Chapter 6
Reindeer Herders' Food Knowledge Systems

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Abstract Reindeer husbandry is part of an Arctic civilization strongly tied to nature and dependent on it in multiple aspects, including the diets of its peoples. Food production in nomadic Sámi reindeer herding has, through generations, been nested within the seasonal use of pastures, securing biodiversity, and traditional knowledge of food preservation techniques. The traditional knowledge, culture, and language of reindeer herders provide a central foundation for building sustainable food systems and social-ecological resilience in the Arctic. Food knowledge systems of Arctic Indigenous peoples should be viewed as indicators of social-ecological resilience. There is a need to rethink the food systems' strategies in the governance of Indigenous reindeer herders' societies, their economy, and external relations. Arctic Indigenous food knowledge systems are damaged due to climate change, loss of biodiversity, loss of grazing land, and failure in economic reforms since traditional knowledge about food was not included in sustainable development planning and public management.

Keywords Indigenous food systems · Reindeer herders' food systems · Traditional knowledge

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6.1 Introduction

Indigenous civilizations (Mathiesen, 2023) have been part of the Arctic ecosystem for thousands of years, shaping their relationships with the northern climate, flora, and fauna. The interconnections between peoples, wildlife, and the environment within the Arctic underpin these relationships. Since time immemorial, Indigenous peoples have built unique knowledge systems and rich and diverse cultures that allowed the Arctic peoples to sustain their livelihoods through biological resources by hunting, gathering, fishing, and reindeer herding, affecting what people eat and their health. The Inuit Circumpolar Council Alaska has pioneered the insight into and understanding of Inuit food security and food sovereignty connecting Indigenous peoples' food to their identity and future (Inuit Circumpolar Council Alaska, 2020), where food culture is a cornerstone of Inuit culture and self- and shared identity. Harvesting traditional food resources is how cultural values, skills, and spirituality are learned – all learn to be within their environments and be part of the ecosystem.

Reindeer husbandry is part of an Arctic civilization strongly tied to nature and affecting the diets of its peoples (Mathiesen, 2023). The food culture of Arctic reindeer herders is a unique phenomenon, and its knowledge systems are complex and holistic, including the use of pastures, traditional food production, and human health. The food systems of reindeer herders are thus also nomadic, founded on the use of mobility in utilizing marginal and variable resources. Indigenous peoples have a very rich understanding of food, with many unique flavors and knowledge, but this culinary world has largely been "hidden" for those who are not a part of this culture. Yet, in many cases, it is overlooked, misunderstood, and assimilated. Experience shows that there can sometimes even be a danger of Indigenous peoples feeling ashamed of their own food culture (Oskal & Pogodaev, 2019a, b).

Arctic biodiversity is the basis for food production systems with the crucial role of traditional and expert knowledge for its sustainable use, protection, and management (Sara et al., 2020). What is the importance of food and food traditions in the context of resilience, biodiversity, and traditional knowledge? Culture develops from food production systems. The freedom to eat food from your land and water is crucial for Indigenous peoples. Food connects peoples to our homelands, both in Indigenous and other cultures. Food reminds us of where we come from, who we are, and where we belong (Sara et al., 2020), and "…to remain who we are, we must continue to eat what we do" (Oskal et al., 2017, p. 15).

Traditional knowledge among Sámi reindeer herders related to reindeer welfare, handling of animals, and Sámi food culture is rich (Burgess et al., 2018). Two reports to the Arctic Council Ministers in 2017, *EALLU* "*Indigenous Youth, Arctic Change and Food Culture, Knowledge and How we have Thrived on the Margins*" and the report *EALLU II* "*Arctic Indigenous Peoples' Food Systems: Youth, Knowledge & Change 2015–2019*" (Burgess et al., 2018; Oskal & Pogodaev, 2019a, b), communicated in a unique way the richness and diversity of Arctic food resources, knowledge, and food preparation and insights in the Indigenous peoples' circumpolar communities. The EALLU book was awarded the 23rd Gourmand

Fig. 6.1 Boska (*Angelica Archangelica*) is a plant with high levels of vitamin C used in both Greenlandic and Sámi food cultures. In the conditions of a lack of vitamins, berries and some types of edible herbs play a special role in the formation of the Nenets diet (Okotetto, 2018). (Photo: Ravdna BME Sara)

Awards Best Food Book of the World in 2018. Indigenous youth from the circumpolar North documented their knowledge of Arctic foods and food systems in a special issue of the scientific journal *Dieđut* (Mathiesen et al., 2018) (Fig. 6.1).

However, nowadays, Indigenous knowledge systems face an erosion of their cornerstone – traditional knowledge – due to various effects of globalization and climate change (Eira et al., 2018). These also affect what Indigenous peoples in the Arctic are going to eat in the future. While Indigenous food systems play a vital role in ensuring food security, promoting community resilience, and supporting sustainable development in the Arctic, they face multiple hazards and challenges. These often co-occur with loss of grazing land, climate change, pandemic, modernization reforms, and rising prices for food and production inputs (Mathiesen et al., 2018; Reinert & Oskal, 2023; van Rooij et al., 2023). Increased human activity and land encroachment lead to the irreversible fragmentation of reindeer pastures and migration routes (Krarup Hansen & Oskal-Somby, 2023; Oskal, 2022). Mathiesen et al. (2018) described Indigenous reindeer herding in Norway and its adaptation to new hazards in the Arctic. Loss of pastures and biodiversity negatively affect reindeer herders' livelihoods, well-being, and ability to adapt to climate change. Fennoscandia

now faces the most difficult situation regarding the cumulative loss of reindeer pastures (Oskal, 2022). As pointed out by the IPCC, the protection of grazing lands represents the most important adaptive strategy for reindeer herders under climate change (Nymand-Larsen et al., 2014) (Fig. 6.2).

It is also important to understand that such processes invariably take place against the backdrop of assimilation. Due to direct discrimination and inequities, the consequences are typically worse for marginalized communities (Sara & Mathiesen, 2020). Therefore, Sámi reindeer husbandry in Norway finds it challenging to determine a sustainable economy based on traditional knowledge and Indigenous worldview. Gordon et al. (2017) stress a disconnection between people and the biosphere and the lack of capacity to monitor changes that could affect sustainable food production. This disconnection might be due to asymmetrical feedback between producers and consumers in the Circumpolar North. The Congress of World Reindeer Herders (2017) recognized that reindeer herders' rich understanding and knowledge base of food and crafts had not been fully utilized for economic development in and by their societies (World Reindeer Herders, 2017). It also noted the need for food

Fig. 6.2 (**a**) Kalaaliaraq market (*Brædtet*) is a fresh food market in Nuuk, Greenland. An example of a resilient food production system nested in the Greenlandic food culture connecting the hunters directly with the market in a period of Greenlandic history where modern supermarkets dominate the capital. This market sells fresh fish, whale, reindeer, and seal meat, sold directly. It is an important place for social interaction for many inhabitants. (Photo: Svein D. Mathiesen, 2022). (**b**) Kalaaliaraq market (*Brædtet*). (Photo: Svein D. Mathiesen, 2022). (**c**) Kalaaliaraq market (*Brædtet*). (Photo: Svein D. Mathiesen, 2022)

Fig. 6.2 (continued)

security for reindeer herding peoples based on equitable resource access, food empowerment, utilization of traditional food knowledge, and food safety regimes adapted to realities and Indigenous cultures in the circumpolar north (World Reindeer Herders, 2017).

Stewardship of the land, hunting, and fishing have always been part of the reindeer herders' daily lives in the Circumpolar North. Lund Olsen (2019) described the value of food through hunting: a hunter in Greenlandic is called *piniartoq*, which literally means "one who wants". 20–30 years ago, *perngarneq*, the first catch, was dedicated to the boys and men in the societies. Today, they are indeed also ritualized toward girls and women. Lund Olsen described Miilu's first catch:

> Miilu is an 11-year-old boy who caught his first caribou in the autumn of 2016. I joined when his parents invited me to celebrate the meat. The family who came all had a gift for Miilu. He was very happy, and his pride was so strong you could almost smell it, and it was as if he had grown somehow, as if he had reached a new stage in his life. The meat of the caribou was made into four various dishes. There was caribou soup with rice pudding, roast, meat with rice, and dried. We all sat and ate it and enjoyed the meat a bit extra than normal because it was shot by one who had been killed for the first time. It was as if the taste of the meat changed because it was the first-catch meat.

Food, nutrition, and production are essential to human health and are key to a healthy life in the North (Oskal & Pogodaev, 2019a, b). As the Arctic is quickly becoming an integrated part of the global economy, reindeer herders are also facing highly varying socio-economic conditions and the effects of assimilation past and present (Oskal, 2022). We need to prepare Indigenous reindeer herders' food systems for future disruptions and to plan in a way that builds on assets and advances food systems that are equitable for the long term based on all available knowledge. Until recently, food knowledge was largely absent from resilience and disaster planning activities in Indigenous reindeer herders' communities in the Arctic.

This chapter provides an overview of Indigenous reindeer herders' food knowledge systems. We also highlight why the Arctic Indigenous food system is an indicator of social-ecological resilience. The chapter discusses how the resilience of Indigenous food systems in the Circumpolar North can recover from external shocks and changes to ensure a sufficient nutrient supply and economy for the Indigenous societies.

6.2 Social-Ecological Resilience in Indigenous Sámi Reindeer Herders' Food

> Food systems have the potential to nurture human health and support environmental sustainability; however, they are currently threatening both…Providing a growing global population with healthy diets from sustainable food systems is an immediate challenge…because much of the world's population is inadequately nourished, and many environmental systems and processes are pushed beyond safe boundaries by food production, a global transformation of the food system is urgently needed. (Willett et al., 2019, p 393)

Social-ecological resilience of Indigenous food systems refers to the capacity of these systems to maintain their integrity, function, and adaptability in the face of social, environmental, and economic changes or disturbances. Indigenous food systems are characterized by their reliance on traditional knowledge, practices, and relationships with the natural environment.

Indigenous food systems are deeply rooted in cultural traditions, values, and practices. They maintain and revitalize cultural knowledge, ceremonies, food sovereignty, and the transmission of traditional practices from generation to generation, such as the Sámi reindeer herders' knowledge of the seasonal use of pastures including the use of extensive land for migration. Traditional Sámi food products, like *dipma biergu* (soft meat), have a unique quality based on Sámi traditional knowledge of reindeer meat tenderization (Sara & Mathiesen, 2020).

The resilience of reindeer herders' food system also involves preserving cultural identity, promoting community cohesion, and reinforcing the intrinsic connections between food, language, spirituality, and social structures. Sámi language preserves the knowledge of traditional slaughtering practices and the quality of meat: *bakkahit* (a deliberate action by reindeer herder to leave the rumen inside the reindeer for tenderization), or *dipmat* (become soft(er) or tender), and *rotnu* (female reindeer that has not had a calf in the present year or that has lost the calf in the spring) (Sara & Mathiesen, 2020) (Fig. 6.3).

All these processes and products have a word or concept; therefore, naming is important. A reindeer herder expresses everything he or she does through the Sámi language, and the concepts contain knowledge.

Sámi reindeer herders use at least 42 concepts that represent the knowledge base and technical language of reindeer meat. Some key concepts are *buoidi*, *ađđamiin*, and *joládžiin*, which reindeer herders use in the assessment process for reindeer meat quality (Sara & Eira, 2021). Reindeer herders use more than ten different concepts for fat content when assessing the carcass after slaughtering. For example, *čáhceváibbat* is very poor quality, and this meat is not for human consumption. Furthermore, *váibbat* is also poor quality. The use of concepts such as *ađa* and *ađđamiin* refers to better quality, while those such as *jolli*, *suorbmajoliin* (one finger), *guovttisuorpmas* (two fingers), *golmmasuorpmas* (three fingers), *njealjisuorpmas* (four fingers), and *ceakkobealgi* (all four fingers plus the thumb up) are from good to very good quality, and the thickness of the fat layer is explained by measuring with fingers, which is also a quality indicator (Sara & Eira, 2021; Sara, 2019) (Figs. 6.4, 6.5, and 6.6).

Sámi reindeer herders tend to utilize traditional knowledge in their private slaughtering, starting with the reindeer selection process for food production (Sara & Eira, 2021). One has to consider multiple aspects: the type of reindeer and its gender, age, behavior, condition of the animal, and fat content. The time of slaughter influences the reindeer selection, likewise, the role of each reindeer in the herd. Sámi herders select reindeer depending on the food to be prepared. The preferred animal for food for the family is a castrated male (*spáillit*) and female reindeer without a calf (*rotnu*). It is meaty and has large amounts of fat (Sara & Eira, 2021). Sámi herders use the fat concept in many considerations resulting in many definitions, such as those describing the reindeer's welfare and outward appearance. Different types of fats and their melting characteristics determine the preparation process and dishes (Sara & Eira, 2021). Sara et al. (2022) conclude that the traditional Sámi method is based on systematic, complex, and holistic Indigenous knowledge and determines the foods reindeer herders eat (Figs. 6.7 and 6.8).

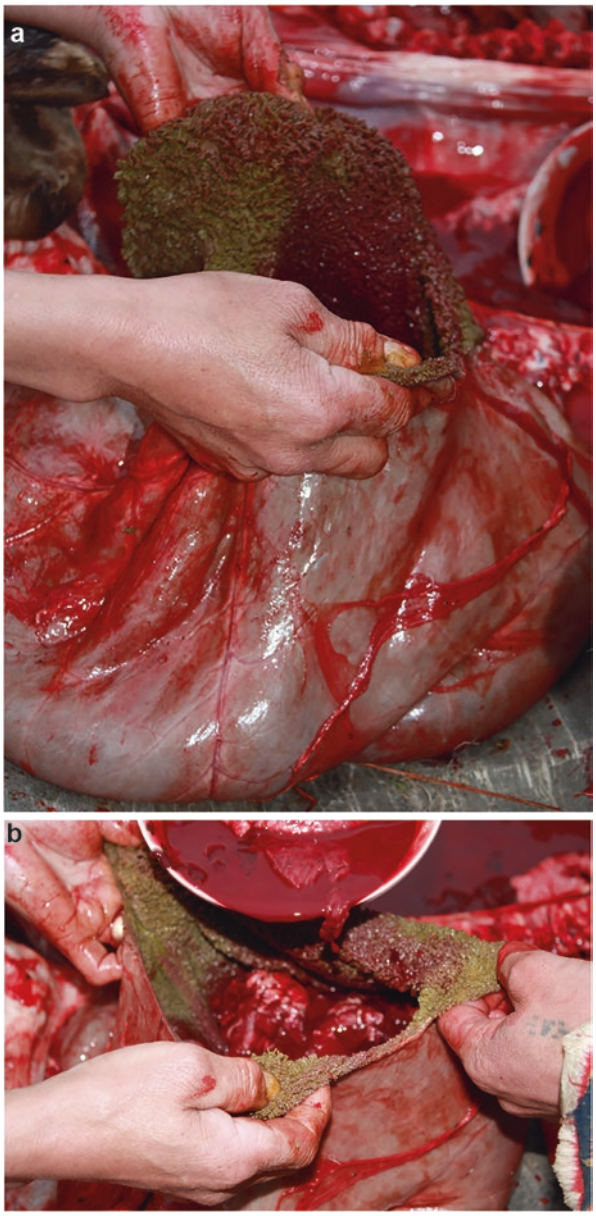

Fig. 6.3 (**a**) Reindeer rumen: the stomach is turned inside out and cleaned in snow. Then blood, meat, and fat are added. In the winter, the stomach is only cleaned with snow. The intestines are used for blood sausages as a taste enhancer after fermentation in bullion. After fermentation, the rumen is frozen, but in summer, it is preserved with fermentation only (Sara & Mathiesen, 2020). (Photo: Svein D. Mathiesen). (**b**) Reindeer rumen. (Photo: Svein D. Mathiesen). (**c**) Nenets reindeer herders in Yamalo-Nenets AO, Russia, are preparing reindeer rumen for fermentation with blood, meat, and fat. In the Nenets language, it is called *sorak* or *sydy* (Sara & Mathiesen, 2020). It is similar to the Northern Sámi *málle-čoavji* (Turi, J., 2010). (Photo: Svein D. Mathiesen)

Fig. 6.3 (continued)

Fig. 6.4 *Leavssosbuoidi*: the caul fat or fat netting around the reindeer rumen. (Photo: Ravdna BME Sara)

Fig. 6.5 (**a**) *Goastebuoidi:* fat from ruminal mesenteric fat (*leavssus*) packed hard inside the reticulum (*čalmmas*), dried and stored until rancid after about 1 year. It is fat used for frying fish and reindeer meat, added to different dishes to enhance the unique tastes of Sámi cuisine. In the picture, *goastebuoidi* is freshly prepared for drying. (Photo: Inga Margrethe Gaup). (**b**) *Goastebuoidi:* reindeer ruminal fat packed in the reticulum. In the photo, it is cut across after drying for 2 months outdoors. (Photo: Svein D. Mathiesen)

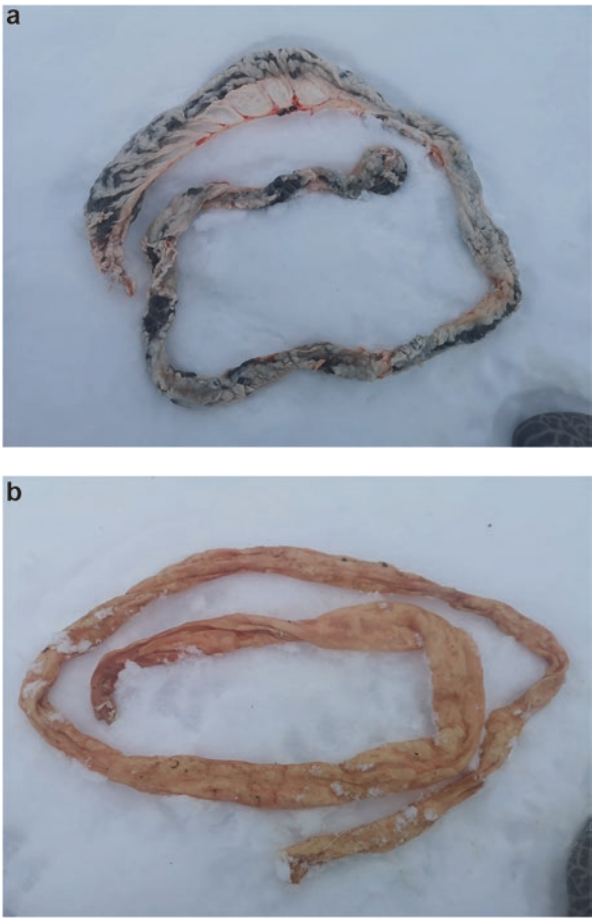

Fig. 6.6 (**a**) *Maŋŋebuoidi:* reindeer colon. (Photo: Aslak Ante Sara). (**b**) *Maŋŋebuoidi* turned inside out before blood is added and boiled. (Photo: Svein D. Mathiesen)

Indigenous traditional knowledge is rooted in generations of lived experience and observations specific to local environments. Traditional knowledge of Indigenous peoples has unique ways of expressing quality. For example, in Greenland, the food Inuits eat contains microorganisms that they ingest alongside the food. Industrialized food systems offer significant advantages from a safety point of view but have also been accused of depleting the diversity of the human microbiota with negative implications for human health. In contrast, traditional artisanal foods are potential sources of diverse food microbiota. Traditional foods of the Greenlandic Inuit are comprised of animal-sourced foods prepared in the natural environment and are often consumed raw. These findings have potential positive health implications for understanding the nature-sourced traditional Inuit diet, contrasting current diet recommendations and modern industrialized food systems (Hauptmann et al., 2020). The dietary importance of eating rumen content in

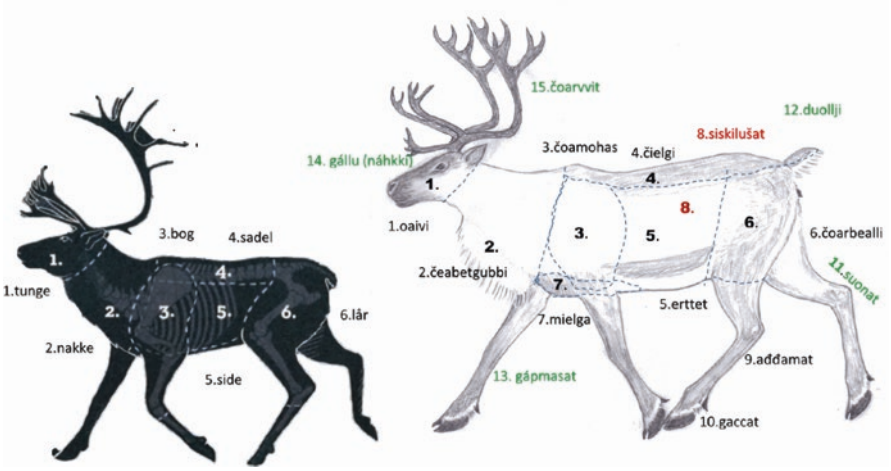

Fig. 6.7 The Norwegian or industrial (left) and Sámi way (right) of butchering a reindeer. The industrial way of butchering only uses some pieces of the reindeer as food, while the Sámi way utilizes the whole reindeer. (Illustration: Aslak Ante Sara, Ravdna BME Sara, Inger MG Eira & www.matprat.no, 2018)

Fig. 6.8 *Mielga*: reindeer breast cut across. From the left corner to the right, it is approximately 8–9 cm. (Photo: Ravdna BME Sara)

Greenland was reported as early as 1888 by Fridtjof Nansen (1893) and challenged the understanding of the quality of food resources. This part of food knowledge systems enables Indigenous communities to adapt their food systems to their regions' unique climatic, geographic, and ecological conditions, ensuring food security despite changing conditions.

Another example of the Sámi traditional food practice is smoking reindeer meat in a Sámi lávvu (nomadic tent) (Fig. 6.9). Smoking is a method of food preservation that has been a long tradition among Sámi reindeer herders (Krarup Hansen et al., 2022a), virtually unknown to science and public management (Krarup Hansen et al.,

Fig. 6.9 Sámi reindeer herders' approach to meat smoking in Northern Norway performed in the traditional Sámi tent, the *lávvu* (Krarup Hansen, 2022a, b)

2020). Due to carcinogenic polycyclic aromatic hydrocarbons (PAH) forming during smoking, smoked meat can be associated with human health risks (IARC, 1987, 2010; Ledesma et al., 2016).

However, this risk depends on the smoking method, the temperature, and the wood species. The first scientific study (Krarup Hansen et al., 2022b) using different Arctic wood species (willow, birch, and juniper) and plant parts (logs and twigs) for smoking reindeer meat confirmed reindeer herders' technique that birchwood, and especially birch twigs, generates higher smoking temperatures than willow (Krarup Hansen et al., 2022b). PAH levels of analyzed reindeer meat cuts were lower than EU-recommended maximum levels (Krarup Hansen et al., 2022b), except for reindeer meat smoked with birch twigs. The finding that birch-smoked reindeer fat could have relatively higher values also illustrates the need for co-production between traditional knowledge and science (Krarup Hansen et al., 2022b).

Indigenous food systems prioritize the consumption of a wide variety of traditional and locally available foods, including wild game, livestock, fish, foraged plants, and cultivated crops. This emphasis on nutritional diversity contributes to balanced diets, providing essential nutrients, vitamins, minerals, and dietary fiber (Sara et al., 2022).

Arctic food is the key to a healthy life in the north, so observed dietary shifts in the Arctic are a cause for concern (Burgess et al., 2018). While the Mediterranean diet is well known, the diet of Arctic Indigenous peoples is less familiar. However, the Arctic and its Indigenous food systems could be envisioned as a future "Mediterranean of the North" (Reinert et al., 2022). Using traditional and relatively simple production methods with relatively few ingredients, Arctic Indigenous peoples' diets are typically characterized by high levels of protein and polyunsaturated fat and low levels of carbohydrates (Oskal & Pogodaev, 2019a, b). Sámi reindeer herders' ecological resilience involves maintaining biodiversity, ecosystem health,

and sustainable resource practices. It includes strategies for conserving and regenerating traditional food species, protecting habitats, managing resources, and promoting practices that enhance ecological balance.

Reindeer herders' traditional knowledge base could provide new insights to help decision-making bodies and local governments more effectively prepare for and respond to crises that disrupt food security for their residents and ensure a secure food supply for the future (Burgess et al., 2018; Sara & Mathiesen, 2020; Sara et al., 2022; Sara & Eira, 2021; Krarup-Hansen et al., 2020, 2022a, b).

Enhancing the resilience of a food system can be achieved in different ways: through the food systems and knowledge based on the Arctic realities, through the ability of the Indigenous nomadic food system to bounce back and return to its sustainable stage through re-stock of animals and breeding. Resilience is also planted in the ability of the food system to deliver future acceptable food products by spreading risk based on high biodiversity and using the whole animal. Indigenous Arctic people's diets are highly varied, with a wide range of food all year round. Yet today Indigenous food knowledge production is affected by multiple stressors such as climate change, loss of grazing lands, erosion of traditional knowledge, as well as government reforms (Turi, 2002; Eira, 2012; Eira et al., 2013; Johnsen et al., 2017; Tonkopeeva et al., 2023; Mathiesen, 2023). Indigenous reindeer herders need immediate adaptive solutions and new societal opportunities for the preservation and development of the reindeer herders' food cultures.

6.3 Sámi Reindeer Herders' Circular Economies

The circular economy concept has recently gained increasing global attention also in the Circumpolar North (Oskal & Pogodaev, 2019a, b). The pillars of circular economy are waste elimination, product circulation, and nature regeneration. In short, a circular economy aims to eradicate waste in manufacturing processes and systems throughout the economic model. In contrast, the linear "take, make, and dispose of" economy wastes enormous amounts of resources such as materials, energy, and labor. Food waste is a substantial challenge in the global food system, where a third of all food produced in the world is never eaten because it is spoiled or discarded (FAO, 2011). The Arctic region is no exception (Oskal & Pogodaev, 2019a, b).

However, as far as Indigenous civilizations and traditional livelihoods go, the circular economy concept is in no way new: in a traditional family-based model of reindeer herding, there is no such thing as waste products from reindeer (Burgess et al., 2018), and similar norms and traditions are found across the Arctic (Unger, 2014). Indeed, reindeer herding and traditional Indigenous livelihoods and ways of life can be considered the oldest and best-performing part of a circular economy (Oskal & Pogodaev, 2019a, b). In such a food system, every part of the living creature is seen as a resource with some economic potential for usage. *Every part of the reindeer – from the hoof to the antlers – is seen as a resource with some sort of*

economic use potential. All parts can be utilized for something; if not as human food, then they can be applied to other products like clothing, tools, artifacts for sale, etc. This means that in some regards, reindeer herders' food systems are comprehensive in scope. Moreover, every extended family member is seen as an essential human resource, where everyone has a role in the traditional economic model – men, women, children, youth, elders, reindeer herders, their aides, and other local helpers. This also applies to knowledge, where different members of the family would have partly different bases of traditional Indigenous knowledge. This reflects a relatively wide scope of the food systems of Arctic Indigenous peoples in terms of resources and resource utilization, family roles, and diverse knowledge bases. These food systems can be seen as the very essence of Indigenous traditional knowledge in practice, representing real-world sustainability in praxis (Burgess et al., 2018). As formulated by Reinert et al. (2022), they are "sustainable to the bone".

Many Indigenous peoples and marginalized populations live in environments that are highly exposed to climate change impacts due to this heightened exposure and their natural resource-based livelihoods. These societies are already observing and responding to changes exacerbated by climate change. In her Ph.D. thesis, Ravdna BME Sara pioneers the importance of Indigenous knowledge in Sámi reindeer herders' food security and Sámi families' food sovereignty (Sara, forthcoming 2023).

In economic terms, the original Indigenous civilizations may be seen in the light of what the Austrian economist Karl Polanyi, in his studies of the industrial revolution in Britain, entitled *pre-capitalist societies*. In order for capitalism to function, argues Polanyi, one had to invent three fictitious commodities that did not previously exist as products in markets: money, paid labor, and private ownership of land (Polanyi, 1944).

Looking at reindeer herding as a form of pre-capitalist society (Reinert & Oskal, 2023), one might also see the original food systems of reindeer herders and other Indigenous peoples as *pre-capitalist food systems* based on subsistence, barter, external relations, family-based organization models, and traditional Indigenous knowledge.

In the time of transition to "modernity," Western and Soviet agricultural science was introduced to "modernize" reindeer herding into specialized meat production (Benjaminsen et al., 2015; Eira et al., 2018) and thus away from the diversity strategy known from before (Eira et al., 2018; Benjaminsen et al., 2015; Magga et al., 2011; Mathiesen et al., 2013). In the aftermath, at the very least, one can conclude that these "experiments" have had unintended detrimental effects on the social organization and economy of reindeer herding and thus affected reindeer herders' ability to adapt to change and the resilience of reindeer herding societies (Mathiesen, 2023). While objectives and intentions may have been good, as the saying goes, "the road to disaster is paved with good intentions." Reindeer herders have their own understanding and vision of the economy of reindeer husbandry, which are often different from those of mainstream society and the "Western scientific tradition" (Turi, 2016; Turi & Keskitalo, 2014).

For example, meat quality is viewed from the point of how attractive meat is as food for humans. The scientific definition of quality covers everything from food safety, ethics, animal welfare, durability, consistency, smell, the color of meat and fat content, and slaughtering processes (Langaker, 2010). Consumers associate the quality of meat with attributes such as tenderness, safety, water-holding capacity, and flavor and meat color (Wiklund et al., 2014). Even a European special classification has been developed for this purpose, the EUROP classification system (Wiklund, 2014).

Sámi reindeer herders focus on meat quality throughout the whole slaughtering process. Traditional slaughtering of reindeer holds different processes that imply meat quality before, during, and after slaughtering. Traditionally, reindeer herder follows certain customs that matter during slaughtering, such as the growing moon, killing method, season, pastures, and what type of reindeer is slaughtered. Firstly, the slaughtering takes place nearby the reindeer herd when it is the right season for slaughtering. Reindeer herder selects an animal in the herd to be slaughtered according to specific criteria that depend on age, shape, and condition and what type of food is planned to be made (Sara & Eira, 2021). The animal is slaughtered with traditional methods and processes which have not been scientifically documented. The slaughtering method is common in all Sámi regions but with some variations (Sara et al., 2022). These slaughtering methods have been used and passed over to the younger generations for a long time. However, traditional slaughtering practices are not visible to those "outside." So far, we are unaware of any scientific articles where Indigenous reindeer herder's traditional knowledge is used in planning, experimental design, or scientific analyses of reindeer meat quality (Sara, 2019). The knowledge embedded in the concepts used during the slaughtering explains the slaughtering process, names of different butchering methods, and meat and other parts of the reindeer (Sara et al., 2022).

One of the authors visited all former Sámi-owned field slaughterhouses for reindeer in Northern Norway in 2003, which had all been shut down in 1995–1998 due to new public regulations and their interpretation praxis. This experience brought about a new realization. On the one hand, the reindeer herders interviewed underlined the importance of their own handling of the market for reindeer meat for their own economy. But another element was strongly and consistently brought forward in the visited reindeer herders' own analysis: the importance of the closed field slaughterhouses for the whole *siida*, for the whole family, especially the women, and for utilizing every resource from the reindeer toward every market. This also included their relations with external actors and local society.

The foundation of a family-based economy was threatened when women's role was endangered after the modernization and rationalization of Sámi reindeer husbandry, when the women almost lost their right to own their own reindeer (Wiig, 1984, p. 313). The women's direct economic role in reindeer herding was severely diminished, which now meant pushing live reindeer onto transport trucks to industrial slaughterhouses, thereby, in effect, ending the valuable role of women and the family as an integral and traditional part of the reindeer herding economy (Reinert,

2007). Ulvevadet (2004) note that women almost completely disappeared from reindeer husbandry in worse cases.

This is very serious to the future maintenance of reindeer herding culture, language, values, and norms and maintenance and transfer of traditional Indigenous knowledge. The result is, among other things, the loss of language and understanding of food, also meaning a loss of many traditional products for potential markets.

Norway's social and economic reforms between the 1960s and 1970s affected the Sámi reindeer herders' food knowledge system since reindeer herders' Indigenous food knowledge system was not included in the mainstream Norwegian food reform (Sara, forthcoming 2023). In the article "The Art of Governing and Everyday Resistance: 'Rationalization' of Sámi reindeer husbandry in Norway since the 1970s," Johnsen and Benjaminsen (2017) documented that:

> for many pastoralists, the Agreement and the 1978 Act introduced a system that did not make sense. While some subsidies were seen as very valuable as they made life and work easier (e.g., support for snowmobiles), there were other subsidies that were described as "absurd". The authors continued: "They made jokes about "money being thrown" at them, referring to various subsidies that they received without having requested them. Interviewed pastoralists in West Finnmark said they received subsidies for purchasing cheese, which they traded for more desired goods at the grocery store, and they continued working and kept funds received for taking time off and paying a replacement to look after the herd. (Johnsen & Benjaminsen, 2017)

The following statement reflects the lack of integration of traditional food systems into modern forms of production through industrialized slaughtering and processing of reindeer meat:

> …The main challenge to Sámi reindeer husbandry today is that a large part of the raw materials of slaughtered reindeer, such as skin, bones, heads, blood, and intestines, are regarded as waste and are thrown away and not used for food production or economic development. In this modernized processing of reindeer, I believe that as much as sixty percent of the reindeer is not utilized. The bulk slaughtering of calves in our industry has been a major threat to the active participation of women in Sámi herding since the raw materials that Sámi women traditionally used are no longer available, thereby forcing us away from the herding business. If the traditional materials for clothes and food production are unavailable, the specialized language and traditional knowledge related to these processes will disappear. The calf slaughtering strategy imposed upon us as a reindeer herding people has so impacted the role and perspectives of women in reindeer husbandry that this is having significant consequences for the continued survival of family-based reindeer husbandry as we once knew it.
>
> Inger Anita Smuk, a senior Sámi reindeer herder from eastern Finnmark and Chair of the Board of the International Centre for Reindeer Husbandry (Degteva et al., 2017, p. 172)

In 2016, Chef Alfred Larsen in Guovdageaidnu, Sápmi, criticized in a local newspaper how only reindeer calf meat was available in the stores. He stated that reindeer calf meat was very tender and easy to prepare and chew, but with little taste and without consistency and could be destroyed with minimal preparation. In traditional Sámi cooking, much of the preparation is aimed at bringing the flavors. Prime meat cuts from reindeer calves are also small and less usable. The difference in meat

quality between older animals and calves is significant (Larsen, 2016; Oskal & Pogodaev, 2019b).

Within this holistic understanding of traditional family-based reindeer herding, one can find the essence of a truly circular economy. Now the world outside Indigenous societies seems to be "rediscovering" this model of thinking, forgotten in our time of sc. "modernity" with its great scientific discoveries, increases in living standards, perceived "endless" world resources, and corresponding "universal faith in everlasting growth." Alternatively, said in another way by Johan Mathis Turi:

> …from the beginning, human societies have been built on the application of traditional knowledge (...) As scientific knowledge developed and brought extraordinary results in almost all fields, a shift in people's attitudes towards traditional knowledge occurred, and it gradually became devalued. (J.M Turi, in Oskal et al., 2009)

Thus, earlier understanding and models may have been too easily forgotten. The original circular model seems to have disappeared in the visible or official economy of reindeer herding in Fennoscandia in the last 30 years. However, it is still practiced internally within families to varying degrees (Oskal & Pogodaev, 2019a, b). Attempts to specialize the economic activities of reindeer herders, thereby decoupling the family, its different members, and their different base of traditional Indigenous knowledge from the economic activities, might have additional negative effects beyond just the economic loss of product-market combinations and diversity in economic adaptation; it could weaken the original family-based reindeer herding model, the very core model upon which all reindeer cultures have historically been built.

6.4 New Economic Models and Innovation: *Boaššu – NOMAD Indigenous FoodLab*

Traditional ways of life and livelihoods have been and are central to the economies of Arctic Indigenous peoples. The food resources and production from these traditional livelihoods are often little known outside the indigenous context. However, they are much in line with global food trends, such as renewed interest in one's origins, physical health, organic foods, and ethnic roots (Oskal & Pogodaev, 2019a, b).

The traditional livelihood of reindeer pastoralism represents a model of sustainable exploitation and management of northern terrestrial ecosystems based on experience accumulated over generations, conserved, developed, and adapted to the climatic and political-economic systems of the North (Magga et al., 2011). It also represents a human-coupled ecosystem, which has developed a historically high resilience to climate variability and change (Magga et al., 2011; Mathiesen et al., 2013). The traditional economies that have existed for thousands of years have served as the foundation for the survival and prosperity of Indigenous peoples in the most severe natural environments of the world.

However, over the past 100 years, significant changes have occurred in the economic models of the Arctic Indigenous peoples (Oskal & Pogodaev, 2019a). In many Indigenous communities, attempts were made to transform their economy into "new" models ranging from capitalism to a socialist plan economy. This has jeopardized the existence of these peoples because the change in the traditional structure of the economy and social organization of Indigenous peoples was undermined by erroneous theories and ideas that were often implemented in various socio-economic experiments. As a result, the ancient traditional civilization of nomadic Arctic Indigenous peoples today is under pressure (Op.cit).

Yet as far as there is an abundance of food resources and food security, there is evidence to suggest that Indigenous peoples' food products have a positive market potential (Oskal, 2022; Yang et al., 2020). Indeed, revitalizing traditional food products for modern markets can generate local value and create sustainable businesses in the food sector (Oskal, 2022) (Figs. 6.10 and 6.11).

Of importance here is the diversification of the local economies and solving the problems of bringing untapped resources to new markets in a way that benefits the primary producing Indigenous societies. Innovation is also combining known things in new ways. The *Boaššu – NOMAD Indigenous FoodLab* initiative represents an innovative knowledge contribution on how local Indigenous societies can get into a position to exploit the opportunities arising from a rapidly changing Arctic. It is an example of the synergy between traditional knowledge of reindeer herders, sustainability, and innovation created by the International Centre for Reindeer Husbandry and World Reindeer Herders.

The *Boaššu – NOMAD Indigenous FoodLab* simultaneously represents *two ways of knowing about food*: on the one hand, a high-tech kitchen of steel and aluminum, with contemporary cooking methods and equipment operated on natural gas and limited electricity, and, on the other hand, a traditional Indigenous food system, where the food in the last instance is prepared on the open fire in the *lávvu* – the cone-shaped traditional nomadic tent used by reindeer herders. Such nomadic tents – *lávvu* – are the traditional home of the nomadic Indigenous reindeer herders. The open fireplace is called *árran* in the Sámi language, which marks the natural center of the *lávvu*. The inner part of the *lávvu* is the kitchen, which is called *boaššu* in the Sámi language.

The FoodLab is based on the interconnectedness of the tripartite concept: *boaššu* (the kitchen), *árran* (the fireplace), and *lávvu* (the tent, which also unifies the other elements). Easily transportable by road, the FoodLab is constructed in the spirit of the reindeer herders' nomadism. The kitchen modules also have skis underneath to transport them into the tundra in the winter, i.e., close to the reindeer herds in the seasonal migrations and pasture use. The FoodLab kitchen modules, the *lávvu* and the concept were constructed in cooperation with *KSH Arkitekt* and *Bakkely Smede- og Maskinfabrik* in Denmark, among others.

The *Boaššu – NOMAD Indigenous FoodLab* brings together traditional Indigenous food knowledge, reindeer herders' food production practices, and the Western world's most advanced technologies. It bridges the traditional Indigenous

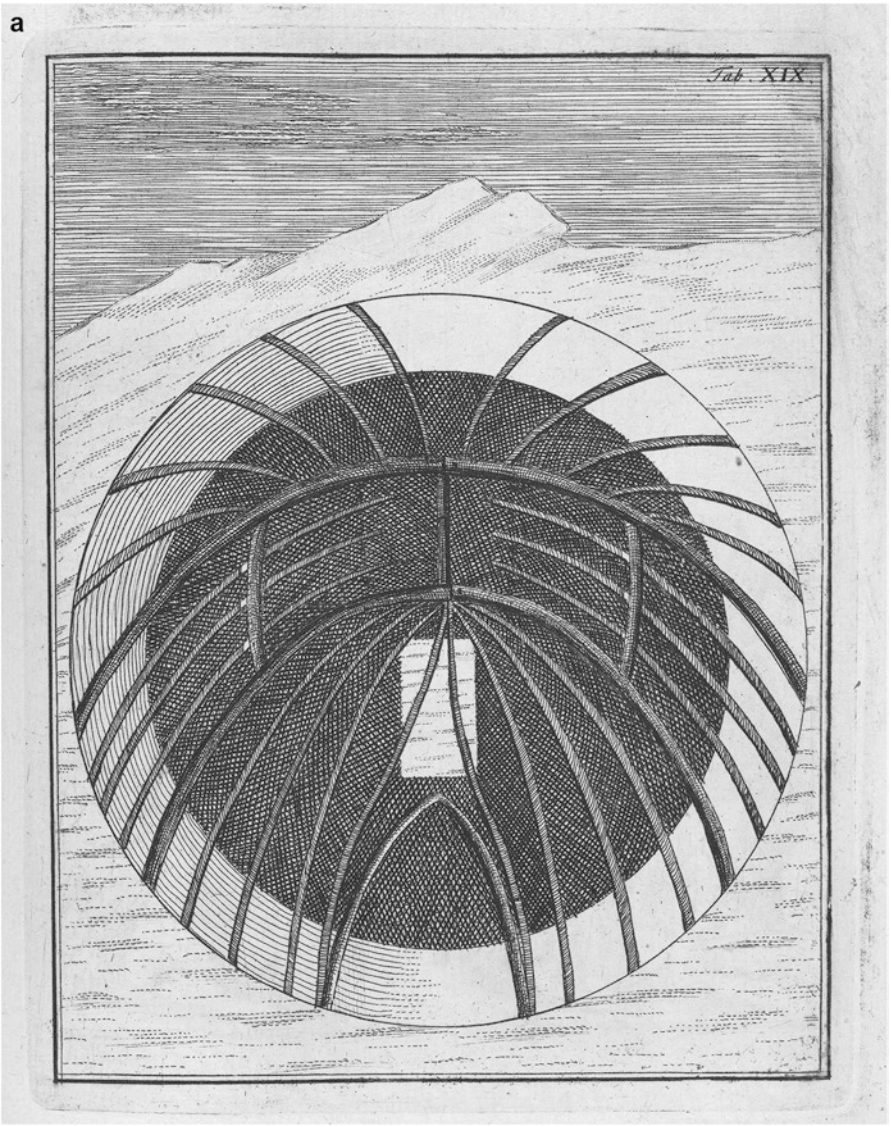

Fig. 6.10 (**a**) *A Winter Tent Seen from Above,* an image of a traditional Sámi *lávvu* from Knud Leem's book *Beskrivelse over Finmarkens Lapper, deres Tungemaal, Levemaade og forrige Afgudsdyrkelse*. Published in 1767, the book contains over a hundred illustrations by O.H. von Lode based on Leem's descriptions. Knud Leem was a Danish priest and scholar who studied the Sámi language, culture, and way of life. (Illustration: National Museum; Leem, 1808(1767)). (**b**) *The Construction of a Lávvu*. While the book was published in 1767, the original image plates were created in the 1750s, but the history of the *lávvu* itself dates centuries back. (Illustration: National Museum; Leem, 1808(1767))

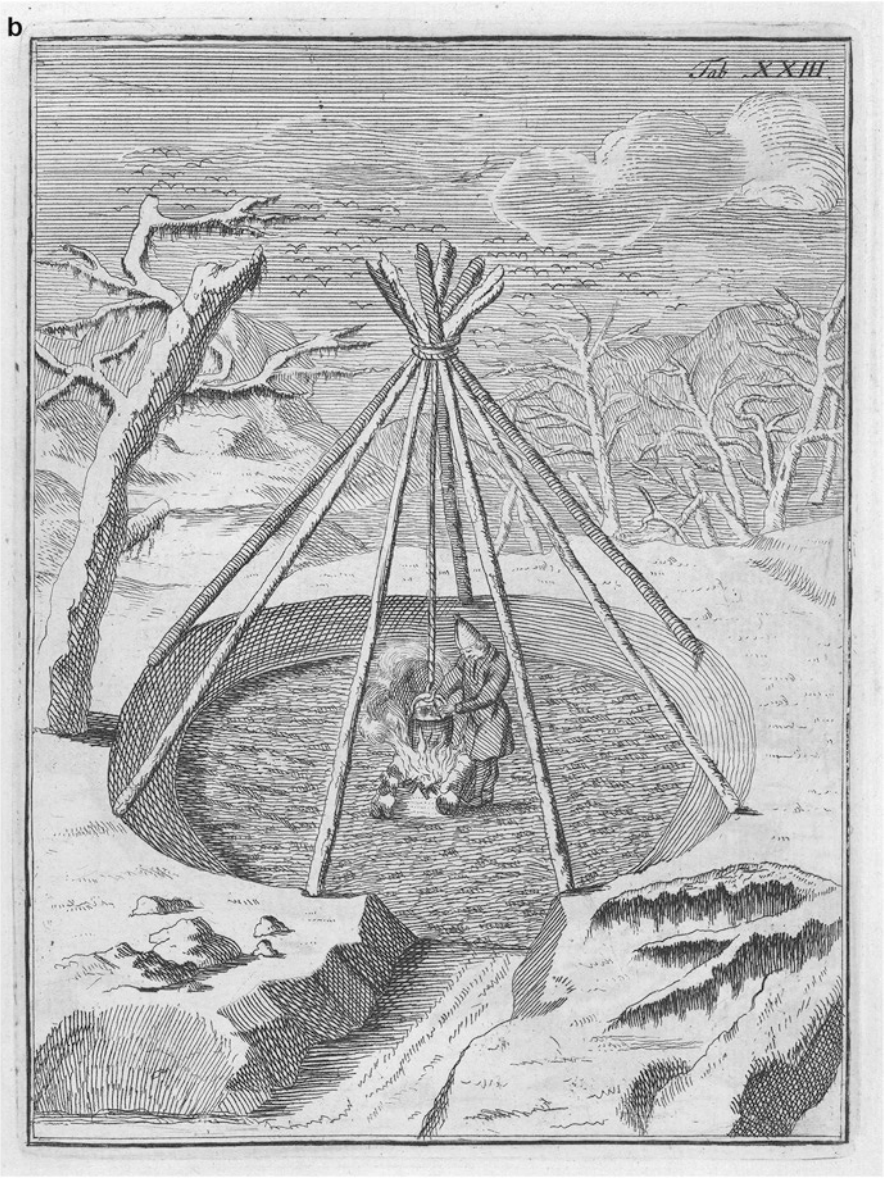

Fig. 6.10 (continued)

food systems with a nomadic high-tech Bocuse d'Or kitchen, the very first of its kind. This creates a nexus between different worlds and ways of knowing about food (Burgess et al., 2018), in a transboundary function between business and academia, between science and traditional Indigenous knowledge, and between traditions and the present. It aims to create opportunities to document traditional

Fig. 6.11 *Boaššu – NOMAD Indigenous FoodLab* at the UN World Food Forum, FAO HQ, Rome, October 16–21, 2022. (Photo: Anders Oskal/ICR, 2022)

Indigenous knowledge, using the available knowledge and resources and revitalizing what has been lost, instilling pride in Indigenous traditions, sparking creativity, shaping innovations, inspiring entrepreneurship, and ultimately strengthening Indigenous Peoples' economic base for the long term. *Innovation is also about creating new products from known resources (*Schumpeter*,* 1934*),* e.g.*, revitalizing traditional food products for new markets*.

To ensure successful adaptation for Indigenous peoples and their youth, traditional livelihoods, and societies, one must ensure that the young generations can also use the opportunities arising from Arctic change. This is part of what ICR's various youth engagements attempt to facilitate, to ensure that an opportunity of a changing Arctic is an opportunity for all – thereby leaving no one behind (Pogodaev & Oskal, 2019; Oskal, 2022). This way, the internal resources should be mobilized, and Indigenous youth should be empowered to take charge of the challenge of societal adaptation and resilience building. The FoodLab acts as a platform for Indigenous youth to take the lead in developing their own economies, societies, and destinies. It is also meant to serve as a connector between science and traditional knowledge that fully respects different knowledge systems while also driving the frontiers of our common knowledge about food (Fig. 6.12).

> Boaššu FoodLab tent at FAO shows the power of Indigenous Peoples' Knowledge systems, which combine traditional knowledge of food with new tech & innovation to address today's challenges. Thank you to Norway for supporting Artic Indigenous Peoples. (Qu Dongyu, FAO Director-General, 2022)

The FoodLab concept can also be seen as relevant in relations between reindeer herders and their surroundings, e.g., in relation to making visible Indigenous traditions, food knowledge, and local value added. This could also link to the old

Fig. 6.12 Indigenous food diplomacy in action: *Boaššu – NOMAD Indigenous FoodLab* hosting (from right to left) ICR Executive Director Anders Oskal, FAO Director-General Qu Dongyu, Norway's Ambassador and Permanent Representative to the UN agencies based in Rome Morten von Hanno Aasland, and Ambassador and Permanent Representative from Mexico to the UN agencies based in Rome Miguel Garcia-Winder on the sidelines of the UN World Food Forum. (Photo: Marina Tonkopeeva, 2022)

practice of *verddevuohta* (i.e., institutionalized "relational friendship" between nomadic Sámi reindeer herders and sedentarized people) (cf. Eidheim, 1966, p. 427), that has been a historically important and integral part of the traditional food system. The FoodLab concept has already shown strong potency in the outreach of food systems and Indigenous issues at large. This has been demonstrated in local, regional, and global arenas, including local Indigenous festivals, the Arendal-week political conference in Norway, the UNEP+50 anniversary in Stockholm, and the World Food Forum in Rome, Italy, and so on. The *Boaššu – NOMAD Indigenous FoodLab* is endorsed and has been supported by the University of the Arctic, Bocuse d'Or, International Gourmand Foundation, Arctic Council, UNEP/S+50, and FAO Indigenous Peoples' Unit, among others (Fig. 6.13). Arguably, the external relations and outreach of reindeer herding societies have become even more important under Arctic change and globalization, to raise awareness and spread understanding for reindeer herding societies' needs. Seen on this background, the NOMAD Indigenous FoodLab concept could thus also represent a new model of Indigenous diplomacy (de Costa, 2009; Beier, 2009), as an extension of traditional external relations

Fig. 6.13 Indigenous youth from the Circumpolar North is attending an international workshop on Indigenous Youth Leadership: "Advance Resilience in Arctic Communities" and practicing Indigenous food diplomacy on the premises of the *Boaššu – Nomad Indigenous FoodLab*, August 2022. (Photo: Anders Oskal)

practices of reindeer herders (Eidheim, 1966, p. 427), adapted to the challenges, needs and opportunities of current times – i.e., a model for *Indigenous food diplomacy*.

6.5 Conclusion

Arctic Indigenous food knowledge system evolved throughout centuries. The traditional knowledge, culture, and language of reindeer herders provide a central foundation for building food systems and social-ecological resilience locally. There is a need to rethink the food system strategies in the governance of Indigenous reindeer herders' societies. One must protect the pastures and rivers for the health and economy of the Indigenous communities. It is necessary to rewire the different parts of the food systems and reconnect to the biosphere through food cultures (Gordon et al., 2017, p.13). Arctic food governance must accept the sustainability of reindeer herders' Indigenous food systems and a deep understanding of the local ecosystems, including plant and animal species, seasonal cycles, and natural resource management that exist in Indigenous traditional knowledge systems. This knowledge is essential for sustainable food systems, as it ensures the long-term health and resilience of the environment. There is an urgent need to accommodate Indigenous traditional knowledge and family-based food when certifying Indigenous food

products to include different kinds of knowledge (Sara & Mathiesen, 2020; Burgess et al., 2018).

In principle, however, change means both challenges and opportunities (Oskal, 2022). But the realities of nomadic Indigenous peoples are often somewhat different: most of the time, one has to spend so many resources, time, and energy on the negatives that one is not really in a position to exploit the opportunities Arctic change brings effectively. Balance of opportunity is sometimes perceived as virtually impossible. As one young Sámi herder described their struggle against a multinational company: "It cannot be right that one side gets all the benefits and the other is struck with all the problems." Therefore, things need to be done differently for Indigenous reindeer herders also actually to benefit from Arctic change. It is necessary to call for culturally anchored development and entrepreneurship, building Indigenous economies and societies from within. Fair trade arrangements, friendly investments, joint ventures, and assistance for entrepreneurship and innovation are all useful ways by which mainstream businesses could assist Indigenous youth and their societies in developing their own economic base (Oskal, 2022).

In conclusion, we would refer to the Jåhkåmåhkke Declaration on the occasion of the sixth World Reindeer Herders' Congress in Sweden in 2017, which states:

> …Recognize that reindeer herders base their existence on a holistic economic system, where diversity and utilization of marginal resources are key fundaments, a system that is uniquely adapted to the seasons and risks of our natural environment, that keeps our people and societies healthy, that is integrated and expressed in our cultures and based on our Traditional Indigenous Knowledge, and that has kept our peoples secure from time immemorial, and underline that it is very important that this holistic system is understood and taken into account in public management.

One of the outcomes of the EALLU project is the *Food Innovation Leadership Program* which was initiated by the International Centre for Reindeer Husbandry (ICR) and Nord University of Norway in the realization of the Arctic Council Fairbanks Declaration point #22, in which the Arctic states:

> …Encourage the establishment of a program for training Indigenous youth in the documentation of traditional knowledge related to food, food entrepreneurship, and innovation.

The best available knowledge has to be used to rethink the future of Arctic food systems, both science-based knowledge and Indigenous peoples' traditional knowledge. The expression "less but better" is used to guide Western meat consumption toward sustainability. Its definition, however, lacks clarity and may push meat consumption further from sustainable practices (Sahlin et al., 2020). In a similar way as knowledge of sustainable food systems and traditional food security in Sápmi could be a keystone to developing future systems for local food security and food sovereignty in the European North (Nilsson, 2015, 2018), a similar model could be applied to Indigenous knowledge in the entire Circumpolar area.

In a nutshell, reindeer herders' Indigenous food systems encompass examples of environmental sustainability; societal, environmental, and community resilience; adaptation to local conditions; biodiversity preservation; seasonality; climate

change adaptation; effective governance and decision-making models; the source for identity strengthening and self-determination; and a platform for knowledge exchange and cross-generational learning and Indigenous diplomacy. Traditional knowledge of Indigenous reindeer herders offers valuable insights into coping with climate change impacts on food production. Therefore, the food knowledge system of Indigenous peoples in the Arctic can provide future indicators when observing social-ecological resilience to change.

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