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Exploring land use conflicts arising from economic activities and their impacts on local communities in the European Arctic

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ABSTRACT

The European Arctic is commonly thought of as a pristine and homogeneous area. In reality, it is a diverse region experiencing growth relying on natural resource extraction. Despite local communities being primarily affected by industry activities, most socioeconomic impact assessments are conducted at the macro level. This study addresses this gap by examining the impacts of economic activities on local communities. Using secondary data and semi-structured interviews from 15 hubs in five European Arctic countries, the study draws on locally relevant insights. Findings indicate that many activities focus on economic growth, and existing strategies do not adequately address biophysical boundaries. Furthermore, alternative activities need to be developed in a more balanced manner that aligns with the needs of indigenous and local communities. Finally, participation of various actors in future developments is critical to reduce the negative impacts of industry activities.

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1. Introduction

The European Arctic, often viewed as an untouched wilderness due to its harsh weather and sparse population, has a rich history of industrial-scale economic activities like mining, forestry, and aquaculture, which rely heavily on Arctic natural resources. Recent studies (Glomsrød et al.,

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2021; Suopajärvi et al., 2022) highlight the need for sustainable resource use in these fragile ecosystems. The seemingly untouched nature has also become a basis for tourism, challenging the notion of the Arctic as merely a resource periphery and presenting it as a 'pleasure periphery' (Müller et al., 2019). The region is home to 1.6 million people, including roughly 10% indigenous populations (Arctic Council, 2023; ArcticStat, 2023). The Sámi in Sweden, Finland, Russia, Norway, and the Inuit in Greenland maintain traditional livelihoods such as hunting, fishing, and reindeer herding, with their culture deeply tied to the land. These communities face significant challenges from industrial impacts and climate change. Researchers (Ford et al., 2021; Glomsrød et al., 2021; Suopajärvi et al., 2022) have shown that indigenous people are particularly vulnerable to the cumulative pressures from various resource-intensive industries.

Existing literature (European Commission, 2021; GRI, 2022; UNEP et al., 2020) has developed guidelines for evaluating the socioeconomic context and impact of industries. Building on these, this study adapts the definition of socioeconomic impact to include 'all social and cultural consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of society. Cultural impacts involve changes to the norms, values, and beliefs of individuals that guide and rationalize their cognition of themselves and their society' (Southcott et al. 2018, p. 108; Vanclay, 2002, p. 190). The Global Reporting Initiative (GRI) is a widely used framework providing sustainability guidelines and social impact measures, focusing on performance assessment and corporate social responsibility (CSR) reporting (GRI, 2022). Additionally, the Life Cycle Assessment (LCA) and its social counterpart (SLCA) evaluate the social impacts of projects and sectors through supply chain analysis (UNEP et al., 2020). Both frameworks prescribe indicators, 'quantitative or qualitative measurements designed to measure direct or indirect impacts of resource development on human lives' (Petrov et al., p. 109), and recommend a participatory approach in conducting social impact assessments. The Arctic Social Indicators II Report (Nordic Council of Ministers, 2014) is the most comprehensive socioeconomic impact assessment in the Arctic, focusing on regional and mostly quantitative data.

While helpful in simplifying complex information, many scholars (Arce-Gomez et al., 2015; Lahiri-Dutt & Ahmad, 2011; Vanclay, 2002; Vanclay & Esteves, 2011) argue that indicators fail to capture 'softer' social issues or nuances. These include culture, community fears and aspirations, traditional knowledge, values, traditions, gender roles, equality, and vulnerability, many of which are difficult to measure and evaluate. This underscores the importance of using qualitative methods and data to understand the more holistic influences and benefits/disbenefits provided by various activities or industries (Arce-Gomez et al., 2015; Lahiri-Dutt & Ahmad, 2011; Vanclay, 2002; Vanclay & Esteves, 2011).

Local socioeconomic assessments are rare and often merged with environmental studies. Many focus only on one or two industries, such as mining (A. Frederiksen & Kadenic, 2016; Hansen 2015; Hansen & Johnstone, 2019; Hansen et al., 2016; Mancini & Sala, 2018; Viinamäki, 2016), fish farming (Bennett et al., 2021; Pollnac et al., 2019), or tourism (Wanting, 2017). However, a multisectoral approach is vital for understanding industry effects, synergies, and trade-offs. Studies advocate for an integrated social impact assessment, blending technical data from databases with community-based participatory methods to ensure the relevance of findings to local communities (Arce-Gomez et al., 2015).

Therefore, an assessment of social and cultural impacts are as important as purely environmental assessments of different land uses (Ford et al., 2021; Petrov et al., 2018). Scholarly literature suggests that human well-being aspects on the local level should be more surveyed (Stammler & Toivanen, 2021), because crucial impacts of extractive activities are mostly present at this level (A. Frederiksen & Kadenic, 2016; Mancini & Sala, 2018). Within this context, we investigate the local socio-economic impacts of economic activities in the European Arctic as part of the EU funded project.¹ We ask: what are the socio-economic impacts of economic activities on local communities across 15 different locations in the European Arctic?

This research highlights the importance of informing and involving local decision-makers and all interested parties to sustainably manage and develop the region's future. It explores potential benefits and drawbacks in specific locations, as well as synergies and trade-offs among analysed industries. The goal is to reveal local realities and explore how industry expansion, coupled with environmental conservation, could potentially offer new opportunities for all residents, fostering balanced development.

In subsequent chapters, we introduce the selected hubs for our study and our methodological approach. [Section 3](#) details the socio-economic data of each industry, cross-hub characteristics and impacts, and synergies and trade-offs between industries. We then proceed with the discussion on implications for the Arctic regions' future and conclusions of our study.

2. Research design and method

2.1. Study areas – Arctic hubs

In our study, 'hubs' refer to specific research locations ([Figure 1](#)), defined as nodes with significant economic activities or industries that embody the Arctic's challenges and impacts. These hubs were carefully selected by project partners as focal points where global and local dimensions intersect, often leading to conflicts and/or synergies (Bennett et al., [2021](#); Keskitalo & Carina, [2017](#); Similä & Jokinen, [2018](#)). These hubs are often located in historically significant and relatively populated areas and host one or more main activities: fish farming, forestry, tourism, mining, and indigenous livelihoods (e.g. reindeer herding, hunting, fishing). We subsequently analysed these activities in this paper. Hubs arise organically or through strategic planning, influenced by the movement of people, goods, capital, and power. They are situated in the following European Arctic countries that were part of the project: Finland, Sweden, Norway (including Svalbard), Iceland, Greenland, and the Faroe Islands. [Table 1](#) details their main characteristics.

2.2. Exploratory research method

In this study, we employed an exploratory and descriptive approach to assess the local socio-economic impacts of economic activities in the European Arctic. Unlike traditional assessments that rely on indicators and criteria, we sought a more holistic understanding of industry impacts. This aligns with the definition of exploratory research by Stebbins ([2001](#)) and Swedberg ([2020](#)), which focuses on gaining insights rather than testing specific hypotheses or establishing causal inferences. Exploratory studies are essential for generating new ideas or analysing new contexts, identifying potential relationships and research gaps, and laying the groundwork for future research (Given, [2008](#); Stebbins, [2001](#); Swedberg, [2020](#)). This approach also allowed us to consider various perspectives and contextual factors in our analysis, preserving the uniqueness and complexity of the hubs.

Following Stebbins ([2001](#)), the exploratory research method is flexible and aims to uncover underlying social processes, cultural artifacts, psychological aspects, structural arrangements, and belief systems. Identifying these specificities leads to a better understanding of local realities. Proponents of this method emphasize openness to diverse data sources and an open-minded research process (Given, [2008](#); Stebbins, [2001](#); Swedberg, [2020](#)). Accordingly, we used both quantitative and qualitative data collection and analysis, as detailed in the proceeding chapters.

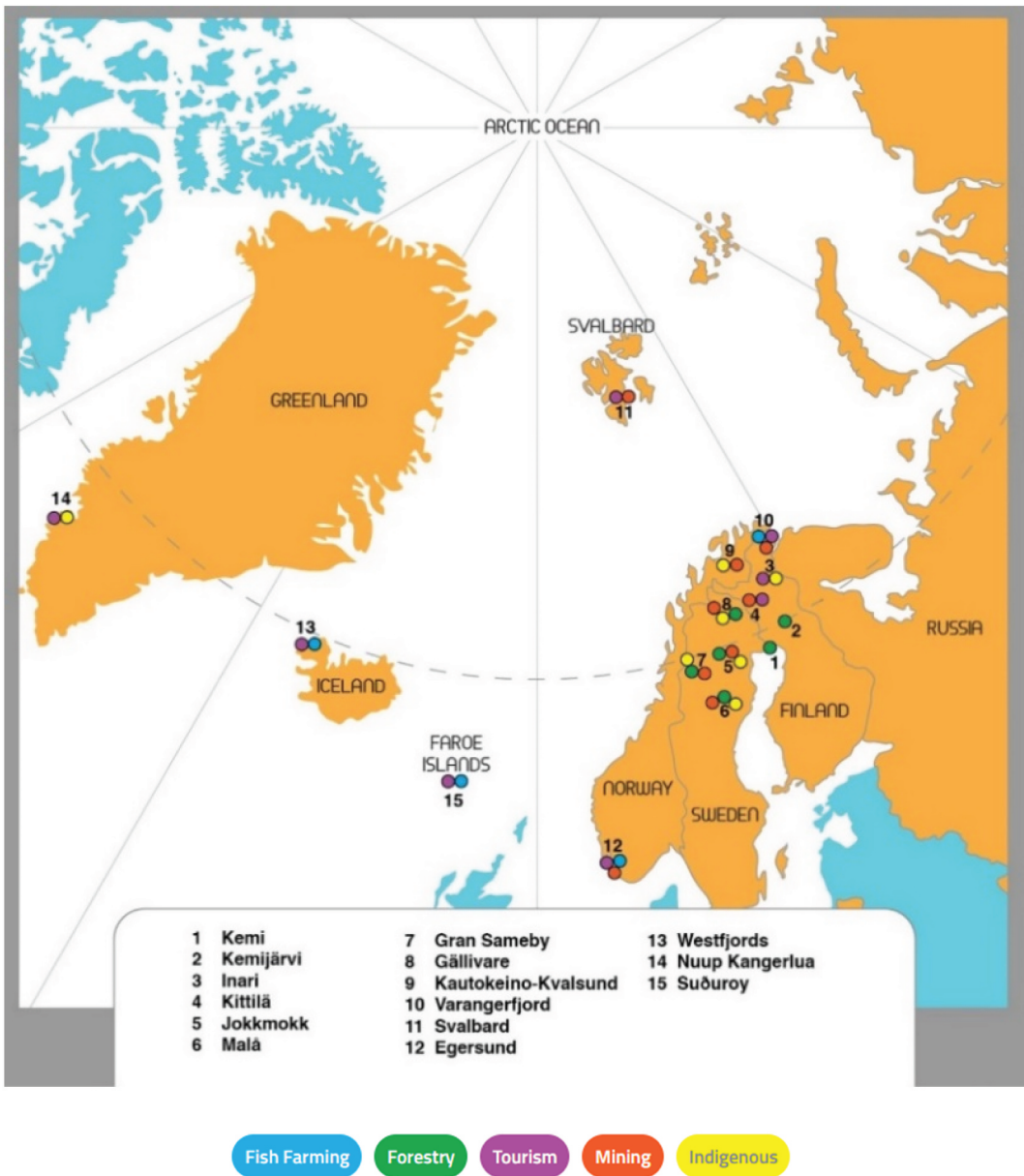


Figure 1. Overview of the location of hubs analysed in this study2.

2.3. Data collection

To address our research question, we first relied on secondary data collected from local and regional statistics, grey literature (including company and institutional reports), scientific literature, policy documents, and semi-structured interviews. This data captured both quantitative aspects (e.g. employment rates, population, forestry, and mining areas) and qualitative aspects (e.g. expert opinions and insights from indigenous communities) to detail the socio-economic and cultural dynamics. The objective was to get an in-depth understanding of local socioeconomic impacts where unified data could not be found, producing thick descriptions of the hubs that offer nuanced understanding beyond what numbers and statistics can capture. Additionally, we employed an

Table 1. Main characteristics of the analysed hubs.

Hub/Country		Industries	Population	Population change	Gender Distribution
Kemi	Finland	Forestry	1995: 24696 2023: 19371	–22% Decreasing	2023–1:1 Male: 9634 Female: 9737
Kemijärvi		Forestry	1995:11775 2023: 7030	–40% Decreasing	2023–1:1 Male: 3521 Female: 3509
Inari		Tourism, Indigenous	1995: 7851 2023: 7127	–9% Decreasing	2023–1:1 Male: 3687 Female: 3440
Kittilä		Mining, Tourism	1995: 6205 2023: 6822	10% Slightly increasing	2023–1:1 Male: 3376 Female:3446
Jokkmokk	Sweden	Forestry, Indigenous	2000: 6126 2023: 4742	–23% Decreasing	2023–1:1 Male: 2448 Female: 2294
Malå		Forestry, Indigenous, Mining	2000: 3718 2023: 3013	–19% Decreasing	2023–1:1 Male: 1550 Female: 1463
Gran sameby ³ Gällivare		Indigenous, Forestry Mining, Forestry, Indigenous	NA 2000: 20489 2023: 17371	NA –15% Decreasing	NA 2023–1:1 Male: 9033 Female: 8338
Kautokeino-Kvalsund ⁴ (Guovdageaidnu – Kautokeino)	Norway	Mining, Indigenous	1995: 3140 2023: 2847	–9% Slightly decreasing	2023–1:1 Male: 1493 Female: 1384
Varangerfjord (Vadsø, Vardø, Nesseby and Sør-Varanger (Kirkenes)		Fish Farming, Tourism, Mining	1995: 20378 2023: 18240	–10% Slightly decreasing	2023–1:1 Male: 9189 Female: 9051
Svalbard		Mining, Tourism	1995: 1218 2023: 2596	113% High increase	2023–8:9 Male: 1379 Female:1217
Egersund (Eigersund)		Fish Farming, Tourism, Mining	1995: 12798 2023: 15011	17% Increasing	2023–1:1 Male: 7549 Female: 7311
Westfjords (Vesturbyggð+ Tálknafjarðar- hreppur)	Iceland	Fish Farming, Tourism	1995: 1581 2023: 1450	–8% Slightly decreasing	2023–7:9 Male: 814 Female: 636
Nuup Kangerlua (Nuuk)	Greenland	Tourism, Indigenous	1995: 7984 2023: 8496	6% Slightly increasing	2023–1:1 Male: 4442 Female: 4054
Suðuroy	Faroe Islands	Fish farming, Tourism	1995: 5067 2023: 4617	–9% Slightly increasing	2023–1:1 Male: 2428 Female: 2194

Sources: (ArcticStat, 2023; Statistics Faroe Islands, 2023; Statistics Finland, 2023; Statistics Greenland, 2023; Statistics Iceland, 2023; Statistics Norway, 2023; Statistics Sweden, 2023) Population change and gender ratio are derived from available national statistics. Gender ratio is female:male e.g. Wetsfjords – 7 females per 9 males.

exploratory bottom-up approach, with co-authors who are field experts initially identifying relevant and available data to answer our research question. Given the data complexity, the data collection used a flexible outline adaptable to the study sites. Table 2 provides the summary of data overview, sources and documents analysed in this study.

Data collection was focused on local data, shifting to regional or national data only when local information was unavailable. Obtaining industry-specific data proved challenging, especially from small tourism operators without CSR or sustainability reports, while large companies offered global, unsegmented reports, that also challenged comparisons. For indigenous activities like reindeer husbandry, traditional fishing and hunting, we relied on qualitative data from semi-structured interviews, articles, reports, and partner/expert insights. Existing policy documents and regulations

Table 2. Data collection overview per hub and industry.

Level	Data	Sources	No of documents
Local/regional	Population structure, education, economy, society and culture Issues and conflicts	Statistics database, official reports, articles, grey literature	7 statistics databases 62 articles, reports and grey literature
Indigenous activity (reindeer husbandry, hunting)	Population, livelihood, language, traditional knowledge, culture, governance Issues and conflicts	Studies, reports and local expertise	26 reports, articles (only referring to indigenous activity – can also be part of other studies mentioned above)
Industry (firms or organization)	Production, trade, employment, revenue and other industry relevant data to determine contribution to the community, region or state Issues and conflicts	CSR reports, sustainability reports, company websites	48 reports and company websites [9 Fish farming, 4 forestry, 15 mining, 2 tourism (international companies only) + 18 company websites (tourism)]
National	Demography, economy, society and culture Policies, regulations	Official country reports, Laws and policies	6 country reports (incl Faroe Islands) 36 policies (industry specific) [12 fish farming, 4 forestry, 7 mining, 9 tourism, 4 indigenous]

impacting industries, communities, and indigenous peoples were also collected. Ten online meetings with project partners from September 2022 to January 2023, served to discuss data relevance, sources, and interpretation.

From May to December 2022, 59 semi-structured interviews with experts were conducted to explore the local impacts of economic activities in specific locations. Interviewees were purposively selected for their diverse opinions, influence on decision-making, expertise, and commitment to the issue. Representatives from groups, including indigenous peoples, affected by industry expansion were also included (Appendix A).

Since we are following exploratory research design, the questions were open to gather comprehensive data, to include topics or aspects that are rarely covered by national impact assessments, such as qualitative data on (1) economic activity importance (2) issues and conflicts (3) actors and agents (4) catalyst and barriers (5) effects on local community, cultures and histories (Appendix B).

2.4. Data analysis and interpretation

Employing an exploratory research approach, we utilized content analysis and data comparison within an inductive framework to generate hub characteristics. All secondary data were uploaded to an online database and categorized by level (local, regional, national, industry, indigenous activity). Co-authors screened data relevant to their expertise to identify key characteristics and create a coherent narrative on the socioeconomic impacts of the industry. This involved segmenting the data, producing matrices with key characteristics, and continuously refining them through comparison. Refined characteristics were then discussed with co-authors to reach a consensus on their relevance. Findings for each industry were summarized and collated into one synthesis document for further analysis (Bogadóttir et al., 2022; Edvardsdóttir et al., 2022; Lidestav et al., 2022; Myntti et al., 2022; Nygaard et al., 2022). To validate and supplement our findings, we utilized semi-structured interview data, which provided deeper insights into the specific impacts of industries and activities. Interviews were transcribed, translated into English, and analyzed using Atlas.ti 8.4.26.0 for Windows, an analysis software for qualitative data (Scientific Software Development 2017). Content analysis focused on the explicit content of the interviews, particularly concerning the economic activities corresponding to the five interview themes mentioned above. Interviews were coded inductively, and meaning units or quotations were compared to the findings from the synthesis reports to identify consistent patterns and relationships.

3. Results

This chapter focuses on the socioeconomic context and impacts of existing industries and activities on local societies and cultures per analysed activity in each hub. We present the summary of our findings per economic activities: forestry, mining, fish farming, tourism and indigenous activities and a cross-hub comparison, as detailed below.

3.1. Forestry

For understanding forestry activities, analysis was done in the six hubs. These are as follows: Jokkmokk, Gällivare, Malå and Gran Sameby in Sweden, and Kemi and Kemijärvi in Finland. Appendix B provides overview of the main characteristics of the study areas.

The forest and wood processing industries has long been vital to northern Finland and Sweden's local and national economies, processing timber for global markets. The value chain depends on continuous forestry activities like soil scarification, planting, and pre-commercial thinning, before and after final harvest. In Kemi, Kemijärvi and Malå there are wood processing industries that significantly increase the local forestry value creation both through the industrial work generated and through by-products in the form of hot water and energy for the municipal grid. Increased production increased jobs and vitality in the area (I12, I11, I14, I15, I16, I17, I20). However, in Jokkmokk and Gällivare there are no wood processing industries. Most of the harvested timber must therefore be transported out of the municipality. From the local perspective, it is the forest land and forest properties that represent the main value made up by different assessment criteria. Timber is usually the main component but also hunting rights contribute to the market value. The most current statistics on market prices assessed by the real estate agency Ludvig & Co (Lesprom Network, 2023) show that in northern Sweden, the prices per hectare is increasing more than the price per cubic meter of wood. However, research also shows that those values are only a part of the total value assessment that forest owners themselves put on their land and ownership (Lidestav & Nordfjell, 2005; Westin et al., 2017). For many Swedish forest owners, social values (like recreation and culture) outweigh economic aspects (such as timber and hunting leases), with environmental considerations (like conservation and water quality) ranking in the middle (Lidestav & Westin, 2023). In Finland, on the other hand, the share of the private forest owners emphasising multifunctionality or recreational use have decreased during the past two decades while those emphasising security and income have clearly increased (Karppinen et al., 2020). This suggests that forests and forest management is an essential part of many livelihoods in our hubs.

Additionally, based on expert interviews, Finnish and Swedish forest owners receive compensation for the loss of forestry income from the establishment of wind turbines and power lines in their forests. They also receive compensation for protecting their forests for conservation in compliance to Natura 2000. However, respondents from Sweden and Finland find the compensation to be sub-standard (I18; I52; I58).

Sustainability issues on wood use are present in northern Finland even though the operations of Stora Enso's pulp mills in Kemi and Kemijärvi have ceased. The newly inaugurated bioproduct factory of Metsä Fibre in Kemi, the largest in the northern hemisphere, will affect the whole study region as it will increase the timber use to 7.6 million m³ from the present 3.1 million m³. This will lead to demand for more wood also in neighbouring countries, especially in northern Sweden (Metsä Fibre, 2021).

Despite the positive impacts of forestry on local, regional and national economy, forestry is in conflict with other sectors such as wind energy development, mining expansion, infrastructure projects and reindeer husbandry. Forestry is by most reindeer herding communities considered as the most impending threat to reindeer husbandry due to its variety of negative effects. For more than a decade, detrimental effects on the ground lichen resource have been recorded leading to a decline of 70% of lichen-rich forests in Sweden (Sandström et al., 2016). Extensive logging, rigorous

replanting, and fire suppression have led to the decline of ancient, open pine-dominated habitats crucial for ground lichens that are replaced by dense forests favouring mosses (Kivinen et al., 2010). Ground lichens have also been negatively affected by fertilization, the introduction of lodge pole pine (Horstkotte et al., 2023) and soil scarification (Kivinen et al., 2010) that significantly reduced their cover and biomass. Furthermore, clear-cut forestry harms arboreal lichen, vital for winter reindeer nourishment (Esseen et al., 1996). However, high density of reindeer can lead to decline of lichen pastures like in the Kautokeino-Kvalsund hub-an indigenous hub (Hofgaard et al., 2010; Tømmervik, 2003). Additionally, reindeer grazing pressure have been found to dramatically decrease the ground lichen biomass in Finnish Lapland (Akujärvi et al., 2014). Furthermore, replacing clear-cuts with selection cuttings have not improved the state of the arboreal lichens, as cutting the largest trees also removes the best habitats for arboreal lichens (Rikkonen et al., 2023).

3.2. Mining

In total, seven mining hubs were analysed: Kautokeino-Kvalsund, Varangerfjord, Svalbard and Egersund (Norway), Kristineberg/Malå and Gällivare (Sweden), and Kittilä (Finland). Appendix C provides an overview of the key characteristics related to these mining hubs.

While there are no currently operating mines in Kautokeino-Kvalsund, the hub is still considered a mining hub due to the contested establishment of new mines. Nussir AS which started exploring since 2006 and received their licence in 2019 with the support of the local government. However, environmental NGOs, Sami Parliament, Reindeer herders, the Governor objected to the establishment of the mine and up to now the mine is still not built. Another company Arctic Minerals AB's is planning to reopen a different yet inactive mine – Biedjovággi since 1993, that also spur objections from the community, reindeer herders, and municipal officials. Varangerfjord is also experiencing issues in restarting a mine that has been closed and reopened multiple times affecting population dynamics. Varangerfjord experienced a sharp decline after a mine closure, while Svalbard managed to maintain stable population figures despite ceasing unsustainable mining activities. The number of employees in the mining sector strongly decreased and will decrease further, but the population stayed relatively stable, as employment possibilities in research and tourism increased. The Varangerfjord hub illustrates the mixed effects of mining on employment and demography. The 2009 mine reopening boosted jobs, but closures due to bankruptcies or unprofitable prices threatened local employment. This highlights the issue of mines rarely being locally owned which challenge the ability to reduce negative impacts on the local environment (Hofgaard et al., 2010). Interviewed experts caution against reliance on mining alone, advocating for income diversification for long-term sustainability (I39; I11; I40; I43). They note that large companies often disregard local interests, such as stable job provision (I59; I40; I38). Kautokeino-Kvalsund hub, where environmental NGOs, Sámi reindeer herding districts and the Sámi Parliament took action against the reopening of the Nussir mine in Kvalsund managed to put it on hold and caused the potential copper buyer to withdraw. Kautokeino Municipal Council stopped the planned Arctic Gold mine in Sámi homeland (Biedjovággi) due to negative impact on reindeer husbandry. Local opposition, however, is not always effective: notwithstanding negative impacts over reindeer herding, plans for further expansion of the existing extraction activities or for new plants are numerous, especially in northern Sweden. One of the possible mitigation initiatives could be the recovery of land to restore pastures but, as the cases of Näsbergfältet, Rakkejaur, Adakfältet and Biedjovággi show, it is often not implemented. The only example of restoration is the Svea mine in Svalbard, now completely removed to restore nature.

While each mining hub indicate significant local differences in the mining industry's impacts, with development patterns varying by country. Sweden and Finland are more investment-friendly and attracts mining operations. Interviewees suggest Nordic mining is 'greener' than in other countries (I43; I58). However, this does not mean that the mines have no environmental impacts, it only means

that Nordic countries have exhibited longstanding commitment and regulation on protection of environment; and they prioritize the use of renewable energy compared to other countries (Nordic Energy Research, 2016; Suopajärvi et al., 2017; Wolf et al., 2022). Production and employment in the mining industry are higher in Sweden and Finland than in Norway, with significant expansion and new plant developments planned in these hubs (Boliden, 2021; Nygaard et al., 2022).

Interviewees note that while mines impact the environment negatively, they provide crucial employment in northern communities and support Norwegian sovereignty in Svalbard (I11; I40; I41). Northern Norway hosts several operational mines (Stjernøya, Tana, Senja, Rana, and Salten), predominantly foreign-owned, offering local employment. However, reopening old mines in Kvalsund and Varangerfjord faces challenges with investors, customers, and social acceptance. A new mine (Nasafjell) is also planned in Gran sameby hub's summer pastures on the Norwegian border.

3.3. Fish farming

The analysis of four fish farming hubs (Westfjords, Suðuroy, Varangerfjord, Egersund) reveals a growing Arctic industry producing high-value exports and that boosts national GDP/GRP (Iversen, Asche, Hermansen, et al., 2020; Nyrud, Iversen, Bendiksen, et al., 2023; Nyrud, Iversen, Robertsen, et al., 2023), see appendix D for the summary.

Despite being nature-based, salmon farming is modern and research-intensive, attracting young, educated workers to remote coastal areas as illustrated in the Norwegian case (Bergesen & Tveterås, 2019; Iversen & Hydle, 2023) including returning locals and foreign settlers (I32). It offers more gender-balanced employment than traditional fisheries. The fish farming industry's male dominance may hinder family attraction, crucial for reversing rural outmigration. As women tend to move to larger cities more than men, addressing the gender imbalance in this sector could mitigate rural depopulation.

In terms fish farming companies and ownership, in Westfjords and Faroe Islands, ownership is non-local, even though the hubs started with small local ownership, but, for example, in Westfjords, Norwegian companies have bought the majority of companies' shares. That has led to a market concentration as few big parent companies, who operate globally (Živojinović et al., 2022). In Varangerfjord owners are national aquaculture companies and there are also no local actors in the businesses (Edwardsdóttir et al., 2022). Same with Egersund which has the biggest companies producing Salmon.

Varangerfjord hub features a complex sea-use conflict between aquaculture, fish tourism, and local Sámi and fishermen's traditional whitefish and red king crab fishing. Expert interviews (I31; I33; I42) highlight the unfair competition between small-scale fishermen and large aquaculture firms. Resolving this issue requires inclusive and transparent stakeholder dialogue with attention on power and inequalities, especially with a new coastal zone plan underway to address the conflict by considering all parties' interests (Flannery et al., 2017; Jones et al., 2016).

Aquaculture expanding is observed in Norway, the Faroe Islands, and Iceland, with Norway experiencing strong growth since the 70s and 80s. The Faroe Islands had a healthy growth since 2002, when the industry was almost wiped out due to disease (Iversen, Asche, Hermansen, et al., 2020). In Iceland aquaculture is rapidly growing since 2010 (Young et al., 2019), offering well-paid jobs, often for highly qualified staff, and featuring better gender balance than traditional fisheries. For Icelanders, this industry presents new growth opportunities for coastal communities facing declines in fishing and fish-processing employment.

The rapid expansion of fish farming introduces environmental and social sustainability challenges to local communities (Bogadóttir, 2020). Environmental impacts include nutrient release, escapes, sea lice, and diseases, requiring management through medical and non-medical methods, such as cleaner fish and thermal treatments, with vaccine use for disease control (Young et al., 2019). Socially, the industry's role in local and global sustainable development is crucial. However, high international

market profitability attracts foreign investment, potentially undermining local community benefits. In Iceland, the dominance of foreign companies raises concerns about employing non-local labor and the lack of profit reinvestment in local areas (Young et al., 2019). Expert interviews confirm that profits from large/international companies are often sent elsewhere, not reinvested locally, limiting community development (I42, 2021; I31, 2022; I32, 2022).

The industry struggles to attract labour, impacting settlement in peripheral areas, which fail to draw younger people, families, and women compared to larger communities. Despite available job opportunities, peripheral areas are experiencing population declines, aligning with the global trend towards urbanization and centralization (Edwardsdóttir, 2013; Grimsrud, 2019; Hayfield et al., 2021; Iversen, Asche, Buck, et al., 2020; Suopajärvi et al., 2022). In Norway, aquaculture has been important for limiting and sometimes reversing this trend. In the Suðuroy hub, aquaculture provides jobs in the private sector, but not as many as the fisheries, and largely low-skilled.

3.4. Tourism

Seven tourism hubs, in Faroe Islands, Greenland, Iceland, Norway, and Finland, were analysed, highlighting tourism's growing role in regional economies and its potential for socio-economic growth (I13, 2022; I18, 2022; I27, 2022). With the rapid expansion of Arctic tourism, income and revenue from the industry has increased, couple with improvement of infrastructure such as accommodations and transport facilities. However, Arctic tourism varies greatly by location and type (Saarinen & Varnajot, 2019), as confirmed by our analysis. Additionally, the COVID-19 pandemic led to a decrease in international tourism which may have affected the development of tourism infrastructure. Appendix E summarizes the key characteristics of tourism in these hubs.

Unlike other industries analysed, tourism mainly involves small and medium enterprises, with cruise tourism as a notable exception. Currently, the number of tourism enterprises are increasing along with the increase number of passengers, travellers and business opportunities in the hubs. Tourism growth also offers more employment to locals and part-time workers. Experts (I27; I28; I29) highlight tourism's role in preserving local culture and social ties. Besides nature-based and cultural tourism, there's potential for expanding gastro tourism, as seen in Nuuk. Winter tourism, particularly northern lights tourism, is booming in the Nordic regions and Iceland, while cruise tourism is rapidly expanding in coastal areas like Nuuk, Westfjords, and Svalbard. The trend in the increase in cruise ships traffic represents a potential source of income for local bus and boat trip providers and ports, but leads to a demand for port expansions. Tourism experts from all the hubs shared a dilemma concerning big cruise ships due to the large number of tourists that they bring in to small coastal towns that can be overwhelming not only to the local community but also to the surrounding environment. This is also followed with increased sailing trips in the small side fjords with disembarkation to areas worthy of conservation. In relation to the impact and number of tourists, cruise tourism generates little income in comparison to other types of tourism (I27; I2; I38; I39). However, there is a trend to have a more sustainable cruise tourism. This can be illustrated by the Svalbard (2022) masterplan ('Destination Svalbard Towards 2030') and Government of Greenland's owned marketing company Visit Greenland (Sustine Consult for Visit Greenland, 2023) who states that the goal is to prioritize cruise ships and passengers with the smallest footprint and highest value creation, meaning smaller ships (i.e. expedition cruise). Furthermore, 'Cruise-related activities will be subject to the same sustainability criteria and principles as land-based tourism (economic, social and environmental status), which will be measured separately for conventional cruises and expedition cruises as outlined in the ongoing development of new cruise tourism regulations in Svalbard' (Svalbard, 2022). Infrastructure investments, including road networks, hotels, restaurants, and airports, are enhancing tourism site accessibility. This is evident in the expansion of airports in Nuuk, Ilulissat and Qaqortoq in Greenland. Further, an important contributor to the increasing economic trend in

Inari is the international airport at Ivalo. Also, direct flights from Europe to Kittilä have been increasing, which is important for this sector, linking rural and Arctic Inari to the wider world.

Despite the positive impacts of the tourism industry, increasing tourism affects the way of living and the quality of life of the local communities, both positively and negatively. Positive impacts come through increase in services as identified in the survey made in Inari and Suđuroy hub (Fors et al., 2023). However, tourism can cause conflicts, particularly when it introduces new land and fjord uses that clash with traditional practices. In the Faroes, the predominantly nature-based tourism faces challenges from landowners using outfields for sheep pastures, feeling excluded from tourism development. This has led to local restrictions due to the recent surge in tourist numbers (I3).

In Svalbard, tourism contributes to housing scarcity and job instability due to seasonal employment (I39). Norway lags in tourism education, risking the use of unskilled guides. Increased tourism and cruise traffic strain infrastructure, causing emissions and noise pollution, with adverse effects on marine wildlife (G. Hovelsrud et al., 2020, 2021; G. K. Hovelsrud et al., 2023). In both Finnish hubs, conflicts arise between tourism and traditional livelihoods like reindeer herding, especially in Inari, where issues include crowding, noise, and littering, alongside tensions between husky businesses and reindeer herding, affecting local Sámi life. In Kittilä, reindeer herding competes for land used for tourism, mining, and wind power industry, though there's optimism that tourism and reindeer herding can synergize with adequate collaboration and dialogue (I8; I24).

The new international airport in Nuuk, expected by November 2024, is seen as a catalyst for tourism growth in Greenland, supported by local tourism services, Visit Greenland, and governmental and municipal backing, including hotel and tourist cabin land allocations. While this attracts external investment, particularly in Nuuk, it may prioritize international ownership and seasonal workers, challenging traditional fishing and hunting with new tourism activities. However, some interviewees who are not in favor of mass tourism and more into nature-based adventure tourism are against these developments (I10; I27). Most recently, a concession application for trophy hunting in a favorite hunting area in the bottom of the fjord Nuup Kangerlua has prompted a shift from traditional hunting and fishing to other uses. Even though legislation mandates citizen participation in resource utilization projects, yet swift development efforts often inadequately align with this requirement, sparking repeated criticism and objections to such initiatives.

3.5. Indigenous activities and cultures

This paper highlights the diversity and complexity of indigenous societies in the European Arctic, showcasing hubs like Inari (Finland); Jokkmokk, Gällivare, Malå, and Gran Sameby (Sweden); Kautokeino-Kvalsund (Norway); and Nuuk (Greenland), with key characteristics summarized in Appendix F. Each hub presents unique challenges and opportunities, underscoring the importance of context-specific understanding across different indigenous communities, including Inuit and Sámi, and varying interpretations of 'indigenous' in Greenland. Despite their differences, indigenous peoples share common challenges such as vulnerability, cultural and livelihood threats from colonization, resource exploitation, outmigration, and language loss (Brännlund & Axelsson, 2011).

Indigenous peoples can resort to international treaties like ILO 169⁵ (International Labour Organization, 1989), UNDRIP⁶ (United Nations, 2007), FPIC⁷ (UN-REDD, 2013) and UNDG Guidelines⁸ (United Nations Development Group, 2008) for land rights and cultural protection. However, the term 'indigenous' lacks a straightforward definition, relying on a mix of objective and subjective criteria, and is inherently political. In Greenland, the term is not widely used, reflecting diverse opinions and political debates about autonomy and decolonization. Some prefer the term Inuit over Kalaallit (Greenlanders), reflecting ancestral self-identification, while Kalaallit signifies a broader identity for anyone connected to Greenland, regardless of background.

Greenland, with self-governance and a majority Inuit population, stands distinct among indigenous regions. Its parliament and government comprise indigenous/Kalaallit/Inuit individuals, with Greenlandic as the official language spoken by most (Udgvjet af Bureau for Inatsisartut, 2009).

Conversely, the Sámi in Finland, Sweden, and Norway hold special constitutional status and some autonomy, with their own parliaments and cultural programs to preserve traditions and languages (Parliament, 2024). Despite legal recognition and support, they remain minorities within nations pursuing policies that sometimes conflict with indigenous practices, including forestry, mining, energy and infrastructure projects (Cambou, 2020; Similä & Jokinen, 2018).

Language plays a key role in preserving indigenous cultures by transmitting traditional knowledge (I16). Despite past colonial dominance, where only the dominant language was promoted, differences exist between Greenlandic Inuit and Sámi people. Greenlandic, though Danish remains prevalent in education and administration (K. Frederiksen & Carl, 2017), is widely spoken as a first language and is not considered vulnerable today (Ottendahl et al., 2021). Conversely, despite Sámi languages' official status and inclusion in education across Finland, Norway, and Sweden, Sámi struggle to maintain their languages, facing varying degrees of language vitality. Indigenous centers like Jokkmokk (Sweden), Inari (Finland), and Kautokeino-Kvalsund (Norway) play crucial roles in culture and language preservation through comprehensive education from kindergartens to universities. These centers balance formal education needs with culturally relevant programs, institutionalizing traditional culture within Western education frameworks. In contrast, providing a system of cultural and linguistic education is not necessarily sufficient, because the will to learn one's language and culture are also strongly self-determined. According to a Sámi reindeer herder association representative (2022) interviewed in Inari, the situation for Sámi languages is alarming and it is a challenge to get the children and young people interested not only in the language but also in the culture (I16).

Estimating the number of indigenous people is another challenge. Not only the lack of a universal definition makes precise count and comparison impossible, but none of the considered countries include ethnicity in the census (OECD, 2019). However, again, we can underly a significant difference between Greenlandic Inuit and Sámi: in the first case, even if the people born in Denmark from Greenlandic parents are excluded from the count and, vice versa, people from Danish families born in Greenland are counted as Kalaallit, the vast majority of people is of Inuit descent and can speak kalaallisut/Greenlandic.

Sámi communities do not have accurate counts. The Parliament (2024) estimates that there are between 50,000 and 65,000 indigenous people in Norway, between 20,000 and 40,000 in Sweden, and ca. 8,000 in Finland. Sámi communities at the hub level are often small, composed by a few thousand or even a few hundred people, and many of them migrate to cities. Additionally, the Sámi have never been isolated from the majority non-Sámi population. Inter-marriage between the three groups were common (Nordlie-Berg, 2022), even if the groups were culturally and linguistically distinct. During the 1900s, most Sámi were assimilated/absorbed into the majority population, a process facilitated by the states (Lantto & Mörkenstam, 2008). Today many Sámi have a mixed ancestry, and being a Sámi or not is often a question of personal identity, where reindeer husbandry, Sámi language, cultural markers, and family history play important roles (Åhrén, 2008).

When it comes to traditional economic and subsistence activities, they include mostly hunting, fishing and reindeer herding for both Sámi and Inuit people. In both cases there are people who are practicing hunting and fishing on a recreational level, combining a traditional activity with a job in the mainstream wage market, and people who are professional and full-time hunter, fishers and herders. It must be noted that Sámi and Inuit people are having jobs that are not 'traditional' per se, but are still directly related to the Sámi and Inuit communities: this is the case, for example, of administrative jobs in Sámi and Greenlandic institutions, jobs related to culture and teaching, cultural tourism and handicraft etc (I29; I6; I7). On the other side, traditional livelihoods for example, reindeer herding, hunting and fishing, are today carried out in accordance with modern industrial practices. Reindeer slaughter became regulated and the indigenous and nomadic norms were not allowed to be practiced (Sara et al., 2022). The meat production has modified the structure of herds, and the conflict with predators has pushed many herders to adopt farming practices during winter.

Traditional livelihoods share two main features. Traditional livelihoods are vital for sustaining culture and identity, shaping social relations, cultural practices, values, traditional knowledge, and language, necessitating their preservation (I51). Their relationship with the mainstream market is complex: while intertwined and co-dependent, selling products like reindeer and marine mammals to markets and restaurants, they are also threatened by global economic practices and conservation measures that limit activities like hunting and fishing, affecting local traditions (I26).

Furthermore, traditional livelihoods are regulated by formal rules, including hunting and fishing licenses, quotas, herding district rules, reindeer population caps per area, and restrictions on predator hunting. Not all regulations take into account the Sámi people and Inuits that practices indigenous livelihood, but gives higher weight to a societal overall assessment. This can generate conflict with state authority when they are not consistent with indigenous knowledge, values, needs and wishes. A better inclusion of it through participative policy design and implementation appears to be urgent.

The primary threat to indigenous livelihoods and cultures is the large-scale exploitation of lands, seas, and resources by industrial sectors like mining, tourism, aquaculture, renewable energy, transportation, and forestry, which place indigenous ways of life under multiple pressures (I6; I51). While not all Sámi and reindeer herding communities oppose development, they are looking at the situation in a long run and sustainability and respect to nature and reindeers are their main motivations for fighting for their rights to the land (I47).

In addition, climate change impacts natural resources, creating unstable conditions. For instance, rising sea temperatures may shift interest to the High North for salmon farming due to excessive warmth in southern regions. This in turn will lead to increased conflict with local Sámi fishman's in coastal communities particularly in Kautokeino-Kvalsund hub. On the side of reindeer husbandry, climate change makes grazing more difficult due to lack of available food in the wild, as well as unpredictable and extreme weather changes that may impact the migration behavior of reindeers (I51; I54). Decreasing sea ice cover in North and West Greenland changes the conditions for local indigenous and traditional hunting and fishing in the season.

However, all mentioned sectors could offer potential benefits to local and indigenous communities. If they are properly planned with meaningful and sufficient inclusion of indigenous group, their impacts could be mitigated or at least properly compensated (I47; I28; I43). The positive example of Sámi cultural and educational institution could serve as a metaphor and practical case of merging of different ('indigenous' and 'global') needs. This shows that, through participation, inclusion and support of indigenous autonomy and self-determination is possible to produce innovative and sustainable solutions.

3.6. Cross-hub characteristics and impacts

Until now many studies have scrutinized at the socio-economic conditions in the Arctic region (Arctic Council et al., 2004; Glomsrød et al., 2021; Nordic Council of Ministers, 2014), however, these studies were mostly focusing on global and national levels. The present study goes further and its main purpose is to present local impacts and analyse how existing economic activities influence on local communities, including indigenous societies and cultures, in different hubs. Although the studied hubs are very diverse it is still possible to identify commonalities and then analyse each one within its own context to understand specific challenges and develop unique opportunities. Here, we summarize similarities and differences according to the features that have proven to be crucial in our analysis.

Analysed industries produce both positive and negative impacts on a local level. Summary of the local benefits and drawback are shown in [Figures 2 and 3](#), respectively. We can observe a complex effect of the industries on rural outmigration. Some examples (e.g. Kittilä for mining; Westfjords and Suđuroy for fish farming) have contributed to mitigating or reversing outmigration, stabilizing populations, and attracting youth. However, these industries often perpetuate gender imbalances,

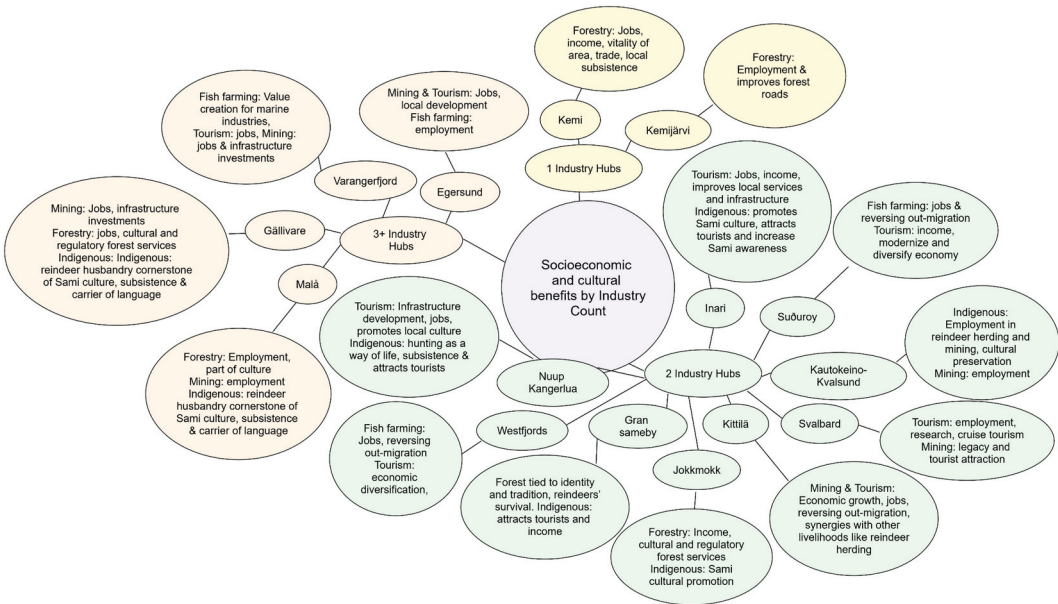


Figure 2. Local socioeconomic and cultural benefits by industry count. Details are available in Appendix G. Created by Zivojonovic, I. & Elomina, J. in blocksandarrows.com. Different colors refer to the number of industries operating in the hubs: yellow- 1 industry only; green – 2 industries; orange- 3 industries.

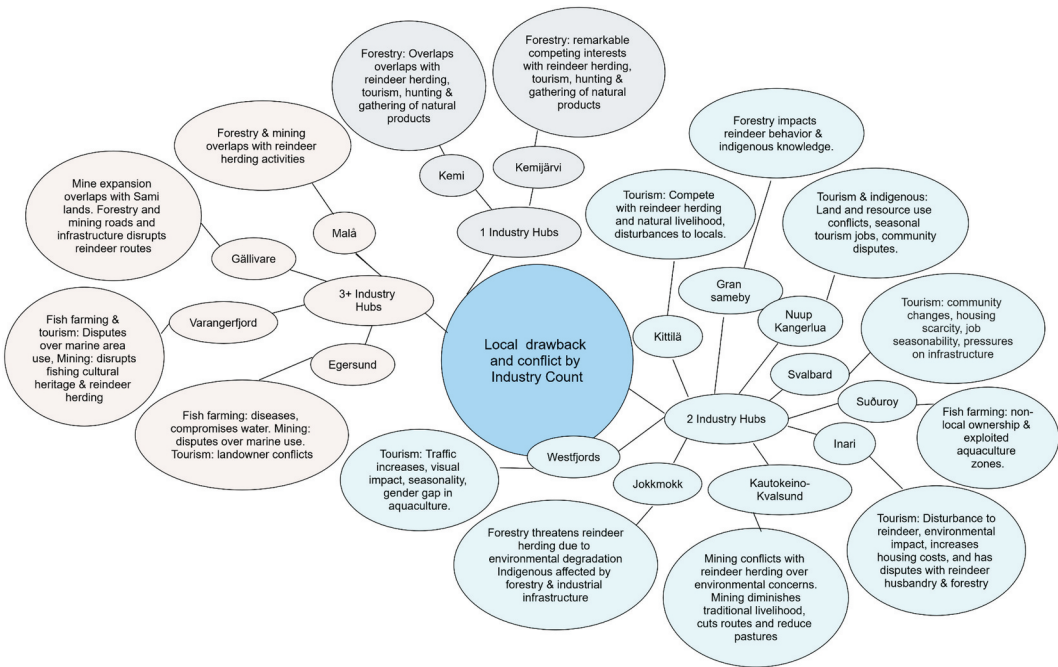


Figure 3. Local drawback and conflict by industry count. Details available in Appendix H. Created by Zivojonovic, I. & Elomina, J. in blocksandarrows.com. colors refer to the number of industries operating in the hubs. grey- 1 industry only; blue – 2 industries; orange- 3 industries.

being predominantly male-oriented. Kittilä presents a more balanced situation due to its strong tourism sector which is more female-oriented. Nonetheless, issues like slight population declines in Varangerfjord complicate the narrative. Furthermore, indigenous communities may face increased outmigration if traditional livelihoods are jeopardized by external pressures on resources and land. The proposed mines in Varangerfjord and Nussir, alongside Nasafjell, raise concerns about non-local labor impacting cultural heritage and reindeer husbandry, as highlighted by Lien (2021).

All analysed livelihoods are providing new jobs and business opportunities for local and foreign people and offer a good opportunity to mitigate unemployment and increase tax revenues. They provide opportunities to increase income that can be used to support traditional livelihood (interdependence between subsistence and wage economy). But these aspects have also an opposite side. If indigenous hunters and fishers opt to work for companies due to higher profitability, it risks narrowing their traditional livelihoods and limiting their transmission to future generations due to reduced time for practice and teaching. When we look, for example, at tourism, beside income, good opportunity for indigenous people is to raise awareness, share and strengthen their cultures and prevent cultural appropriation through tourism services. The same applies to non-indigenous communities that can create local products for example, food or experiences. However, in tourism, jobs are often not well-paid and seasonal. Furthermore, if not locally owned and managed, tourism could become mass tourism and owned by foreign investors and operators, with limited local benefits and increased negative impacts on local communities. This is reflected through higher accommodation prices, crowding, environmental degradation, zero income generated locally (ex-cruise/charters). Furthermore, there are negative impacts over local population, such as housing shortages/high prices, pressure over services by external seasonal workers who do not spend their earned money in the community and in some cases do not pay taxes in the municipality (fly-in-fly-out). Seasonality is the common issue to many of these livelihoods, and could be a challenge for employees because of income instability. Combination of activities, e.g. mining and geotourism activities can counteract seasonality issues. To counteract seasonality issues Kaján (2014) reported that local communities adapted diversified cultural and heritage indoor tourism that can be done in all seasons e.g. musical and cultural events that are not snow dependent. This is aligned with Varnajot (2020) study where he suggested that local communities should reinvent or innovate their tourism products rather than solely relying on the 'Arctic' tourism stereotype. While economic activities may boost municipal income, the risk remains that little revenue stays local, especially when industries are run by foreign companies whose interests may not align with those of local communities.

Looking further, these industries provide new services and infrastructures, they need good connectivity (new roads and transport options) that can be useful for local population too. Most interviewees highlighted this importance and mentioned that the road and infrastructure development also form synergies with tourism (I11; I13; I14; I20; I23, I33; I45; I56; I59). We could also observe new education opportunities or that companies (especially mining) are providing support through agreements with municipalities and the local population to provide cultural initiatives, sports offers and new facilities (I43, I52; I55). In many cases these developments also bring improved healthcare. However, the downside for operating these industries assume intensive use of existing infrastructures, which in some cases in Nuuk, already suffers from increasing capacity pressure and lack of maintenance (e.g. heavy traffic on roads, pressure on housing and health sector) and services, which induce inequalities and put further pressure on the environment (new roads, wind park, hydropower plants, etc.).

3.7. Industries synergies and trade-offs

The relationship among industries in the Arctic region is complex and it is challenging to definitively state whether economic activities exhibit synergies or trade-offs. Therefore, we utilized a spectrum to account for the possibility of intermediate relationships between two activities, see Table 3 for summary.

Table 3. Synergies and trade-offs per industry.

Activities	Fish Farming	Forestry	Mining	Tourism	Reindeer husbandry*	Traditional Hunting**
Fish Farming						
Forestry						
Mining						
Tourism						
Reindeer husbandry*						
Traditional hunting**						
synergy Trade-off No data						

*Indigenous peoples' economic activities include reindeer husbandry and hunting.

**Inuit tradition of hunting caribou, ox, whale, etc.

Based on our Norwegian hubs, Varangerfjord and Egersund, fish farming has trade-offs with mining. Mine tailings and fjord deposits cause seabed and water pollution, harming residential and recreational areas, and disrupting traditional fishing and reindeer herding activities. Local Sea Sámi fishermen contested the mining company's operation for its harmful impact on Varangerfjord's marine environment (Nygaard et al., 2022). In Egersund, environmental NGOs protested against seafloor tailing deposits in the 1980s, leading to a shift to land deposits, which also proved harmful, with solutions still being sought (Nygaard et al., 2022).

Regarding tourism, fish farming has both benefits and drawbacks. Interviews indicate that the fish farming and aquaculture sector enhances ports and roadways, aiding visitor access (I33, I36). However, the fjord landscape is marred by sea cages (I33, I32). Tourists, often unaware of fishing area zones, can disrupt fish farming operations (Edwardsdóttir et al., 2022). Littering and environmental degradation are additional consequences of Arctic tourism (Bogadóttir et al., 2022). We could not assess trade-offs and synergies of fish farming with forestry, reindeer husbandry, and hunting due to the absence of hubs combining these activities.

Forestry has trade-offs with reindeer husbandry, as discussed in Chapter 3.1. In summary, forestry activities, such as harvesting, soil scarification, and other silvicultural treatments, reduce landscape connectivity, leading to the loss of lichen, a crucial reindeer food (I6, I7, I23, I18, I11; Lidestav et al., 2022). These landscape changes also affect reindeer behavior and migration routes. Wild animals are similarly impacted by forestry activities, resulting in additional trade-offs. Forestry and mining have an intermediate relationship since mining expansion requires land conversion. In northern Finland and Sweden, where forest lands are privately owned, landowners can negotiate better payments (I59). Both industries share road and railway infrastructure for transporting goods (Živojinović et al., 2022). In relation to tourism, forestry activities ruin the landscape, the main attraction of the area. However, forest roads provide tourists access to remote areas (I7, I11, I12, I18; Bogadóttir et al., 2022; Živojinović et al., 2022).

Mining has severe trade-offs with reindeer husbandry (I21, I49, I58, I44, I49). Mining expansion overlaps with Sámi and reindeer herding traditional lands, disrupting routes and increasing grazing land fragmentation (Myntti et al., 2022; Nygaard et al., 2022; Živojinović et al., 2022). Dust from mines affects reindeers' ability to find lichens, impacting their diet (Nygaard et al., 2022). Regarding mining and tourism, both have drawbacks and benefits. Mining areas can be transformed into tourism sites (I36), but open-pit mines ruin the landscape, especially for nature-based recreationists (Bogadóttir et al., 2022; Živojinović et al., 2022). However, mines contribute to infrastructure development in local hubs, benefiting tourists with improved communication, roads, and recreation facilities (Elomina & Živojinović, 2024).

Tourism has an intermediate relationship with all economic activities in the Arctic. It disturbs reindeer through activities like snowmobiling and husky sledding, and contributes to littering and environmental degradation (I16, I7, I38). However, tourism also raises awareness about local culture and Sámi traditions (I6, I7; Bogadóttir et al., 2022). Tourism conflicts with traditional hunting practices, as tourists' ignorance of rules disrupts hunting areas (Bogadóttir et al., 2022). In Nuuk, a ban on humpback whale hunting, seen as barbaric by tourists, has angered whale hunters who

view it as a disruption of their traditions (I26, I30). While tourism highlights local culture and traditions, boosting markets for local goods and services, it also causes environmental wear and tear (Bogadóttir et al., 2022; Živojinović et al., 2022). Natural parks and reserves are major tourist attractions despite the negative impact of mass tourism on the environment (I18). Additionally, wind farms, like mining and deforestation, ruin the romanticized Arctic landscape (Živojinović et al., 2022).

Reindeer herding and hunting are the two economic activities found to have synergies, as traditional hunting occurs only during specific seasons, ensuring it does not disrupt the reindeer herding cycle. This activity is essential for indigenous peoples to supplement their needs, especially in preparation for winter (Myntti et al., 2022; Živojinović et al., 2022). In Greenland, critics argue that traditional hunting negatively impacts whale populations in the fjord. However, local hunters maintain that traditional hunting sustains their practices and ways of life, which are integral to their survival. They argue that whales have remained in the fjord despite a century of hunting. When done sustainably, hunting also helps balance prey-predator populations (I26, I27, I30).

Based on our synergy and trade-off analysis, only traditional land uses exhibit synergies with each other, while all other economic activities have both trade-offs and synergies. Balancing the effects of these activities is crucial. However, our results indicate a willingness to sacrifice certain outcomes to achieve others. For example, mining and forestry have severe trade-offs with indigenous land uses, yet mining industries continue to operate and expand in the European Arctic. Studies have documented the adverse environmental impacts of mining (Flick et al., 2022) and its effects on traditional livelihoods (Myntti et al., 2022; Zachrisson & Lindahl, 2023). Similarly, the effects of forestry are comprehensively documented (Horstkotte et al., 2023; Kivinen et al., 2010; Sandström et al., 2016). Despite this, the European Arctic remains committed to an extractive development path, prioritizing economic growth.

4. Discussion

In general, big and resource-intensive industries are having major impacts on landscapes and land uses, with negative consequences on ecosystem services, recreational and emotional aspects (important for identity building, maintenance of values, norms and traditions and transmission of livelihood), quality of the environment and livelihoods in Arctic region. This is in parallel to the findings of Österlin and Raitio (2020) and Fohringer et al. (2021) specifically with mining and forestry in Sweden, where mining expansion and land use can displace towns and grazing lands for reindeer, affecting local and indigenous culture and identity. Similarly, forestry operations negatively affect lichen availability which is the main food source of the reindeers during winter (Sandström et al., 2016). On tourism, Müller and Viken (2017) stated that although tourism is a powerful modernizing phenomenon, impacts that came with it should be well managed e.g. commodification, stereotyping, othering and marginalization. On the other hand, fish farming and expanding aquaculture can lead to further deterioration of sea and coastal areas that may negatively affect local income generation in the long run (Aanesen & Mikkelsen, 2020).

Beside material impacts, this means that there are strong cultural and identity changes and losses: indigenous languages, traditions and practices are connected to livelihoods and can be challenged and in the worst case disappear. This is well identified in Arctic resilience report (Arctic Council, 2016). This paper highlights that despite the diversity among Arctic indigenous societies, they share commonalities as vulnerable minorities facing threats from colonization, land exploitation, outmigration, and loss of language and traditions. Müller and Viken (2017) have also pointed out that as minorities, indigenous people tend to be neglected or marginalized even though it forms part-and-center of all economic activities in the Arctic. Therefore, it is crucial to weigh the pros and cons of industrial developments in the Arctic to balance and integrate the interests and needs of indigenous communities (Tennberg et al., 2021; Tervo-Kankare et al., 2018). Focus should be on developing suitable transition activities for local communities and utilising possible synergies (Ivanović et al., 2023). For indigenous communities synergies could be found with tourism, when higher value can be created by combining traditional activities and tourism while fostering intercultural sensitivity (Viken et al., 2021).

Our findings align with economic and social impact assessments conducted at the Arctic regional level, such as the Economy of the North 2020 and Arctic Social Indicators II 2014. These assessments remain the most recent comprehensive socioeconomic impact studies relevant to our research. Glomsrød et al. (2021) noted that regional economies prioritize the development of extractive activities, a trend corroborated by our interviews and local narratives. Like their report, our study builds on existing findings to provide a deeper understanding of the socioeconomic impacts of economic activities in our focus areas.

We also found that GRP/GDP and the Human Development Index can be misleading measures of development. While these indices suggest that European Arctic countries have very high human development (UNDP, 2024; The World Bank, 2024), they fail to capture the nuances of local realities. Some local communities believe true development is more closely linked to cultural preservation and environmental sustainability, and they do not view their quality of life as high when their culture and landscape are exploited (Elomina et al., 2024).

Glomsrød et al. (2021) and the Arctic Social Indicators II report (Nordic Council of Ministers, 2014) also highlighted the difficulty of collecting comparable data on socioeconomic conditions in the Arctic due to data availability issues. Each region presents unique data challenges and different priorities. Their report indicated improved human development in the West Nordic region based on health, population, material well-being, and education. However, our interviews reveal that not everyone in the European Arctic perceives their human development as high. Additionally, while both studies have a broader scope, including Canada and Russia, our study was limited by funding constraints and the current geopolitical situation.

What becomes obvious is that participation is key to avoiding or at least reducing negative impacts. Current literature and interviewed experts agree that true participation is essential for addressing land use conflicts (e.g. I30, 2022; I36, 2022; I43, 2022; Accastello et al., 2019; Chambers & Kokorsch, 2017; Fitzmaurice & Rosello, 2020). However, the opposite is often true in practice (Beland Lindahl et al., 2018; Nygaard, 2016). Stakeholders must be engaged in a meaningful participatory process from the start to ensure new activities benefit the community without harming the local context. Power imbalances must be addressed to prevent merely symbolic inclusion of local people without actual decision-making power. This is in the interest of the industry itself. For instance, Arctic travellers are often environmentally and socially aware and may be willing to pay more for ethical and responsible tourism. In mining, as shown in Norwegian cases and in Greenland, protests can stop projects and make clients withdraw proposals. In forestry, forest owners attach strong values to the multiple uses of resources, so the industry should behave coherently. There is a need for common platforms for local communities to exchange information, data, and communicate better. Public–private partnerships or bottom-up initiatives are needed to avoid imposing tools or communication modes on locals; instead, these should originate from within the communities (Demiroglu et al., 2020). Forbes et al. (2019) also called for better integration between indigenous and Western knowledge systems.

This article shows that policies regulating the analyzed industries are decided at different levels. For instance, allocation of space for fishing is sometimes decided locally, while mining permits are mostly a state responsibility. Although forestry policy responsibility lies with individual member states, the EU can legislate on policy areas impacting forests, such as trade, environment, climate, and energy. Multiple actors decide on different issues, and the extent of state involvement in these industries varies. Improving existing policies and ensuring cross-sectoral communication and activities are crucial. Current developments focus predominantly on economic growth, with insufficient attention to biophysical or planetary boundary perspectives (Ramcilovic-Suominen et al., 2022).

In the Arctic, regional economies often focus on developing extractive industries (Glomsrød et al., 2021). The benefits, environmental impacts, and fairness in natural wealth distribution need scrutiny, especially given market volatility (Glomsrød et al., 2021). Alternatives aligning with indigenous communities' desires for balanced development warrant greater consideration. New development should consider 'postgrowth' paradigms, such

as degrowth and doughnut economics (EEA, 2021; Raworth, 2012), as well as postcolonial (Schöneberg, 2019) and decolonial justice approaches (Ramcilovic-Suominen et al., 2022).

Existing power relations and operational modes embedded in today's global political, governance, and economic structures could be transformed. This transformation requires questioning existing development strategies, aiming for a more balanced, nature-oriented, socially and culturally inclusive, and just future. As described in the report 'Economy of the North,' Arctic regions belong to different national regimes, and information on social and economic issues has been dispersed and not easily available at the circumpolar level (Glomsrød et al., 2021).

4.1. Limitations of the study

This study faced challenges, primarily due to data availability at the local level and variability in data quality and timing, which challenged comparisons. These disparities affect both quantitative and qualitative data, with the latter variably sourced from national documents, scientific literature, and occasionally supplemented by indigenous community project partners for enhanced insights. Consequently, future research would benefit from more detailed, systematic data collection across regions and countries, allowing for more critical and comprehensive analysis.

5. Conclusion

This paper presents the local impacts of economic activities in the European Arctic, focusing on their effects on communities, including indigenous societies. It demonstrates how industries create job opportunities, mitigate unemployment, and boost tax revenues, but also warns of potential adverse effects on ecosystems, recreational areas, environmental quality, and cultural identities. The paper underscores the need to tailor approaches to each hub's unique challenges and opportunities, contributing to a broader socio-economic and cultural impact assessment in the Arctic.

Recommendations include scrutinizing the development of extractive industries for equitable benefit distribution and environmental impact. Emphasizing alternatives that respect indigenous communities' preferences for balanced development is crucial. Acknowledging the Arctic's diverse governance and the scattered nature of socio-economic conditions, innovative governance mechanisms should aim to transform entrenched power dynamics and promote a sustainable, inclusive, and just future for the European Arctic.

Notes

1. ArcticHubs is EU Horizon 2020 project that aims to develop sustainable, solution-oriented tools to reconcile competing models of livelihood and land use in the European Arctic (Natural Resources Institute Finland (Luke) 2021).
2. <https://projects.luke.fi/arctichubs/hubs/>
3. Gran Sameby is a Reindeer Herding Community involving seven reindeer herding families with about 50 members. Their year-round lands in Arjeplog and Sorsele municipalities, while their winter pastures are in Sorsele, Lycksele, Vindeln, Skellefteå, Umeå and Robertsfors municipalities. In total it covers 5438 km². Thus, it does not make much sense to give population figures.
4. Only includes data on Guovdageaidnu – Kautokeino. Kvalsund was dissolved on 01Jan2020 hence no population data.
5. ILO Convention No. 169 concerning Indigenous and Tribal Peoples in Independent Countries.
6. United Nations Declaration on the Rights of Indigenous People.
7. UN-REDD Programme Guidelines on Free, Prior and Informed Consent.
8. United Nations Development Group Guidelines on Indigenous Peoples' issues.

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