Chapter 6
Ethics of Knowledge Production in Times of Environmental Change

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Abstract This chapter includes transdisciplinary analysis, ethical considerations, and guidelines about co-producing research across science and Indigenous peoples' traditional knowledge systems, particularly in the Arctic region in times of environmental and climatic change. The authors intend to reach out to many readers with different backgrounds and interests. The study employs inter- and transdisciplinary framing of the knowledge systems. This includes an implicit criticism of the typical narrowing of study to disciplinary siloes. It is claimed that traditional academic research misses the importance and positive contributions of different knowledge traditions and thought styles, and it is further claimed that inclusivity of these traditions is an ethical component of responsible research. In this sense, it is hoped that the following chapter inspires researchers to transcend institutionalized knowledge framings and opt for co-production of knowledge that is ethically responsive to rich cultural traditions in the Arctic. Any type of research done in communities should not exploit the Indigenous communities and knowledge holders.

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6.1 Introduction

Arctic Indigenous peoples face transformative changes that are impacting family-based nomadic traditions. Indigenous reindeer herders encounter vegetation changes in and around pastures where land use such as forestry, strictly protected areas, and tourism have been introduced without their free, prior and informed consent. Added to these impacts are climatic changes that will create challenges for reindeer herding in the future (Magga et al., 2020).

> …Remember, it is not us reindeer herders who have been the cause of climate change. The reindeer know what paths to take. Many people have lost their connection with nature, but the animals maintain this connection and that is why we follow the reindeer.

Senior reindeer herder Vassily Vassilievich Nomchaivyn of brigade № 4 in Kanchalan, Chukotka (Magga et al., 2020).

From the herders' perspective, it is important to increase cooperation between reindeer herders and researchers. Several studies of traditional Sámi knowledge have examined the role of traditional knowledge in Sámi reindeer husbandry and found it important for observation of snow cover (Eira et al., 2013, 2016), herding organization (Sara, 2009), reindeer governance (Johnsen et al., 2017; Turi, 2016), nomadic slaughtering and reindeer meat quality assessment (Sara et al., 2022; Sara & Eira, 2021) and smoking of reindeer meat (Krarup-Hansen et al., 2022). Traditional knowledge is based on experience that is accumulated in people's memory and actions over multiple generations (Magga et al., 2020). Article 26 of the Declaration on Science and the Use of Scientific Knowledge (UNESCO, 1999) states that:

> traditional and local knowledge systems, as dynamic expressions of perceiving and understanding the world, can make, and historically have made, a valuable contribution to science and technology, and that there is a need to preserve, protect, research and promote this cultural heritage and empirical knowledge.

Moreover, the Intergovernmental Panel on Climate Change concluded in the Special Report on the Ocean and Cryosphere in a Changing Climate:

> Institutional arrangements that provide for strong multiscale linkages with Arctic local communities can benefit from including indigenous knowledge and local knowledge in the formulation of adaptation strategies (high confidence). The tightly coupled relationship of northern local communities and their environment provide an opportunity to better understand climate change and its effects, support adaptation, and limit unintended consequences. (IPCC, 2019)

The mainstream scientific community and governmental institutions have today begun to demand the implementation of traditional knowledge. The term "Indigenous knowledge" recognizes that Indigenous Peoples constantly produce and reform what they know (Johnson et al., 2016: 7). This chapter aims to discuss Indigenous knowledge and the ethics of knowledge production in times of environmental change. The findings of this Chapter are based on the INTERACT II D9.1 – Guide for Local Adaptation to Environmental Change Project (Magga et al., 2020).

6.2 Philosophical Approach to Scientific Knowledge and Indigenous Knowledge Systems

We shall here introduce philosophical aspects of defining and delineating different knowledge systems. Philosophers always start with the classics. The classical definition of knowledge is knowledge as *justified true belief.*[1] This goes back to Plato (cf. Plato's Theaetitus) but gained importance in the philosophical discussions since the twentieth century. Now, reflect for a minute on each term! Truth in knowledge systems is always assumed to be the case, though it remains a tentative hypothesis. If you find out something is not true, we don't call it knowledge anymore. We are fallible, yes, but when we credit something as knowledge, we assume its truth. Furthermore, if we know something, then we obviously also believe it. The opposite is not true: not all that we believe we would classify as knowledge.

And now secondly**: justified** true belief. This is the more problematic issue about justification, and that is where different knowledge systems differentiate. Obviously, scientific knowledge is based upon a very specific way of justification, and that includes two crucial elements. On the one hand, there is a whole range of scientific methods that produce certain results, the methods that link the theoretical part with the empirical part of our conceptualizations of reality. On the other hand, it includes the social element of validation, the element of peer review, and organized skepticism (as discussed by Merton, 1938, 1973). That is, scientific knowledge is validated through the process of criticisms from your peers within the scientific communities, and we call this the peer review which can take various forms. This is the basic justification of knowledge in science.

How is it for Indigenous knowledge systems as a contrast? Well, they are also justified beliefs and they are justified through – more or less – place-based or regional, social traditions, very often accompanied by personal experiences and narratives about them. They can change over time as experiences accumulate and errors are erased. And finally, the transmission of trusted elders in the community (rather than peer review) is the bridge from the past to the present, and from the individual to the community. These are the reasons why one would give credit to Indigenous knowledge systems as they have emerged in various locations.

Now, the important observation here is that those justifications are completely rational. Rational in the sense that they give us relatively good reasons to believe in them. But the reasons are different. In that sense, they are rational systems where the difference lies with the accredited value of the sources. People actually value the sources differently. In science, tradition does not count for much, whereas it counts for quite a bit in traditional systems of Indigenous knowledge.

The challenge in modern society is to align these two knowledge systems and not to end up with the intellectual hubris that only values scientific knowledge. We need

[1] This is the so-called JTB condition of knowledge. We shall here not engage in the further development of JTB by Gettier-style examples, but simply refer to current textbooks for further discussions (cf. e.g., Lehrer, 2018).

Fig. 6.1 Sámi scientist meeting Nenets reindeer herders in Yamal, Russia (2009). (Photo: S.D. Mathiesen)

to overcome the belief that scientific knowledge is superior in all walks of life. As we have experienced time and again, it is not; often science has created the problems in the first place which then science is called upon to repair (e.g., the use of pesticides during the Green Revolution). In any case, the conflict between knowledge systems is not a matter of fact or the reality out there, but it is a matter of whose values count the most (Funtowicz & Ravetz, 1993). Our approach and view are that we have to align these two knowledge systems and that we have to interact with both of them (Fig. 6.1).

6.3 Defining Indigenous Peoples' Traditional Knowledge in the Context of the Arctic Council

The multitude of terms and definitions related to Indigenous and traditional knowledge causes confusion about the meaning behind the words. For the purposes of this chapter, it is important to highlight as stated by Magga et al. (2020) that Indigenous knowledge is (1) inherited, owned, and generated by the holders of that knowledge and (2) place-based, varying depending on the setting (Magga et al., 2020).

The only official definition developed in an international, intercultural Arctic context is in the *Ottawa Principles on Traditional Knowledge*, developed by the six Permanent Participant organizations that represent Indigenous Peoples in the Arctic Council:

> Traditional Knowledge is a systematic way of thinking and knowing that is elaborated and applied to phenomena across biological, physical, cultural and linguistic systems. Traditional Knowledge is owned by the holders of that knowledge, often collectively, and is uniquely expressed and transmitted through Indigenous languages. It is a body of knowledge generated through cultural practices, lived experiences including extensive and multigenerational observations, lessons, and skills. It has been developed and verified over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation. (Arctic Council Indigenous Peoples' Secretariat, 2015)

Since 2015, many Permanent Participants have taken an institutional standpoint preferring the term "Indigenous Knowledge" to "Traditional Knowledge" (Magga et al., 2020). This change seems to have begun in 2013 when the Arctic Council used the term "traditional and local knowledge (TLK)" in a Ministerial Declaration for the first time since its founding in 1996 (Arctic Council, 2013, 2017). The Arctic Council began to use "TLK" as its default term to "Support the use of consistent terminology regarding traditional and local knowledge throughout the work of the Arctic Council" – a recommendation suggested by the Arctic Council's Sustainable Development Working Group (2015).

One may notice that terms like "traditional and local knowledge" or "local and Indigenous knowledge" equate Indigenous Peoples' knowledge to knowledge that is held by locals who can refer to old traditions which include segments of knowledge (Magga et al., 2020). For terminological reasons, it may be wise to adopt the phrase given by the Arctic Council in 2019, traditional knowledge and local knowledge (TKLK), which distinguishes local knowledge systems from indigenous knowledge systems.

Many Permanent Participants define Indigenous Knowledge with the same wording agreed in the Ottawa Traditional Knowledge Principles; the terminology has shifted primarily to emphasize Indigenous Peoples' ownership of their own knowledge systems (Magga et al., 2020). Yet different Indigenous institutions retain varying positions on the definitions and terminology. In its report "Application of Indigenous Knowledge in the Arctic Council," the Inuit Circumpolar Council offered this expanded definition:

> [Indigenous knowledge] has developed over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation. Under this definition, IK goes beyond observations and ecological knowledge, offering a unique 'way of knowing' to identify and apply to research needs which will ultimately inform decision-makers. (ICC, 2016, n.d.)

Indigenous Peoples retain the ability to coin their knowledge systems: for example, the Sámi Council prefers to use their own language to describe their way of knowing: "*Árbediehtu*" (Guttorm, 2011). The International Centre for Reindeer Husbandry (2006) uses the terminology *árbevirolaš máhttu ja dieđalaš máhttu* for traditional knowledge. The herders' knowledge of assessing lávvu-smoking is not only *diehtu* - theoretical knowledge about the practice - but also embodied skills, *máhttu.* (International Centre for Reindeer Husbandry, 2006; Krarup-Hansen et al., 2022). Inuit Circumpolar Council Alaska (2016) specifically notes that the Inuit, for example, can sometimes refer to their knowledge as "Indigenous Knowledge", "Inuit Knowledge" or "Traditional Knowledge".

Arctic Peoples agree on the following stances in the definition of Indigenous Knowledge:

- Indigenous knowledge is a systematic way of knowing.
- Indigenous knowledge is paramount to Indigenous world views; it emphasizes ways Indigenous peoples relate to other people and the environment.
- Indigenous knowledge is passed down through generations and relies on communication with elders.

- Indigenous knowledge is not static; Indigenous peoples are constantly producing and reforming Indigenous knowledge systems.
- Indigenous knowledge is place-based and varies depending on the setting.
- Indigenous knowledge holders experience a common fight to bring their world views and understanding back to their peoples.
- Indigenous knowledge is rooted in the use of land but opposes the conquest of the land.
- The Permanent Participants referred to the holistic definition of traditional knowledge – which is integral to Indigenous knowledge – in the Ottawa Traditional Knowledge Principles.

(Arctic Council Indigenous Peoples' Secretariat, 2018)

The difficulty in assigning one definition or term is that Indigenous knowledge systems constantly evolve around the location where that knowledge is held (Magga et al., 2020). One should consider that over 500,000 Indigenous people live in the Arctic, comprising many different ethnicities and communicating in up to 90 languages – depending on the methods used to classify languages and dialects – each of which is inherently linked to its own Indigenous knowledge system (Arctic Council Indigenous Peoples' Secretariat, n.d.). Indigenous Peoples are non-monolithic with varying perspectives on how their knowledge systems should be used, shared, and communicated. Therefore, working directly with Indigenous Peoples and institutions of a particular study area is essential to co-producing knowledge across science and Indigenous knowledge systems.

6.4 Science for Policy in Complex Reality

Many people, especially in academia, tend to separate the descriptive parts of our language use from the normative parts. As a consequence, many scientists would hold that science is about facts of the world, and that values have no role in science since we seem unable to "discover" them from our empirical observations. However, this traditional view has since the 1950s been criticized even from within the philosophy of science (Rudner, 1953; Douglas, 2009), and nowadays many would agree that facts and values are in fact intertwined, even in the best of our sciences.

This is even more obvious when one moves to science-for-policy, i.e., the move to transform knowledge into practice. In most cases, one discovers that reality is rather complex, and allows for different lenses on how to account for this reality (Saltelli et al., 2020). In these cases, we typically accumulate the inherent uncertainties at the same time as the stakes of getting it wrong get higher. This is basically the situation of post-normal science (PNS) as described by Silvio Funtowicz and Jerome Ravetz (1993). The "mantra" of PNS is this: (i) facts are uncertain, (ii) values are in dispute, (iii) stakes are high, and (iv) decisions are urgent (Gluckman et al., 2020). In PNS values and facts are intertwined. This challenges traditional conceptions of relevant expertise. If values are at stake in PNS, then obviously we cannot simply rely on scientific peer review as quality assurance. Therefore, PNS includes a call for "extended peer review", where affected parties and civil society are included.

This is also an ethical consequence if one takes the call for Responsible Research and Innovation (RRI) seriously. PNS becomes a condition not only of our sciences but of society at large. With this background, we quickly see how this leads to a call for the co-production of knowledge and transdisciplinarity.

6.5 Co-production of Knowledge and Transdisciplinarity

All science-for-policy, and all efforts to bring knowledge to specific uses starts always with the problem formulation. It is therefore important to realize that this is the first hurdle: Who defines what the problem is? Are all actors and parties agreed on what the problem is? Is there one or many problems to deal with? Often, we will face what was called "wicked problems": "problem understanding and problem resolution are concomitant to each other" (Rittel & Webber, 1973).

A "co-production of knowledge" approach brings together different knowledge- and value- systems while building collaborative partnerships from 'different ways of knowing' (Magga et al., 2020). The peoples in the Arctic are also experiencing rapid changes, and those who will experience the most extreme changes will need to access the knowledge gathered about and around them so that they can adapt to the rapid changes (Eira, 2012). According to ICC Alaska (2022), "*Bringing together multiple knowledge systems, specifically Indigenous Peoples' knowledge systems, and science, can lead to more equitable, inclusive, and useful outcomes*" (Yua et al., 2022) (Fig. 6.2).

Research that is relevant to local communities and benefits them needs to involve the communities. This can be done through the co-production of knowledge between the local communities and the scientific community (Eira et al., 2013, 2018; Näkkäläjärvi & Juntunen, 2022). The parties or actors produce new knowledge together, on equal terms:

Fig. 6.2 Community-based workshop in Yamal tundra. (Photo: S.D. Mathiesen)

> We propose that co-production should be viewed as an exploratory space that brings together different values and social relations and a generative process that produces new interactions and forms of knowledge and that can lead in turn to meaningful ways of shaping and taking part in health care. (Filipe et al., 2017)

Co-production of knowledge is the production of knowledge happening in the sphere where academic knowledge and other knowledge systems meet (Pohl et al., 2010). Co-production of knowledge is now also integrated into the widely used concept of transdisciplinarity (Kaiser et al., 2020; OECD, 2020) which extends interdisciplinary science by opening up for other epistemic traditions as an ongoing dialogue with, among others, Indigenous knowledge systems and other stakeholders. Transdisciplinarity is characterized by: (i) *Ab initio* commitment to the framing of the question by integrating different domains and disciplines of knowledge, even when this means working across different theoretical perspectives and methodological practices; (ii) a focus on real-world problems, where context and complexity are recognized and confronted as part of the methodology (Gluckman et al., 2020).

Another definition of co-production of knowledge is "simultaneous production of knowledge and social order" (Guston, 2001: 401). Knowledge co-production processes need to address methodology, theory, and use of the co-produced knowledge in practice (Magga et al., 2020).

According to Pohl et al., "Sustainable development requires the production of knowledge that strikes a balance between scientific and other forms of knowledge" (2010: 267). Co-production of knowledge supports sustainable development by balancing the extraction and use of natural resources with Indigenous knowledge about the integrity and stability of the natural system. According to Eira (2012), co-production of knowledge can benefit local communities and the scientific community, and the end product is sustainable science.

Co-production of knowledge is also a way to produce the best available knowledge because local communities are involved, can influence the research process, and make it more relevant for themselves. Another relevant factor is that co-production can provide different angles to approach issues and phenomena that contribute to robust results (Saltelli et al., 2020).

Some of the Arctic Council projects have actively involved Indigenous knowledge in Indigenous-led projects, such as: 'Indigenous youth, food knowledge and Arctic change' (EALLU) managed by the Association of World Reindeer Herders and 'Circumpolar Wildland Fire' and the Arctic Wildland Fire Ecology mapping and monitoring project (ArcticFire) lead by the Gwich'in Council International to advance work on wildland fires at the Arctic Council. Some of the projects have focused on bringing together traditional knowledge holders, scientists and resource agencies to assess freshwater river systems, identifying actions that are taken by the Permanent Participants in recent years that build resilience, or deploying traditional and local knowledge through the creation of a knowledge exchange program and establishing professional networks related to energy resources for remote Arctic communities. In addition, the Permanent Participants have provided their expertise in Indigenous languages and traditional knowledge for the language map on Arctic Indigenous languages produced by the UiT University Library and the Arctic

Council Indigenous Peoples' Secretariat (2019) that is further developed as an online educational resource.

According to Wheeler et al. (2020), attention to the role of Indigenous knowledge in environmental monitoring, research, and decision-making is likely to attract new people to advance this field of work.

Co-management builds adaptive capacity at multiple levels by fostering shared understanding, increased dialogue, and interaction. Co-management provides emerging networks that give rise to new social practices and interactions, allowing greater ability to cope with variability and building longer-term adaptive responses that minimize risk and uncertainty (Armitage et al., 2011).

6.6 Current Principles and International Ethical Guidelines to Cooperate with Indigenous Peoples

Calling on different groups and sectors of society to work together towards a common goal will always involve potential conflicts arising from social hierarchy and differential power relations. Therefore, ethical issues will arise and need to be clarified. The International Centre for Reindeer Husbandry (ICR) has developed its own Ethical Guidelines. According to the guidelines, traditional knowledge has equal value to scientific knowledge and has essential practical value for the carriers of such knowledge in their day-to-day activities and subsistence. Guidelines also note the need to develop additional guidelines tailored to each partnership:

> TK is more than a source of empire for researchers. TK carriers shall play a central part in shaping projects and shall be involved as equal partners in consultation and decision-making.

This guideline supports the need to create such guidelines where the scientific community and local community meet, their knowledge plays an equal role and their cooperation can be developed.

When working with Indigenous issues, on Indigenous land, and with Indigenous peoples, then cultural sensitivity plays an important role. The ICR Ethical Guidelines (2006) recognize Indigenous Peoples' ownership of the knowledge and the use of the knowledge, and underline that "*all researchers working in the North have an ethical responsibility toward the people of the North, their cultures and the environment. Traditional knowledge is of equal value as scientific knowledge and when traditional knowledge holders' knowledge is used, they have a right to determine how it should be used. Traditional knowledge carriers shall play a central part in shaping projects and shall be involved as equal partners in consultation and decision-making"* (International Centre for Reindeer Husbandry, 2006).

The guidelines also discuss the role and the importance of capacity building benefitting the communities and how all relevant projects shall include capacity building as a separate project goal (ICR Ethical Guidelines):

- "Capacity building means empowering Indigenous peoples as minorities through increased knowledge, in order to make them able to become truly equal partners in processes with mainstream society. The capacity building thus includes building knowledge in the Indigenous societies themselves, their people, their own institutions, and organizations.
- All relevant projects shall include capacity building as a separate project goal. As far as practically possible, the projects should involve some form of evaluation of effects on capacity building. The projects should preferably be designed so that any results of capacity building are made measurable".

Considering the further development of the Arctic Science Cooperation Agreement (2017) and the outcome of the 2nd Arctic Science Ministerial Meeting (2018),[2] there is a strong need for new guidelines outlining (1) how researchers should operate in Indigenous peoples' territories and (2) how cooperation between researchers and local communities can be developed.

Various other guidelines include The Global Environment Facility, "Principles and Guidelines for Engagement with Indigenous peoples" (2012); United Nations Development Group, "Guidelines on Indigenous Peoples' Issues" (2009); CARE Principles for Indigenous Data Governance; UNESCO, "UNESCO Policy on Engaging with Indigenous Peoples" and "UNESCO's Engagement with Indigenous Peoples" (2018). The Akwé: Kon Voluntary Guidelines provide a collaborative framework ensuring the full involvement of Indigenous and local communities in assessing the cultural, environmental, and social impacts of proposed developments on sacred sites, lands, and waters traditionally occupied by Indigenous peoples and local communities (Secretariat of the Convention on Biological Diversity, 2004).

Common among these guidelines in that research activity must be based on free, prior, and informed consent (FPIC). It is a principle protected by international human rights standards that clearly acknowledge Indigenous peoples' right to self-determination, stating that "all peoples have the right to freely pursue their economic, social and cultural development." (Corntassel, 2008). The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), the Convention on Biological Diversity, and the International Labour Organization Convention 169 (ILO 169) all uphold FPIC.

International recognition of Indigenous peoples' rights also helped them work on Indigenous ethical guidelines to move forward (Juutilainen, 2017). For example, UNESCO's Universal Declaration on Bioethics and Human Rights' (2005) gave specific attention to Indigenous peoples' interests in research affecting them, as well as communities' roles in providing consent for such activities. UNDRIP also highlights Indigenous peoples' collective right to exercise control over expressions of their cultural heritage and intellectual property. Article 31 states, "*Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge, and traditional cultural expressions, as well as the manifestations of their sciences...*" (Khotimah, 2007).

[2] https://www.arcticscienceministerial.org/arctic/de/home/home_node

Ethical principles for research on Indigenous Peoples at the national level: Tri-Council Policy Statement 2 (1998, updated in 2018) – Chap. 9: Research Involving the First Nations, Inuit and Métis Peoples of Canada (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, and Social Sciences and Humanities Research Council, 2018); Te Ara Tika Guidelines for Māori research ethics: A framework for researchers and ethics committee members (Hudson et al., 2010); and AIATSIS Code of Ethics for Aboriginal and Torres Strait Islander Research (2020). Canada also has various guidelines for cooperating and working with Indigenous peoples at regional level. Take, for example, *Draft Principles that Guide the Province of British Columbia's Relationship with Indigenous Peoples*; Ontario Human Rights Commission's report (2018); and Canada's Ministry of Health and Long-Term Care, *Relationship with Indigenous Communities Guideline* (2018).

According to Magga et al. (2020), in Canada, there are regional protocols as well as regional permitting processes for entering Indigenous communities and territories to conduct research. Polar Knowledge Canada (POLAR) has provided instructions for conducting research in Canada's North. These instructions showcase best practices as well as region-specific information for conducting research in Canadian North. The Gwich'in Traditional Knowledge Policy entitled, Working with Gwich'in Traditional Knowledge in the Gwich'in Settlement Region (2004), was drafted in preparation for including, but not limited to increased research interests in the Gwich'in Region and the Conducting Traditional Knowledge Research in the Gwich'in Settlement Area – A Guide for Researchers (2011) sets guidelines and requires research agreement to be completed for any research that documents Gwich'in Traditional Knowledge. This work is led by Gwich'in Tribal Council and their traditional knowledge policy (Gwich'in Tribal Council, 2004; Gwich'in Council Research, n.d.; Gwich'in Social and Cultural Institute, 2011. Magga et al. (2020) highlight some of the regional processes: the permitting authorities in Yukon, Northwest Territories, Nunavut and Nunatsiavut. In Nunatsiavut, Nunatsiavut Government requires research applications for any research conducted in Nunatsiavut and it can only happen with the full knowledge of the Nunatsiavut Government and Labrador Inuit. There are also research licenses for conducting research in both the Northwest Territories and Yukon (Magga et al., 2020).

In the Canadian context, principles of ownership, control, access, and possession (OCAP), is self-determination applied to research. OCAP is a political response to persistent colonial approaches to research and information management (Schnarch, 2004). The principles of OCAP inform the development of national ethics policies in Canada and guide researchers working with First Nations, Inuit, and Metis communities (Juutilainen, 2017: 29).

The development and consolidation of sustainable practices in Sámi research, especially the importance of ethical guidelines for Sámi research, has been discussed among Sámi and Sámi research since the 1970s (Holmberg, 2018, 2021). The Ethical Guidelines for Indigenous Health Research (2016) and the "Proposal for Ethical Guidelines for Sámi Health Research and Research on Sámi Human Biological Material" (Kvernmo et al., 2018) offer an overview of principles to

ensure that research is considered safe from a cultural perspective, that it is respectful and responsible, of good quality, and useful to the Sámi communities as well as individuals. The guidelines intend to establish that research on the Sámi population and local Sámi communities, or their biological material, takes into account and respects the diversity and distinctive character that distinguishes Sámi culture and the Sámi communities, and ensures full equality and reciprocity throughout the research process (Kvernmo et al., 2018).

The Finnish Sámi Parliament has a procedure for seeking the FPIC of their Sámi constituency in research projects dealing with cultural heritage, traditional knowledge, and other activities that have or may have an impact on this heritage and knowledge (Sámi Parliament in Finland, 2019). The procedure aims to guarantee that the Sámi Indigenous rights are realized, promote the preservation of Sámi cultural heritage and traditional knowledge, and safeguard the Sámi self-determination. Based both on FPIC and the Akwé: Kon Guidelines, the procedure was adopted in 2016 and the English version became available in 2019 (Sámi Parliament in Finland). In 2018, a working group3 was established to develop ethical guidelines for research involving the Sámi in Finland. The Working group was set up by the experts on the Sámi and Indigenous studies from the Universities of Oulu, Rovaniemi, and Helsinki and from other relevant Sámi institutions.

All in all, each culture's uniqueness makes it impossible to develop general guidelines for the traditional knowledge of all cultures (Nordin Jonsson, 2011).

6.7 Ethical Considerations in Research and Science Cooperation

One of the areas where the ethics of dealing with Indigenous knowledge systems comes to the fore could be the area of food. Obviously, reindeer husbandry relates closely to our foodways. Therefore, food ethics would be an example where what we discussed above about Indigenous knowledge systems has to be implemented.

Food ethics has to observe that our modern food ways are in fact not sustainable in the long run, that our food production is out of sync with nature, that food security is not guaranteed on a global scale, and that our food production adds to climate change (Kaiser & Algers, 2016). And, furthermore, we have to add our more recent insight that mainstream food consumption is very often unhealthy and wasteful. What we have observed from the ethical point of view is that we in the industrialized nations have commodified all of nature and all the animals around us and that what we first thought were benefits quickly turned into problems.

Now, one can hold that respectful life and respect for nature is or should be a basic value for all of humanity. However, in real life, this is particularly true for all Indigenous communities. Somehow in the modern western world, we seem to have

lost this tradition and forgotten this basic value. We forget that we have to interact *with* nature, and not against it. We don't have to subordinate it to our will and exploit its resource to the very limit, but, again, we have to work together with the laws of nature, seek harmony and maintain integrity. The case of modern food production is an example of disrespect for our environment and valuable cultural traditions.

This respect for nature is still very dominant in Indigenous cultures as it is for example in the Sámi culture or in the Māori culture. In that sense, one of our conclusions is that Indigenous food culture can be a guide, and maybe a benchmark for more ethical and sustainable food in the future. This is our basic message: Let us sit down and learn from each other, let us use these traditions, let us use these different frames of knowledge and these different value systems in order to mix them fruitfully and to learn from each other. We need to develop better the basic virtues of good dialogue across cultural boundaries and science. We have to open up for diversity in knowledge frames and the various lenses we apply to approach an issue. In terms of transdisciplinarity and co-production, we call for immediate ethical consequences and may guide us to better ethics in our dealings with food, with the environment, and the conditions of living together in culturally diverse societies.

6.8 Conclusion: The Urgency of Arctic Change

Indigenous Peoples in the Arctic have to deal with unexpected and unparalleled challenges which demand adaptation and resilience strategies in place (Tonkopeeva et al., 2022). Led by the generationally inherited knowledge, nomadic reindeer herders and caribou hunters are living on the frontlines of climate change and globalization (Markkula et al., 2019; Käyhkö & Horstkotte, 2017). However, as observed by Magga et al. (2020) the past Indigenous peoples' assimilation and ongoing marginalization, including inaccessible decision-making structures and science, aggravates adaptive capacity to these changes. Therefore, Indigenous communities are in an urgently need to develop creative ways that constructively support the future of their cultures, well-being, and daily lives (Magga et al., 2020).

New ways of positive cooperation between researchers and communities that make use of multiple ways of knowing – including science, Indigenous knowledge, and local knowledge – can facilitate holistic understanding, societal resilience, and adaptive capacity.

We now witness an explosion of research, development, and policy agendas in the Arctic. Complex global realities call for more collaborative relationships that can facilitate innovative educational strategies and integrated observation systems. It is necessary to secure future training for leadership capabilities in research activities and within Indigenous communities. Training should address long-term sustainable thinking based on the best available practices of knowledge co-production that would involve scientific, traditional, and Indigenous knowledge.

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