, identify places of refuge, and plan for protected areas. Furthermore, the related data can be useful for researchers studying marine mammals (and the relationship between environmental and human impacts), significant cultural and ecological sites, and Arctic bird species. Therefore, establishing a comprehensive and longitudinal framework of each route's maritime traffic and its variability, based on overall activity, temporal and spatial distribution, vessel type, and proximity to communities, is essential in terms of addressing the challenges and ensuring good governance (Dawson et al., 2017; Pizzolato et al., 2016; Eguiluz et al., 2016).

Since the Arctic regions are diverse, a more comprehensive governance framework is needed to simultaneously enable strategic infrastructure development, ensure a solid foundation for policy decisions, and protect the environment. When the case of the Kara Sea is examined from an institutional perspective, in addition to public organizations Rosatom and Novatek, major investors, such as Northern Shipping Company and Sakhalin Shipping Company, alongside Chinese COSCO, stand as key actors, while the Polar Code and POLARIS are the prominent institutions regulating the shipping activities in the territory. In order to conduct shipping activities in polar waters, vessels are required to hold the Polar Water Operational Manual (PWOM) and the Polar Ship Certificate (PSC). Moreover, the Russian government is particularly strict with its regulation (Tsvetkova, 2020).

Although the development of Arctic maritime supply chains necessitates a crucial balance between environmental protection, economic growth, and social relations, the existing projects are often recognized by single-criterion decision-making to the detriment of other components. Therefore, the existing institutions are criticized due to the neglect of certain factors such as the issue of the non-compliance or crew experience of international vessels (Fedi et al., 2020). Besides, the residents of the Arctic have also become key actors since they are directly affected by the supply chain activities within the region. That is why international investors and financial institutions have developed guidelines and standards to protect Indigenous People's rights, in terms of traditional natural resource use, development plans for these communities, and sharing benefits in the form of social investment. However, Russian companies remain less sensitive to the transnational stakeholders' opinions, since the level of state ownership is relatively high, and many countries are dependent on Russian oil exports (Rodgers, 2015; Wilson, 2012).

Conclusion

The limited availability of longitudinal and consistent data sources, including temporally and spatially accurate maritime activities, presents significant challenges for policymakers, key stakeholders, and researchers. Based on our case analysis, we found that there has been a significant increase in shipping traffic in the NSR, and the voyages have been mainly conducted in the Kara Sea by LNG carriers, oil tankers, and dry cargo ships, which account for 82.55% of total DWT along the NSR between 2013 and 2018.

When our findings are examined from an institutional perspective, in addition to public organizations, Rosatom and Novatek, major investors, such as Northern Shipping Company and Sakhalin Shipping Company, alongside Chinese COSCO, stand as key actors. The Polar Code and POLARIS are the prominent institutions regulating the shipping activities in the territory, while the Russian government is particularly strict with its regulation. Since the resilience of supply chains depends, in the Arctic case, on investments in port facilities, ice-class ship designs, and communication installations, the effective coordination of organizational resources to properly manage protective barriers is essential. Accordingly, a more comprehensive governance framework is needed, in which infrastructure investment, including ports, navigational aids, icebreakers, environmental response, and enhanced search and rescue activities, as well as research into ice conditions (ice thickness and ice ridging), are managed in an effective manner. Considering the diversity of the actors, developing an adaptive and inclusive governance model, in which sufficient national and international input can be provided by means of key actors, holds the potential for the unification of resilience efforts. Furthermore, developing an adaptive governance model is also important for ensuring the sustainability of supply chains, since managing supply chain challenges in the region concentrates on two essential parameters. While the first parameter focuses on establishing the right balance between effective management and implementing new technology, the second parameter highlights protective barriers that initiate improvements in emergency response coordination, enhancing business recovery, and icebreaker assistance.

To conclude, by eliminating the gaps within the human factors (such as the lack of international crew experience), strengthening the Polar Code and its applications, not only in the Kara Sea but also throughout the entire Arctic Ocean, is highly significant. Moreover, it is also necessary to go beyond single-criterion decision-making in major projects. The potential decline of cargoes along the NSR due to sanctions would cost up to $1.7 million, which would directly affect supply chain operations negatively within the Kara Sea region. Besides, recent sanctions have hindered supply chain resilience and sustainability. Given the complexity of the interrelation between sustainability and resilience, developing analytical decision-support tools is recommended for decision-makers to evaluate resilient and sustainable supply chain solutions

(Fiksel, 2006). Therefore, in addition to ensuring technological integration, by taking the Polar Index into consideration (including all the types of impact factors of an efficient sustainable development process), developing a new and adaptive governance framework is recommended, to enhance resilience in the Kara Sea.

Note

1 2020 and 2021 are excluded, due to the COVID-19 pandemic.

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13 Reflections on Lessons Learned and Future Directions

A Succinct Epilogue

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Upon completing this exploration journey through the pages of this book, we are left with a profound realization of the immense work that still needs to be undertaken to address the critical role of supply chain management (SCM) in nurturing a socially sustainable Arctic. The diverse studies collected in this anthology provide a rich tapestry of insights into the various manifestations of supply chain practices and their social impacts across different Arctic regions. However, despite their varying geographic coverage, all of these works acknowledge that developing and maintaining supply chains in the Arctic's extreme environments is a formidable challenge, not only in terms of cost-effectiveness for businesses but even more so in fulfilling commitments to local communities and Indigenous Peoples. As we draw closer to the end of this anthology, it is time to reflect on the valuable lessons we have learned. While by no means exhaustive, three lessons are particularly salient.

Firstly, we are struck by a plethora of far-reaching and multifaceted challenges that Arctic supply chain practices and operations encounter. These challenges range from the intricacies of logistics in Arctic shipping to the unique geographical features of the region, from the limited and decrepit infrastructure to the cultural diversity and social dimensions that shape healthcare delivery and re-supply procurement. With this in mind, the works in this volume bear witness to the complexity of SCM in the Arctic, necessitating a nuanced and context-specific approach to it in the region. This renders a one-size-fits-all framework inadequate for addressing the complex social issues elicited by Arctic-based supply chain operations. Not only does this anthology reveal challenges, it also shines a light on unique opportunities for the development of supply chains in the Arctic. However, the intricate interplay between these challenges and the opportunities arising further amplifies the inherent complexity of various SCM practices in the region. This growing complexity is clearly exemplified in the findings of Tsvetkova et al. (Chapter 3), Saunavaara

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et al. (Chapter 4), and Helgadóttir et al. (Chapter 5). While the paucity of infrastructure is conceived of as an urgent issue that hinders supply chain development, the (re)construction of new infrastructure facilities can also have debilitating impacts. To illustrate this, the aforementioned three chapters unveil how the development of novel transportation routes and SCM practices can trigger social contradictions and unforeseen social repercussions due to the complex interactions between business interests, local residents, and the traditional ways of Indigenous reindeer herders.

Another pivotal lesson we have gleaned is the importance of embracing the demands and perceptions of local residents and Indigenous Peoples in developing socially sustainable practices within the SCM domain. This features prominently in the contributions of Tsvetkova et al. (Chapter 3), Helgadóttir et al. (Chapter 5), Tsvetkova and Nenasheva (Chapter 6), and Schwarzburg (Chapter 9). Drawing from their extensive experience across various regions in the Arctic, these authors all share a common belief: that local residents and Indigenous Peoples possess a profound understanding of the unique context and community needs, which can differ drastically from those of other stakeholders such as businesses and politicians. Moreover, their actions, non-indifference, and capacity for reflexivity have a tangible impact on the development of supply chain practices that help them survive. The aforementioned studies provide compelling evidence of how socially responsible SCM practices carry far-reaching implications for all enmeshed stakeholders. Furthermore, they eloquently demonstrate that social issues and cultural attributes can pose a challenge while also acting as a catalyst for innovation and inspiration within existing SCM practices. Tsvetkova and Nenasheva's (Chapter 6) study of socially responsible food supply chains in most coastal communities in the Russian Arctic is strongly supportive of this observation. This chapter dissects how economic concerns and the need to adapt and maintain mobility have resulted in evolving social responsiveness. Despite the lack of support from local authorities, the explicit and proactive actions of residents underscore the importance of local involvement in SCM practices to ensure survival.

Logically derived from the second, the third lesson advocates for more active engagement from governmental and local authorities to fine-tune northern supply chains and better meet the demands of remote settlements. As vividly demonstrated by the studies presented in Chapters 3–7, 9, and 12, the current level of endorsement and involvement from the government is woefully inadequate. Against this backdrop, the contributions by Gurtu et al. (Chapter 2) and Saunavaara et al. (Chapter 4) deserve particular attention, as they emphasize the critical need for regulatory frameworks that strike a balance between economic benefits, environmental protection, and social responsibility. Despite endeavors to implement market mechanisms to curtail supply chain inefficiencies, they have largely failed to come to fruition and/or have undergone noteworthy revisions over time, as illustrated by Tsvetkova et al. in Chapter 8. For instance, Chapter 11 by Lasserre presents evidence that transport companies and shipping operators have displayed little interest in establishing supply chains and providing re-supply freight to far-flung communities. Moreover, the financial burden of holding supply chains on subsidies, where available, coupled with the fiscal constraints faced by governing bodies, has further exacerbated the situation. Consequently, the question of whether re-supply of freight to northern communities can be cost-effective and translate into more affordable prices for local consumers remains unresolved. With this in mind, a handful of contributions to this anthology highlight the paramount importance of appropriate procurement and re-supply processes. It is crucial that politicians act as intermediaries in bringing together a diverse range of stakeholders, including residents and businesses, to promote socially sustainable and responsible practices within the SCM framework.

To summarize all three lessons outlined above, social sustainability is an immensely important objective that must not be sidelined or ignored. Instead, it deserves to be given equal footing with, or even prioritized over, the other two privileged dimensions of sustainability. However, achieving it in the Arctic is widely considered a daunting task, as evidenced by the abundance of data compiled in this anthology. This is primarily due to the competing and often conflicting interests, ambitions, and demands of various enmeshed stakeholders. It has become evident through the exploration of real-life cases that SCM practices deployed in the region play a vital role in either hindering or promoting social sustainability. As several chapters of this book assert (see, e.g., Chapters 4, 9, and 10), SCM practices that prioritize business interests with a narrow-minded focus on cost efficiency and short-term financial gains, as well as political ambitions, can run counter to social sustainability goals, such as protecting the environment and supporting local communities. On the other hand, SCM practices that put collaboration on a pedestal and seek to align industrial and commercial development with the needs and aspirations of local communities and Indigenous Peoples are essential to reconciling competing interests and thereby fostering the attainment of social sustainability (see, e.g., Chapters 3, 5, 6, and 7).

Overall, we fervently hope that this anthology has yielded valuable insights into a diverse range of SCM aspects in the Arctic. These have included transportation and service delivery; the specifics of tourism supply chains; social responsiveness initiatives in SCM; the adaptation of fisheries to environmental and social concerns; the role of governance mechanisms, such as the Marine Stewardship Council; healthcare delivery in remote Arctic communities; the feasibility of climate-resilient carbon cycle strategies; and the challenges and opportunities of Arctic shipping. In this regard, the present book has responded to the ever-increasing call for more in-depth empirical studies within the field of SCM (Näslund, 2002; Seuring, 2005; Pagell and Wu, 2009; Stock et al., 2010; Quarshie et al., 2016; Tsvetkova, 2021). This anthology has not only empirically explored various facets of Arctic-based supply chain operations but has also drawn upon a corpus of theoretical approaches to lend academic rigor to the book. These approaches have entailed institutional logics, adaptive governance, anthropological and ecosystem frameworks, among others. However, despite the dizzying array of topics and theoretical lenses, all the works collected here share a common goal of urging for greater integration of social responsibility practices into the SCM landscape. Looking back at the pages of this book, we hope to have accentuated the multifaceted and context-specific nature of social sustainability, which necessitates a tailored approach that considers the unique social dynamics at play in each supply chain. As we bid farewell to these pages, we aim to set the stage for a promising research agenda that can guide future work and provide direction in the field.

We heartily encourage scholars and practitioners to delve deeper into the social implications of supply chain operations in the Arctic. Only by doing so can we devise enduringly sustainable solutions that prioritize the well-being of local communities and other stakeholders. Similar to the lessons outlined above, our focus is on illuminating only a couple of the most auspicious paths that naturally appeared throughout the chapters, rather than striving to encompass all. First, due to the marked contrasts between social responsibility and social responsiveness, a huge research gap exists in the SCM landscape. To bridge this gap, a comparative analysis can be conducted to reveal how both concepts contribute to truly socially sustainable practices within SCM. Such research endeavors hold promise for more comprehensively addressing the demands of local communities and improving their overall welfare. Second, exploring the interplay between sustainability and resilience in a supply chain context proffers another rich opportunity for future research. Investigations that uncover how these two concepts impact each other can aid in calibrating an integrated framework for the sustainability–resilience nexus. It is our unwavering belief that this integrated framework can be leveraged to nurture more effective and sustainable SCM practices, particularly in the Arctic context, where supply chain operations are extensively exposed to extreme conditions and (risks of) potential disruptions. Much like the entire book, the proposed avenues for further research reiterate the crucial importance of social responsibility and sustainability principles coalescing into SCM practices in the Arctic. The outcomes of such research efforts possess the enormous potential to augment the cohesive development of the Arctic region while harmonizing the interests of businesses and political ambitions with the needs of local communities.

In closing, we cordially invite scholars, practitioners, and policymakers to join us in our ardent efforts to advance sustainability in Arctic supply chain operations. Together, we can create a truly equitable and sustainable world for everyone! Let us embrace the unique challenges and opportunities elicited by the Arctic region, pooling our efforts to forge socially sustainable and responsible supply chain practices!

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