



Review

# Food and Nutrition Security as a Measure of Resilience in the Barents Region

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**Abstract:** Food and nutrition security builds resilience in a society when people have access to safe and nutritious foods. The Barents region, covering the Northern parts of Finland, Norway, and Sweden, and the North-western part of Russia, seeks common goals that include the well-being of the region's inhabitants by ensuring preservation of local culture and social and environmental sustainability. This paper reviews existing literature on food and nutrition security in relation to building resilience and promoting well-being in the region. Amongst the local communities, traditional foods have served as a major source of healthy diet that ensures food security. Access to secure, nutritious, and healthy food is one of the aspects offering greater human security and societal stability. Traditional food has served as a major source of healthy diet, in particular, in the remote sparsely populated Barents region and amongst the local communities of the region. However, there is concern about global climate change and its effect on the region and pollution from human activities, such as the extractive industrial activities, that are detrimental to safe and secure food supply chain. In this paper, I highlight the contribution of traditional foods to food security in the Barents region. In addition, the paper emphasized that value addition to these traditional foods will help to stimulate the economy by creating new jobs. Ultimately, ensuring food and nutrition security in a sustainable way within the region will help to build resilience and promote culture and ecology with a view to offering greater human and societal security.

**Keywords:** Barents region; food security; human security; traditional food; resilience

## 1. Introduction

The concept of food security has evolved over the decades with several definitions. A working definition from 2001 states that food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life [1]. This definition incorporates food safety and nutritional balance, reflecting concerns about food composition and other minor nutrient requirements for an active and healthy life. It also takes into consideration the importance of food preferences either socially or culturally. Sustainable development and peace will ensure, when the root causes of human insecurity are addressed, these were noted to include food insecurity and undernutrition, which can contribute to as well as be a consequence of environmental degradation, marginalization, and political unrest [2].

Several studies have emphasized human security as more than the absence of conflicts at state levels but shifting the paradigm towards individual human beings [3–5]. This paradigm shift is mainly as a result of the 1994 United Nations approach to human security when it was defined as “safety from chronic threats such as hunger, disease, and repression as well as protection from sudden and harmful disruptions in the patterns of daily life—whether in homes, jobs or communities” [6]. This calls for a people-centered approach from a multidimensional perspective. The UN recognized that an improved

knowledge and understanding of the possible interplays between food security and human security would provide effective interventions that contribute to lasting solutions [7]. Human security aims at ensuring the survival, livelihood, and dignity of people in response to current and emerging threats that are widespread and cross cutting [8]. The issue of food and human security also applies to the Barents region, since such threats are not limited only to those living in absolute poverty or conflict. The four countries in the Barents region, i.e., Finland, Norway, Sweden, and Russia, are shaped by their national policies that integrate political, social, cultural, and economic policies related to food. Finland, Norway, and Sweden are Nordic countries with welfare support systems and have better infrastructures when compared to Russia.

At a conference on “Building Resilience for Food and Nutrition Security” in 2014, it was emphasized that resilience can be built by helping individuals, households, communities, and countries prepare for, cope with, and recover from shocks or threats and become even better off [9]. Food and nutrition security are important elements of individual resilience, but they can also enhance the resilience of whole economies by enhancing the health and productivity of individuals. At the same time, food and agricultural systems need to be resilient to shocks, both large and small, to help preserve food availability and access even when disaster strikes [9]. The resilience of people in the Barents region, which has been largely unexplored, requires an understanding of the coping mechanisms to the threats of climate change and the impacts of human activities in the region.

Food and nutrition security in the Barents region were reported to be affected by human activities that were carried out in the Barents region [10–12]. According to the Intergovernmental Panel on Climate Change (IPCC), the impact of climate change is more pronounced in the northern latitudes such as the Barents region than other parts of the world [13]. Hunting patterns and strategies for travelling on sea ice in the region are affected, thus compromising food security, food safety, and cultures [14]. Weather instability that is common in the region often results in thaw and refreeze events that damage crops, and less snow exposes plants to wind and frost damage through reduced insulation [15]. Increased human activities associated with more shipping routes, tourism, mining, oil and gas exploration, and pollution ultimately will have consequential effects on food security and safety. The assessment of human resilience within a society relates to food and nutrition security, in terms of how food is obtained, what kind of food, the values associated with food, the quantity and quality of food. The author took part in several workshops related to food security in the Barents region at the Arctic Centre, from 2016 to 2018 in Rovaniemi and participated in an International Conference on Human and Societal Security in the Circumpolar Arctic with specific focus on the Barents region held at Enönköping, Finland, and Kautokeino, Norway, in March 2017.

The objectives of the review paper are (a) highlight the vulnerability encountered by the inhabitants due to climate change and human activities, (b) to identify the interlinked factors that affect food security in the region, and (c) how food and nutrition security can build resilience in the region. Sections 2–4 discuss the vulnerability of the region, the challenges to food security, the relevance of traditional food, and food security indicators in relation to accessibility, affordability, and availability. Section 5 discusses the diversification of food products to promote food security and societal resilience in the region. In addition, the need to get stakeholders involved in the promotion of logistic facilities for marketing with support from institutions. Finally, Section 6 concludes the paper.

## 2. Vulnerability and Resilience in the Barents Region

The Indigenous peoples of the Barents region as well as in many other Arctic countries are often faced with outside interests in their natural resources. In the past, policies of assimilation that integrated Indigenous peoples into national society were common [16]. Such policies and industrial development have consequences on the ecology of the Barents region; they were also reported to have direct impacts on traditional livelihoods [17].

Despite the fact that the Barents region is rich in natural resources, climate change, which is more prevalent in the region than in other parts of the world [13], creates a major challenge in the

utilization of these resources [18]. Climate change affects all the four dimensions of food security, i.e., availability, access, stability, and utilization of food [19]. Climate change has been described as a significant “hunger-risk multiplier” that pose a big threat to food security in many parts of the world including the Barents region [20]. Issues of human insecurity also affect the Global North especially the marginalized groups who are often vulnerable to food security because of human induced factors and the global market system. Therefore, the food system in the Barents region must respond to these challenges; be more resilient and less vulnerable for their inhabitants.

Resilience, described as the ability of a system and its component parts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration or improvement of its essential basic structures and functions [21,22]. According to Barrett and Constanas, development resilience is the capacity over time of a person, household or other aggregate unit to avoid poverty in the face of various stressors and in the wake of myriad shocks [23]. A food system that guarantees enough nutritious food for the individual and their household ensure their security.

The Barents region, with a population of 5.3 million and an area of 17.5 million km<sup>2</sup>, is as large as Poland, Germany, Netherlands, Belgium, France, and Spain combined [24]. The Barents region covers the northernmost part of Finland, Sweden, Norway, and North-West Russia. It is the most populated area above the Arctic Circle [25]. The region is interdependent through transnational economic, cultural, and historical ties. However, it is restricted by distinct national identities, different languages, and national borders [24]. The Barents region is home to Indigenous peoples (Sami, Nenets, Vepsians) and Komi and Pomor Russian minorities. The region is characterized by long distances, sparsely populated with natural resources (forests, fish, minerals, oil and gas), and arctic conditions [17]. For the inhabitants to maintain a secured life, it will be important for policy makers to be aware of the region’s peculiar characteristics such that these resources are managed in a sustainable manner.

The Barents Euro-Arctic region with principal cities is shown in Figure 1.



**Figure 1.** Map of the Barents Euro-Arctic region (Arctic Centre, University of Lapland).

In the region, [26] summarized the four major categories of human activities i.e., (those activities the inhabitants engage in to gain income and support their families) as

- i. Nature-based industrial activities such as fisheries, forestry, agriculture, and aquaculture;
- ii. Traditional livelihoods and subsistence by Indigenous peoples: fishing, reindeer herding, hunting and gathering, subsistence, and nature use;
- iii. Extraction and refinement of resources: oil and gas, mining, related infrastructure and services,
- iv. Other industries, sectors, and livelihoods: transport, shipping, energy sector, tourism, infrastructure, and service sector.

Since the Middle Ages, fishing, hunting, farming, and gathering of wild foods were practiced as a means of providing traditional foods by Indigenous peoples. This practice also gained popularity with non-Indigenous peoples who migrated to the region. During this period, Indigenous peoples played an important intermediary role in the early trans-boundary trade relations as a result of public markets that first started in the 1500s [27]. By interacting with the locals, the non-Indigenous peoples learnt this specific way of life. Such interactions between indigenous and non-Indigenous peoples lead to an increase in interregional trade amongst them during the medieval ages [12]. For instance, the “Pomor trade” between the Pomors of Northwest Russia and the people along the coast of Northern Norway was noted to be very popular from 1740 to 1917 [28]. Currently, there are initiatives to encourage more interaction and reverse outward migration to urban cities especially amongst the youth. Such initiatives include providing infrastructures, job creation and the promotion of bio-economy in the region.

In the Barents region, the impacts of climate change limits access to traditional foods, which have served as a safety net against food insecurity. The increasing dependence of Indigenous people of the North on a global economy have reduced their ability to adapt and consequently their resilience [29].

Traditionally, the Sami Indigenous peoples that cut across the four countries in the Barents region have often relied on a variety of nature-based livelihoods such as fishing, trapping, small-scale family forestry, agriculture, and the gathering of wild berries and other natural products, together with handicraft-like manufacturing of traditional articles [26]. The most common means of livelihood for the Sami Indigenous people has been semi-nomadic reindeer herding and traditional fishing, even though they are not the only source of household income [30]. For example, there is some commercial fishing amongst the Sami in Inari, a Northern Finland town. However, other modern income-generating activities such as tourism fill the gaps in the economy nowadays; and fishing has become a secondary occupation [26]. By engaging in fishing, the locals are able to meet their everyday nutritional needs without undue reliance on imported foods. Fishing brings some extra income that provides the community with more resilience to hunger.

Across the Barents region, approximately 10% of modern day Sami still practice reindeer herding while coastal fishing and fur trapping are also commonly pursued means of livelihoods amongst the Sami [31]. In Northern Finland, the means of livelihood for the local people is mainly winter season tourism and recreation. Metal and forest industry is prominent in Kemi-Tornio while in the Oulu region, it is mainly wood and paper processing, but electronics and high tech are the largest employers [32].

In the Barents region of Russia, reindeer herding is the main livelihood for the Sami. Reindeer herding is mainly concentrated in two big enterprises that are complex agricultural enterprises and they own 90% of all reindeer in the Kola Peninsula [26]. In the republic of Karelia, Arkhangelsk region and the Nenets autonomous area of Russia, it is mainly wood processing, coal mining, oil and gas industry that dominate. In Northern Norway, nature-based tourism and fishing are major industries [33], while in Northern Sweden, it is mainly wood-based biofuels in Västerbotten and nature-based industry in Norrbotten [32].

In order to address the risks and threats that undermine the resilience of communities and societies, the FAO emphasized that access to adequate food should be part of human right, and it should be people-centered, comprehensive, context specific and prevention oriented [7]. Food sharing as an economic strategy has been part of the culture in the Barents region and has served to improve resilience amongst Indigenous peoples; this practice ensures there is the availability of traditional food in almost every household within the community [34]. As more people in the Barents region

are losing access to traditional foods, food security becomes entirely dependent on their purchasing power in a highly competitive money-based economy. On the other hand, the activities that support the local economy, such as bio-processing of traditional foods within the region, will help to create jobs, improve wages, and increase purchasing power that can support the affordability of other healthy foods, such as fruits and green vegetables, which are not readily available in the region.

The availability of minimally produced traditional and local foods that are free from pollutants will offer the inhabitants a choice to more secure and safe foods. Some imported market foods in the region are more expensive, and many have added chemical additives to extend their shelf lives, which may have negative health outcomes [35]. Henceforth, vulnerability to food security in the region will increase if there is a tendency to depend on these food imports at the expense of traditional foods in the region.

### 3. Food Security in the Barents Region

The FAO regarded resilience as a combination of three capacities: adaptive (such as coping strategies, risk management, and savings groups), absorptive (use of assets, attitudes/motivation, livelihood diversification, and human capital), and transformative (governance mechanisms, policies/regulations, infrastructure, community networks, and formal safety nets) [36]. In emphasizing food and nutrition security as a measure of resilience, the local people need to be empowered in taking active roles on how they produce food. This calls for a new system thinking that does not focus on food security only but includes food sovereignty. The Food and Agriculture Organization (FAO)'s states that "food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" [37]. This definition clearly favors the access to food based on the level of income, processing, storage, transport, and retailing methods. These parameters do not encourage food sovereignty. In an effort to reverse this bias, a distinction was made at the 2001 World Forum on Food Sovereignty where it was emphasized that food security differs from food sovereignty. Food sovereignty was defined

as the ability and the right of people to define their own policies and strategies for the sustainable production, distribution and consumption of food that guarantee the right to food for the entire population, on the basis of small and medium-sized production, respecting their own cultures and the diversity of peasant, fishing and indigenous forms of agricultural production, marketing and management of rural areas, in which women play a fundamental role [38].

In the Barents region context, many communities have relied on traditional foods that has contributed to food sovereignty for many generations in the past. For example, the local Northern Finncattle native to Finnish Lapland is well suited for the Arctic condition but sadly almost went into extinction when other breeds were introduced into the region. An ongoing project at the Arctic Centre is trying to revive the Northern Finncattle by working closely with the dairy farmers to capitalize on business opportunities offered by the breed and its milk [39]. Most Finnish Lapland inhabitants prefer the unique taste of the dairy products from Northern Finncattle milk, and it is exotic for tourists, so it will thus help to create jobs for the dwindling dairy farms in the Finnish Lapland region. Food security results when a food system adapts to ensure availability, access, utilization, and stability. If there are changes in the drivers of a food system, they will give rise to changes in food security outcomes [40]. Henceforth, it is important to evaluate the food system drivers in terms of how they can affect both food security and sovereignty in the Barents region.

#### 3.1. Importance of Traditional and Nutritious Food for a Healthy Barents Community

The traditional foods obtained from nature by harvesting in the wild, hunting game, and fishing are known to be nutritious and free from chemical preservatives. Generally, they are consumed with minimal processing and packaging at household levels. Studies have confirmed that these

foods are healthier, as incidence of obesity and other cardiovascular diseases are less rampant in those communities where traditional foods are frequently consumed [41,42]. The traditional foods that are obtained through hunted game animals, wild plants, and caught fish provide the communities with excellent nutrition, promote social cohesion, meet some of their spiritual needs for connectedness to the land and water, reinforce cultural ties, are economically important, and promote overall good health [43,44]. There is a Nordic nutrition recommendation (NNR) for Finland, Sweden, and Norway in the Barents region. The NNR lays emphasis on the quality of food that provide fats and carbohydrates; plenty of vegetables, fruit, and berries; regular intake of fish, vegetable oils, wholegrain, low-fat alternatives of dairy, and meat; and limited intake of red and processed meat, sugar, salt, and alcohol [45] (see also: [11]). The NNR also gives recommendations for adequate physical activity that will contribute to the prevention of lifestyle-related diseases. Russia has adopted the conception of state policy of the healthy nutrition (1998–2005). It recommended that the daily ration of Russian northern inhabitants (Barents region) with an average physical activity should be 4500 kcal [46]. Out of this, about 150 g of protein (this is 15% of the caloric value) and increased amounts of fat—up to 150 g per day—were also recommended. It will be important to safeguard the contribution of traditional foods to health by ensuring there are regulatory measures that monitor their safety from pollutants in the soil, water, or air. The risk and benefit balance associated with consumption of traditional Arctic-Barents foods with increased human activities was rightly captured and has been referred to as the “Arctic Dilemma” [41].

### *3.2. Specific Challenges Affecting Food Security in the Barents Region*

Food systems will fail to deliver food security when the links between them are disrupted. An example of such disruption is global warming in the region. Global warming has resulted in the thawing of snow at a faster rate in the Arctic Barents region. One critical consequence of this is the degradation of permafrost leading to floods and storms resulting in limited access to hunt for games and fishing. Responding to such disruption will require a better understanding to identify and document coping mechanisms in the food supply. It will be important to analyze and strengthen the capability of communities to adapt by identifying the most suitable level (either at local, regional, or national levels) at which adaptation strategy should be implemented [47,48]. Food security in the Barents region is linked to climate change, wildlife management, economic vulnerability, pollution, and cultural security.

Despite the fact that Arctic-Barents residents have a history of adapting to change, the complex interlinkages among societal, economic, and political factors and climatic stresses present unprecedented challenges for northern communities, particularly if the rate of change will be faster than the social systems can adapt [49].

The remote nature of communities in this region often results in limited job opportunities, low income and insufficient money to cover basic food needs that are nutritious. The market food or store-bought foods are more expensive in this region, and they are usually high-sugar, high-fat foods that have negative health implications such as diabetes, obesity, and other cardiovascular diseases [50]. Traditional foods compensate for providing nutritious foods that can be shared within the community at affordable prices. In considering the contribution of traditional foods to food security in the Barents region, there is a need to research the barriers that prevent households from acquiring traditional foods on a regular basis. Other important research topics should include the contaminants in these foods, their levels, and possible health effects.

## **4. Food Security Indicators in Finland, Norway, Russia, and Sweden**

Food security in the Barents region can be better understood through its four main dimensions: availability, accessibility, utilization, and food systems stability [12,19]. The availability of food is the physical quantities of food that are produced, stored, processed, distributed, and exchanged [19]. Accessibility is a measure of the ability to secure entitlements, which are those set of resources (legal,

political, economic, and social) that an individual requires to obtain access to food [19]. Food utilization refers to the appropriate nutritional content of the food and ability of the body to use it effectively [51]. Food systems stability refers to the overall balance of food supply and is determined by the temporal availability of and access to food [12]. An instability in the food system results when one or more of the four dimensions of food security mentioned above is uncertain and insecure.

The Committee on World Food Security (CFS) experts on hunger measurement, hosted at FAO headquarters in 2011, recommended an initial set of nutrition indicators to capture the various aspects of food insecurity [36]. Nutrition indicators are increasingly being used to monitor the impact of resilience program, they are often included in resilience index measurement and analysis. Due to lack of data that are specific for the Barents region, some of the indicators for food security in the countries of the Barents region are shown in Table 1. The average national food production from 2006 to 2014 are shown in the table, and the domestic food price index is also shown. Food production and the price indices are shaped by policies in the national countries. Similarly, market forces in a global economy determine the cost of foods that are completely out of control for the local people in the Barents region.

**Table 1.** Average value of food production (1 \$/caput) and the domestic food price index in Finland, Norway, Sweden, and Russia (2006–2014).

	Finland	Norway	Sweden	Russia
<b>Average food production (1 \$/caput)</b>				
2006–2008	367	269	295	271
2007–2009	365	265	293	282
2008–2010	354	263	290	276
2009–2011	348	256	286	286
2010–2012	337	254	281	288
2011–2013	342	258	277	305
2012–2014	345	254	279	305
<b>Domestic food price index</b>				
2006–2008	1.54	1.57	1.40	4.12
2007–2009	1.54	1.57	1.41	4.14
2008–2010	1.53	1.55	1.44	4.19
2009–2011	1.52	1.54	1.44	4.19
2010–2012	1.52	1.52	1.43	4.20
2011–2013	1.55	1.51	1.43	4.22
2012–2014	1.57	1.54	1.51	4.24

Adapted from (FAO, 2017).

Food production is a measure of availability, and the domestic price index measures accessibility. The value of food production expresses the food net production value and it measures the economic size of the food production sector in a country. It is a cross-country comparable measure of the relative economic size of the food production computed using a weighted population average [36]. The average production of food in Finland, Norway, and Sweden decreased slightly, while there was a slight increase for Russia at the period considered in Table 1. The domestic food price index compares the relative price of foods across countries over time. The relative price of food in each country was calculated in terms of the purchasing power of the country relative to the US population. Since market forces affect the global economy, other intricacies will affect domestic prices in the Barents region. Therefore, it will be appropriate to gather empirical results on food accessibility and domestic food price indices specifically for the Barents region of these countries.

#### 4.1. Availability and Affordability of Food in the Barents Region

In the Barents region, human development is closely associated with cultural integrity and close contact with nature. Therefore, it is important to consider both food security and sovereignty for a sustainable development in the region. In promoting this idea, an international workshop was organized during the Swedish chair of the Arctic Council (2011–2013). It was

a collaboration between the Arctic Human Health Expert Group, (AHHEG) and the Arctic Monitoring and Assessment Programme (AMAP) within the Arctic Council. The workshop held in December 2012, aimed at identifying universal, accessible, and informative summary measures to demonstrate temporal changes in food and water security in the Arctic population [52]. The indicators of food and water security in an Arctic health context measured these temporal changes. These indicators can be measured for the countries of the Barents region; they promote the proportion of traditional foods in diet and the non-monetary accessibility to food when the indigenous population of this region are considered. The identified alternative measures of non-monetary food accessibility discussed were: the presence of hunter/fisher/collector/herder in families/households, accessibility of hunting/fishing/collecting/herding equipment, accessibility of sufficient hunting/fishing/collecting/herding land areas, environmental conditions suitable for hunting/fishing/collecting/herding, and the coping strategies to obtain traditional foods [52]. The other important indicators that promotes food security include healthy weight, monetary food costs, food-borne diseases, and food-related contaminants.

Availability is a measure of the sufficiency of a national food supply, disruption in supply, the capacity of the country to disseminate food and research inputs to expand output [53].

Affordability measures the ability of consumers to buy and pay for food with money, their vulnerability to price shocks and the presence of programs and policies to support customers when shocks occur [53]. Other factors apart from affordability have impacts on food security. These factors include quality and safety of these foods, which include diet diversification and access to potable water.

#### 4.2. Food and Nutrition as Indicators of Resilience in the Barents Region

In relation to the monetary food costs is the monitoring of “nutritious food basket” which is the cost and affordability of healthy eating. It describes the quantity and purchase units of foods that represent a nutritious diet for individuals [54]. The nutritious food basket can be monitored for various age and gender groups.

The preliminary results from an investigation on nutritious food basket in the four countries and cities of the Barents region is shown in Table 2.

**Table 2.** Median Nutritious Food Basket (NFB) in the Barents region.

Country	Median (NFB) %
<b>Finland</b>	
Helsinki	12.7
Oulu	16.6
Rovaniemi *	22.0
<b>Norway</b>	
Oslo	12.5
Tromso *	13.7
<b>Russia</b>	
Yamalo-Nenets *	21.3
Chukotka *	45.3
Arckhangelsk *	33.0
<b>Sweden</b>	
Västerbotten	15.5
Norrbottn *	16.0

\* Within the Barents region. Adapted from (Nilsson, 2016).

The Nutritious Food Basket (NFB) serves as a tool to monitor the cost and affordability of healthy eating in a society. In order to make costs comparable with the different currencies involved in the Barents region, the authors measured the median nutritious food basket percentage as a proportion

of disposable household income [55]. These figures showed that it is higher in the Barents region to sustain a nutritious diet than outside the region. The need to encourage food sovereignty in the Arctic was emphasized as a means to make nutritious food more accessible in the region [55].

#### 4.3. Accessibility to Food and Water

The Global Food Security Index (August 2016) provides a global perspective on the most and least vulnerable countries to food insecurity. The index further highlighted some indicators that are crucial to estimate food security; they include access to potable water, diet diversification, and prevalence of obesity. The access to potable water in Finland is 100%, and average diet diversification was estimated to be 68% between 2012 and 2016. During this period, the prevalence of obesity rose from 19% to 20%. Similar to the values obtained for Finland, the access to potable water is 100% in Norway; the average diet diversification was 68% between 2012 and 2016 and the prevalence of obesity in Norway was slightly higher, it rose from 21.6% in 2012 to 23.1% in 2016 [34]. In Russia, the access to potable water is 96.5%, the average diet diversification was 59% between 2012 and 2016. During this period, and the prevalence of obesity rose from 22.2% to 24.1%. In Sweden, the access to potable water is 100%, and the average diet diversification was higher than the countries at 72% between 2012 and 2016. The prevalence of obesity in Sweden rose from 18.8% in 2012 to 20.5% in 2016 [34]. Although these figures were not specific for the Barents region in these countries, their figures are likely to be higher than average for obesity, due to lower diet diversification and access to potable water especially in Russia. It is also evident from the figures that, with a higher diet diversification, the prevalence of obesity tends to be lower. The contribution of traditional foods in the Barents region will help to diversify the diet of its inhabitants, which in turn can help to limit the prevalence of obesity in the region [12,56].

Access to traditional foods on a regular basis through hunting, fishing and harvesting by households in the communities within the Barents region will contribute significantly towards meeting the recommended intakes. The Nordic Nutrition Recommendations (NNR) used an evidence-based and transparent approach in assessing associations between dietary patterns, foods, and nutrients and specific health outcomes. They recommended frequent consumption of fish, seafood and vegetable oil to lower the risk of most diet related chronic diseases [45]. A limited intake of red and processed meat, sugar, salt, and alcohol was also recommended, as indicated in Section 3.2 above [11]. However, game meat such as reindeer meat is encouraged, as it contributes significantly to the recommended 5–10% of total energy intake of polyunsaturated fatty acid (PUFA) including at least 1% of energy intake as omega-3 fatty acid [45].

#### 4.4. Challenges Associated with Food Safety in the Barents Region

Another important aspect of food security is food safety, challenges associated with the provision of safe food is a big risk towards food security in the region. Microbial and chemical pollutants in soil, air and water jeopardize the pristine nature in this region; human activities that involve extractive industries that are driven by economic gains can cause irreversible changes to the ecosystem. These changes will likely have a huge impact on the livelihoods of many recognized indigenous and non-Indigenous peoples who are important regional actors in the Barents Euro-Arctic resource governance [12].

Contamination from chemicals such as polychlorinated biphenyls (PCBs), dioxins, carcinogenic toxaphenes and pesticides are also of major concern to food safety issues in the region [41]. There are disruptions to food and water supply within many communities in the region due to commercial activities such as mining. Henceforth, it will be important to seek greener alternatives that will not have devastating effects to the food and water supply. Technological drivers such as changes to infrastructure, food processing and handling techniques that preserve foods must also take into account health and safety issues. The nutritionally important food species of the Arctic-Barents region,

such as wild plants including herbs, berries, and mushrooms, and the possibility of these species accumulating contaminants from the environment are worrisome.

The contribution of natural traditional foods and minimally processed with low food additives and their contribution to the health and well-being in the population of the region should be promoted. The gap between traditional indigenous and scientific knowledge as to what the people consume, means of harvest, and processing and distribution techniques need to be preserved for future generations.

## 5. Diversification and Promotion of Food Security in the Barents Region

Food and nutrition security in the Barents region can be promoted by creating a value chain that is relevant to modern times and for the future generation. The changes that occur in the communities of the region that are associated with livelihood patterns have affected how traditional foods are processed, distributed and consumed.

Nowadays, with people having more stable and permanent settlements, the food patterns are changing as they move from a nutrient-dense traditional diet to store-bought foods [57]. Some of these store-bought foods (especially fruits and vegetables), may be expensive and not affordable to those with less income. Cheaper store-bought foods such as wheat flour products, over processed foods with high sugar content and other chemical additives are limited in diversity and freshness which can contribute to a decline in diet quality. Ensuring food security in the Arctic-Barents context will require adopting effective and specific actions at individual, household, regional and national levels [58].

There is a tendency to buy local food, which is partly due to limiting the carbon footprint by keeping food-processing local and close to the consumers. The drive for consumers to know more about the origin of their food are related to the issues of food safety, food adulteration, and food frauds. Such drives encourage more interest in “designated protected geographical origin” brands. Policies that encourage the opportunities to diversify the traditional foods of the region without compromising on quality and safety will be beneficial in the Barents region.

### 5.1. Importance and Use of Natural Resources in Food Sectors

Food systems rely on natural resources and it is important that these resources be not depleted for the next generation. The food we grow, harvest, trade, transport, store, sell and consume is an essential connecting thread between people, their culture and wellbeing, and the health of our planet.

An effect of the associated globalization of food, local shocks in food production, combined with the adoption of new national or regional energy and trade policies was reported to have resulted in global food crises [59]. The authors further suggested that as dependency on trade increases, the global food system would lose resilience, become unstable and susceptible to conditions of crisis. By promoting enterprises at local level in the food sector will improve food sovereignty and resilience at local levels, provide jobs that will reduce emigration from these communities in the Barents region. An integration of the local food market with regional or global food markets could play a large role in the welfare effects of climate in a given region [51]. In 2002, a food security study suggested approaches towards sustainable food security. Legal tools, policies and frameworks coupled with models focused on sustainable food security surrounded their suggestions [60]. One of the suggestions is to establish a structure for marketing local food as an avenue to reduce food imports and community's dependence on food products manufactured in the South. This would contribute to generating a certain wealth within the communities, not only for hunters or for fishers who find a place and sell their harvest but also for the population as a whole, who find a way of procuring products that are often preferred over imported products [12,61]. This is now available in some northern communities with their own branding and marketing of bio-processed traditional foods, such as arctic ice cream, jams from berries, canned reindeer meats, reindeer chips, and other processed natural herbs from the region.

### 5.2. Food as a Means of Societal Resilience

As we have globalized our food system, society have focused on specialized commodity production for export markets at the expense of traditional foods. Food security as a means toward societal resilience need to recognize ethical principles such as human equity, justice between current and future generations, respect for human dignity, and sustainable food production. The root causes of development such as human rights and peace and security challenges in a society can be addressed through the resilience that food security can provide [7]. Societal resilience that involves the ability of the local communities to harvest and process food of their choice and preference should be encouraged in line with strategies of developing food sovereignty. More studies that are context specific and prevention oriented on the important role of food as a means of societal resilience will be important research topics. There is a need for the Barents region to be more resilient in coping with food insecurity in the nearest future. Recognizing the interplay of factors in food and nutrition security, will help to prevent poverty and hunger in the society. It will be important to strengthen the interplay and relationships between food security and societal resilience in the region. Ultimately, with a more resilient society, the region will be able to reduce the flow of migration from rural communities into urban cities.

### 5.3. Promotion of Logistic Facilities for Marketing and Exporting

The transport potential of the Northern sea route will make the Barents region more profitable for business that deal with the rich minerals and bio resources of the region [62]. The impacts on food and nutrition security will depend on how the activities are harnessed with sound policies that involve stakeholders from the region. The promotion of logistic facilities for marketing and exporting in the region varies from country to country. For example, communities located along the Norwegian coastline face different threats to food security compared to those situated inland, as in Finland or Sweden. The variety between communities and regions may be because of a number of factors, such as the access and availability of foods, which can vary year-to-year dependent on climate change. It may also be possible that not all towns and villages in the northern sparsely populated areas of the region have access to nearby grocery stores, leaving them with limited access to food and their markets.

### 5.4. Institutional Supports: Local Governments, Private Sectors, Etc.

Policies that influence consumer access to food depend on functional value chains, equitable market environments, infrastructure, stabilization and above all creating enabling environments for business investment and engagement through incentives and regulations [63]. The critical aspects of enhancing food security and sovereignty in the Barents region will involve multiple stakeholders in developing the value chain of this sector in a sustainable manner that will guarantee the next generation access to traditional foods. It is vital to encourage policies that strengthen local participation in decision making that are related to food security [2]. For example, in a recent opinion poll in Finland on rural communities in northern and eastern parts of Finland, 91% of survey respondents agreed, “the state should guarantee services to keep all of Finland populated”. In western areas, 82% agreed, and in southern areas, 79%. In the capital city region, 69% of the people polled supported the statement [64]. This shows the importance of using national might to politically guide societal development. The majority of Finns want to slow down the forces of urbanization with better access to basic infrastructures in rural areas [65]. In the next few decades, the complexity of dense urban areas was identified to be one of the major challenges that people, organization and governments will face [66].

When policies are driven by an economy that encourage bio-products, recycling, and green technology, they need to be matched with corporate social responsibility. Social impact assessment when considered as part of environmental impact assessments was suggested to involve the analysis,

monitoring, and managing both the intended and unintended social consequences of planned developments and any social change caused within or by the development process [67].

## 6. Conclusions

The paper reviews the food and nutrition security in the Barents region, a region of four different countries. Sustainable local food processing that adds value to the traditional foods that are available in the region will encourage food sovereignty in the communities of the Barents region. Access to clean water, disposal of waste, and less contaminants and pollutants in the environment will be important to ensure food security and safety. In order for the region to build resilience, cross-cutting issues that pose challenges were identified. This is especially important in a region that is facing the direct consequences of climate change and urbanization. Encouraging cross-border collaboration amongst the countries will result in sharing best practices that takes into consideration the unique circumstances of the region. National government policies of the four distinct nations may be harmonized toward the support of infrastructures and job creation in the region. This will help to retain the youth, limit emigration to urban cities, and keep the region more viable. One limitation in this review is the lack of in-depth analyses on food security and its link to the resilience offered by communities in different parts of the Barents region.

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