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Vera Kuklina
George Washington University

URBAN SUSTAINABILITY IN THE ARCTIC

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Urban Sustainability in the Arctic

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Preface

The purpose of this book is to advance efforts to measure sustainability in Arctic cities in the circumpolar north. Ultimately, we hope to apply the 128 indicators listed by the International Organization for Standardization (ISO) in its ISO 37120 (Sustainable cities and communities—Indicators for city services and quality of life) to approximately fifty cities in the Far North. ISO published the first version of the standard in 2014 and a revised version in 2018. We have not succeeded in collecting the 6,500 pieces of data for that analysis yet. The chapters in this book move in that direction by testing how some of the key indicators work in various case study cities. As a stepping-stone to the larger comprehensive analysis, these chapters give in-depth discussions of various aspects of urban sustainability—from energy use to culture-promoting institutions—in a variety of real-world circumstances. These bits and pieces of the larger comprehensive analysis provide a collection of insights designed to illuminate how relevant the international standard for urban sustainability is for cities in the Far North, providing guidance before we apply the 128 indicators to the fifty cities in a comprehensive manner.

We start with the assumption that the ISO standard can apply to the cities of the Far North even if the authors of the standard were not specifically thinking of these cities. However, as the chapters show, the standard often falls short and we identify some places where understanding sustainability in the North requires going beyond the set of indicators included in ISO 37120.

This book is one of the outputs of our Arctic project, which is part of the Partnerships for International Research and Education (PIRE): Promoting Urban Sustainability in the Arctic, which was funded by the National Science Foundation (NSF; Award 1545913). Part of the funding for this work comes from support that the Academy of Finland provided in funding a related project, Promoting Urban Sustainability in the Arctic (no: 299258).

Frequently we refer to this collective enterprise as the Arctic PIRE project. The project, currently funded for a five-year period from 2016 to 2021, is a multidisciplinary, multinational collaboration based at the George Washington University. US partners include the University of Virginia, the Massachusetts Institute of Technology, the University of Northern Iowa, and the University of Alaska. International partners include the University of Helsinki, Moscow State University, the State Hydrological Institute in Saint Petersburg, and the Norwegian Institute for International Affairs. Disciplinary specialists involved represent the fields of political science, physical and human geography, sociology, economics, architecture, urban planning, and climatology. We have also made a strong effort to incorporate young faculty as well as both graduate and undergraduate students into the project in order to provide some hands-on training to the next generation of natural and social scientists. Similarly, where possible we have reached out to policymakers in an effort to gain a better understanding of their concerns and find ways that our research can address important issues.

The central research task is gathering the data to measure the 128 indicators for the fifty cities. That is an ongoing process and the first set of results are described here. As this book shows, we are trying to combine a robust quantitative analysis with a variety of case studies, interviews, and research trips to put the numerical data in the context of lived reality. Other elements of the project include outreach to K–12 students as part of a project called #60above60 that gives students in various northern and nonnorthern locations an opportunity to share sixty-second videos about their cities and how they would go about addressing local sustainability issues. We conducted two summer field trips, one in 2017 and one in 2019, visiting the cities of Salekhard and Vorkuta in Russia, Anchorage and Fairbanks in Alaska, and Whitehorse in Canada, with a group of faculty and students. Project participants have also worked with the Fairbanks Sustainability Commission to help develop both a sustainability plan and improved communication to encourage progress in the areas of food security, energy efficiency, and solid waste management.

This book builds on the analysis published in an earlier volume *Sustaining Russia's Arctic Cities: Resource Politics, Migration, and Climate Change.* That earlier book focused on Russia and laid out the key challenges that Arctic cities are addressing as they try to improve their levels of sustainability. This volume is a necessary step that will lead, ultimately, to a comprehensive analysis of sustainability in Arctic cities. The conclusion discusses ongoing efforts in that direction.

Robert W. Orttung

Acknowledgments

We would like to thank the National Science Foundation (NSF) for funding our Arctic project, which is part of the Partnerships for International Research and Education (PIRE): Promoting Urban Sustainability in the Arctic (Award 1545913). The NSF funding provided an overall umbrella for the research reported here. In addition, many of the scholars had additional grants that supported their particular work. The relevant individual chapters acknowledge those sponsors. These funders include the National Science Foundation, the Russian Geographical Society, and the Russian Foundation for Basic Research.

Part I

Urban Sustainability in the Arctic

INTRODUCTION

Measuring Urban Sustainability in Arctic Conditions

Robert W. Orttung and Luis Suter

Cities have taken on a new significance since the beginning of the twenty-first century, with more than half the global population now living in urban centers. Although cities make up only 3 percent of the world's landmass, the United Nations estimates that in 2018 urban populations accounted for 55 percent of the global population, with that number constantly rising (United Nations Department of Economic and Social Affairs Population Division 2019). The growth of the world's cities has led to growing concerns about urban sustainability and invigorated efforts to define and measure this concept (Science for Environment Policy 2015). Most prominently, the United Nations' seventeen Sustainable Development Goals (SDGs) adopted in 2015 includes SDG 11, "Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable," which focuses specifically on cities and communities.

Despite its remote location, the Arctic has long participated in the global urbanization trend. A majority of the Arctic population resides in urban environments; the region has seen urban growth in resource-rich areas even as the populations in other parts of the Arctic shrink (Dybbroe 2008; Heleniak 2010, 2013; Howe 2009). As Carrie Schaffner's chapter in this volume shows, expanding cities provide housing, jobs, and education for human populations (Glaeser 2011), but also impart negative effects such as pollution, encroachment on open land, and contributions to impacts on the surrounding natural environment far beyond the settlement limits (McKinney 2008). The

Arctic region is particularly sensitive since average temperatures there have risen much more quickly than the global rate over the past fifty years (Arctic Monitoring and Assessment Programme 2017). The changing climate has spurred an interest in measuring the state of the Arctic urban centers, those centers' efforts to promote sustainability, and the efficacy of such efforts. It is imperative to properly assess the extent of the challenges these cities face and the effectiveness of the policies they implement in response to the challenges in order to estimate their ability to survive into the future.

The purpose of this chapter is to introduce a method for measuring the sustainability of Arctic cities. Originally, the project team sought to develop its own Arctic Urban Sustainability Index that would best fit Arctic conditions. The effort was based on the thinking that the Arctic is sufficiently different from the rest of the globe that it deserves its own index. That task proved difficult to execute, however: The assembled multidisciplinary, multinational team had difficulty agreeing on which indicators should be included in the index and how to condense this list down to a top ten that would most effectively inform policymakers. At the same time, a review of the project by National Science Foundation (NSF) auditors suggested that the best way to move forward was simply to apply the international standard for urban sustainability developed by the International Organization for Standardization (ISO)—ISO 37120. The ISO is a nongovernmental international organization linking 164 national bodies that has published nearly 23,000 standards, covering a range of products, services, and systems.

ISO 37120, described in more detail below, is intended to apply to all cities on the planet. It seeks to be an international set of indicators designed to measure and promote sustainability while creating a uniform standard that makes it possible to compare experiences across cities. Use of this standard allows our project to test how well it applies in the extreme conditions of the Far North, and identifies areas where the standard falls short, for example in addressing issues such as remoteness and permafrost. Another benefit of working with ISO 37120 as opposed to a specific Arctic index is that it integrates our work and the Arctic cities into a global conversation in which all cities are measured by the same standard. To the extent that Arctic cities are different from other cities, comparing them across similar measures makes it possible to gauge the level of difference.

This chapter proceeds as follows: First, we define urban sustainability. Then we briefly trace the history of urban sustainability indicators. Building on this discussion, we discuss the creation of ISO 37120 and then examine how it can be applied to Arctic cities. After examining issues of data collection, we then place ISO 37120 in the context of other sets of indicators that have been drawn up to apply to Arctic circumstances. Finally, we provide a roadmap for the book. Although this volume cannot comprehensively test ISO 37120 in Arctic conditions, it provides an in-depth examination of some of the indicators in the context of a variety of case study cities.

Defining Urban Sustainability

Our definition of a sustainable city draws on the foundational statements that stress the use of resources in a way that does not impinge on the living standards of future generations (World Commission on Environment and Development 1987). Sustainability is holistic and highlights the many integrative links among its constitutive components (Dale 2012; Matson, Clark, and Andersson 2016). In the case of ISO 37120 these components range across nineteen categories, from economic vitality to wastewater management. Concerns that previous work did not take full account of the world's complexity and the level of interactions among its systems have led universities to encourage increased multidisciplinary studies from their faculty (Brown, Deletic, and Wong 2015), caused funding agencies like NSF to support research on nexus issues that exist at the interfaces of several systems (e.g., the food-energy-water nexus), and encouraged the National Academy of Sciences to study ways to promote team science (Cooke and Hilton 2015).

Sustainability indicators are collections of specific measurable characteristics of society and nature that measure the various components of social, economic, and environmental quality (Reed, Fraser, and Dougill 2006). They are distinguishable from simple environmental, economic, or social indicators by the way they are integrated and developed with input from multiple stakeholders (Maclaren 1996). Most importantly, the sustainability indicators should not give a snapshot of current conditions, as other indicators do, but instead should provide a sense of whether a city is using its resources in a manner that will allow it to continue to develop into the future.

Despite the considerable work addressing sustainable cities, there are "no mature models of urban sustainability" available today whether in the Arctic or the rest of the planet (Gardner 2016: 3). Even though ISO 37120 lays out a clear set of indicators, there is little agreement about what components are necessary for a sustainable city and the necessary relationship among these components. In fact, "a sustainable Riyadh will look and operate differently from a sustainable Reykjavik," given the entirely different contexts in which they are located (Gardner 2016: 3).

Previous attempts to develop indexes and ranking systems of all sorts have often run into trouble. According to one recent survey of the field, they are "often incoherently defined, anchored in confused and untested theories, measured idiosyncratically, and subject to manipulation by both the raters and the rated, leading to unintended, unwanted consequences" (Snyder and Cooley 2015: 179). Moreover, it is important to take into account ethical considerations in determining what is counted and who is doing the counting, thereby seeking to remember and articulate what is left out (Stone 2018). In a practical sense, indicators are typically a simple way to measure a complex situation and are most effective in starting a conversation rather than in producing a comprehensive assessment (Mair et al. 2018). Despite these clear limitations, we think it useful to set a baseline, measure progress, and identify best practices in the pursuit of urban sustainability in Arctic conditions.

Brief History of Urban Sustainability Indicators

Given the holistic and future-oriented approach that sustainability requires, how is it possible to measure sustainability in quantitative terms? The Rio Earth Summit of 1992 began to address the lack of assessment capacity by publishing Agenda 21, which included a call (in chapter 40), for the development of sustainability indicators (United Nations Conference on Environment & Development [UNCED] 1992). Since the Agenda 21 call in 1992, hundreds of indexes have appeared, ranging widely in scope and scale (Parris and Kates 2003). Twenty years later, the 2012 Rio+20 Earth Summit stressed practical measures for achieving sustainability through the building of green economies and green development pathways in developed and developing countries alike. The idea was to ensure robust economic performance in the developed and developing worlds while also taking into account environmental and social concerns.

The Conference of Parties (COP) meeting in Paris, called COP21 or the 2015 Paris Climate Conference, was even more focused on the actual implementation of policies, with each member country submitting individual plans on how to promote country-level sustainability goals. The seventeen UN SDGs, adopted in 2015 with a target of 2030 provide a comprehensive set of guideposts, addressing issues ranging from poverty to the state of the oceans. While the UN identified seventeen discrete SDGs, the enterprise stresses the interconnectedness of the goals and the need to work on them simultaneously. SDG 11 of this ambitious development plan addresses communities and cities, calling for improvements in environmental stewardship, the building of more-inclusive societies, and long-term planning to continue economic growth without adversely affecting the planet or disadvantaged peoples. SDG 11 seeks to take a more integrated approach than previous efforts by focusing on universal access to adequate, safe, and affordable housing; public transportation; participatory and integrated planning and management, especially with regard to inclusion, resource efficiency, mitigation and adaptation to climate change, and resilience to disasters; protection of cultural and natural heritage; reduction of deaths due to disasters; reduction of adverse environmental impacts from air pollution and solid waste; access to green public spaces; positive economic, social, and environmental links between urban, peri-urban, and rural areas; and the offer of support to developing countries in creating green buildings with the use of local materials to reduce environmental impact.

Creating ISO 37120

Although the SDGs are more noticeable, the ISO 37120 is the first international standard on city metrics and it is more comprehensive in its scope of analyzing urban sustainability. ISO published the first version in 2014 (ISO 2014) and a revised version in the summer of 2018. ISO 37120 is based on the broadly used Global City Indicators Facility project, which included more than 255 cities across eighty-two countries. The World Bank set up this project in 2007 and it is now housed at the University of Toronto, which hosts an on-line database seeking to make the data for the participating cities available (World Council on City Data n.d.).

ISO 37120 2014 included 115 indicators organized into twenty themes (ISO 2014). Of the 115 indicators, 31 were considered to be core, and to require reporting from all participating cities. The other indicators were considered to be supplementary, and to require reporting when available. The core indicators each fulfill the following conditions: They are reportable annually, comparable, relevant to public policymaking, cost effective to collect, understandable, and not overly complex. The revised 2018 version of the ISO 37120 included

Table 0.1. | *ISO 37120 core, supporting, and profile indicators*

Theme	Core indicators	Supporting indicators	Profile indicators
Economy	1	7	3
Education	4	2	0
Energy	5	2	2
Environment and climate change	3	6	0
Finance	2	2	2
Governance	1	3	0
Health	4	2	0
Housing	2	2	6
Population and Social Conditions	1	2	6
Recreation	0	2	0
Safety	5	5	0
Solid Waste	5	5	0
Sport and Culture	1	2	0
Telecommunications	0	2	0
Transportation	2	5	2
Urban/Local Agriculture and Food Security	1	3	0
Urban Planning	1	3	3
Waste water	3	1	0
Water	4	3	0
Total	*45*	*59*	*24*

128 indicators of which 45 were core indicators, for nineteen domains of sustainability—economy; education; energy; environment and climate change; finance; governance; health; housing; population and social conditions; recreation; safety; solid waste; sport and culture; telecommunication; transportation; urban/local agriculture and food security; urban planning; wastewater; and water (ISO 2018). Table 0.1 summarizes the key components of the standard. In addition to the forty-five core indicators, there are fifty-nine supporting indicators and twenty-four profile indicators. The ISO requires cities to collect data on the core indicators to participate in the measurement process, recommends collecting the supporting indicators, and suggests collecting the profile indicators as background information. The number of core indicators ranges from zero to five for the nineteen topics.

Applying ISO 37120 to Arctic Cities

As noted in the preface, we have not been able to collect all the data required to fully measure the approximately fifty Arctic cities described in chapter 1 that make up the heart of this project. Instead, the chapters in this book seek to test out a few of the indicators on a variety of case study cities.

By applying ISO 37120 to some of the most extreme situations on the planet we can stress test the list of indicators included in it and determine whether these indicators are in fact the best available for measuring urban sustainability and if they make sense in Arctic conditions. If they do not give us good data about the Arctic cities, perhaps the standard is not effective for other cities either. Our conclusions on the application of ISO 37120 to Arctic cities will generate new voices in the broader international conversation about how best to measure urban sustainability. Of course, it might eventually turn out that cities are not all alike, so that some components of the ISO index are more universal than others (Smith 2019). Beyond the Arctic/non-Arctic distinction, there may be strong differences between developed and less-developed cities, tropical and temperate cities, and coastal and inland cities. Our findings will fit into the broader context of this discussion.

Naturally, we do not plan to accept ISO 37120 uncritically and many of the chapters in this book provide extensions to the ISO. This introductory chapter provides a brief introduction to ISO 37120, and the book's Conclusion ties together the numerous themes raised by each of the specific chapters. The chapters in this book examine how well a select group of indicators work for a variety of case study cities.

Data Collection

A central concern in measuring the indicators is data collection. The authors of ISO 37120 specifically sought to define core variables that are reportable annually, comparable, relevant to public policy-making, cost effective to collect, understandable, and not overly complex. Currently, there are no widely accepted standards among city governments identifying which data they should collect. City governments around the world gather different data; even when data is collected on similar topics, such as housing, the numbers often are not comparable across countries. The Arctic region spans eight countries whose cities have different methods and schedules for collecting information on their economies, societies, and environments. The diversity, both within cities and across the circumpolar north, is extenuated by the variability in social, political, and economic systems within the Arctic.

Even when the data is available, questions remain about what it is actually telling us. For example, if we have a number measuring a specific aspect of sustainability for a city, does that number tell us about the entire city? In other words, will an indicator hold true across the entire urban area, or is it specific to a single neighborhood or to several subregions within the city? In theory, an indicator must be able to represent an entire urban area, but cities are inherently patchy and diverse (Grove et al. 2015). The result is that, even when we have a number for a city, it might not tell us much about the level of variety across the city in the dimension it is measuring.

Europe boasts the most urban sustainability indicators of any region in the world, and these indexes often focus on different aspects of sustainability. The richness of these indexes results largely from the resources of the Eurostat data collection agency. This institution provides standardized data collection methods, taking in the same measures across many countries. This centralized data center has made it easy to design and test the functionality of many different indexes, and provides historical data with which to validate the accuracy of measures. Unfortunately, Arctic cities do not have a similar system in place that is well developed enough to serve our purposes. The Arctic Council publishes papers using this type of internationally standardized data, but it does not always publish the data that the research was based on. On 28 March 2016 NSF created the Arctic Data Center (http://arcticdata.io/), and we hope eventually to publish the data generated by this project there.

Existing Arctic Indicators

Before diving into our analysis of urban sustainability in Arctic cities using ISO 37120, we here briefly describe previous efforts to measure the sustainability of Arctic cities. To date, Arctic researchers have started developing indicators, but they have not yet focused specifically on urban sustainability. Arctic indicators first emphasized social and environmental concerns and were associated with the need of Arctic communities and policymakers to resolve the complex problems associated with climate change. But the process of developing useful indicators is still in early stages of development. A recent survey of Arctic sustainability research called for sustainability indicators that better link social and ecological processes (Petrov et al. 2015: 9). Additionally, there is a need for greater knowledge about urban areas in the Arctic since the existing “sustainability literature pays negligible attention to urban areas and urban-rural relationships" (Petrov et al. 2015: 11). A key task for the proposed Agenda 2025 is the design of sustainability indicators and monitoring systems (Petrov et al. 2015).

One of the most prominent efforts to develop a set of indicators for the Far North so far has been the Arctic Social Indicators (ASI) project. This effort began in 2006 in response to the publication of the *Arctic Human Development Report,* the first social sciences/humanities report commissioned by the Arctic Council. That report declared, "The SDWG [Sustainable Development Working Group] should organize a workshop to devise a small number of indicators to be used in monitoring or tracking changes in human development in the Arctic over time" (Einarsson et al. 2004: 11). As a result, for the first time Arctic scholars sought systematic ways to measure "social, economic and cultural trajectories of change" (J. Larsen, Schweitzer, and Petrov 2014). They were particularly concerned that life in the Arctic was different from life elsewhere, and therefore sought to add new categories to existing indexes such as the United Nations Human Development Index, including fate control (see chapter 6 of this volume), cultural integrity, and contact with nature (Einarsson et al. 2004: 11). The first Arctic Social Indicators report, published in 2010, included six general domains to measure:

1. Health and Population
2. Material Well-Being
3. Education
4. Cultural Well-Being
5. Contact with Nature
6. Fate Control

The report went on to develop seven indicators within these six domains:

1. Infant Mortality (Domain: Health/Population)
2. Net-migration (Domains: Health and Population; Material Well-Being)
3. Consumption/harvest of local foods (Domains: Contact with Nature; Material Well-being)
4. Per capita household income (Domain: Material Well-being)
5. Ratio of students successfully completing postsecondary education (Domain: Education)
6. Language retention (Domain: Cultural Well-Being)
7. Fate Control Index (Domain: Fate Control)

(J. N. Larsen, Schweitzer, and Fondahl 2010: 153–54)

Criteria for including these particular indicators included “data availability, data affordability, ease of measurement, robustness, scalability and inclusiveness” (J. Larsen et al. 2014: 33).

On the basis of the Arctic Social Indicators, the team commissioned a series of case studies to test the usefulness of the indicators. As the final report, published in 2014, points out, the indicators were focused on Indigenous peoples living in the Arctic and have less to tell us about non-Indigenous people living there. “Although ASI-I insists that the ASI framework must apply to both Indigenous and non-Indigenous Arctic residents, the nature of the data and indicators themselves in the Cultural Vitality, Contact with Nature, and Fate Control domains allow measuring wellbeing of Indigenous people and often precludes us from considering other groups. This is a major limitation in many case studies presented in the current report” (J. Larsen et al. 2014: 46).

Another limitation was that “significant data challenges and incompatible units of measurement across national and administrative borders prohibit the application of ASI indicators to all regions of the Arctic” (J. Larsen et al. 2014: 47). In particular,

> Our original ambition had been to produce extensive sets of comparable data featuring ASI indicators for each of the six ASI domains. However, this task soon proved impossible given the current state of data quality and lack of data availability both at the panarctic level and at different geographical scales. It became clear that we had to limit our analysis to selected regions and, furthermore, that our set of indicators could not be compared between regions in any meaningful way given existing differences in data protocols in addition to other data issues. Furthermore, all five regional case studies required our teams to deviate to varying degrees from the technical definitions of individual ASI indicators. It was necessary to make adjustments to tailor the analysis to meet the regional availability of data and, hence, to settle for the best possible proxies or in some cases substitute with secondbest alternative indicators—though without compromising the validity of the analysis. (J. Larsen et al. 2014: 278)

Overall, the Russian case study, which focused on the region of Sakha (Yakutia), proved to the be the least-data-rich region. In this region, as in others, one could often pick the indicator that best told the story one wanted to tell about the region. For example, if you wanted to highlight a positive trend, you could emphasize that infant mortality rates were falling, but if you took a more pessimistic view, you could stress that suicide rates increased after the collapse of the

Soviet Union. Governments are also likely to try to manipulate indicators in an effort to convince domestic and international audiences that they are performing well (Cooley 2015: 5; Libman and Obydenkova 2016; Zaloznaya and Hagan 2012). Such findings point toward the need to collect several indicators for each domain to develop a complete and nuanced picture of the situation.

Another set of indicators came from Andrey Petrov's project on the Inuvialuit, a group of Indigenous people in the Arctic, as part of the Canadian project called Resources and Sustainable Development in the Arctic. This dataset includes information on population, education, culture, the labor force, well-being, income, government, and housing.

Roadmap for the Book

This book is divided into four parts. Part I introduces what we mean by urban sustainability and how to measure it. The Introduction describes ISO 37120 as the tool we will use to measure sustainability and chapter 1 lays out what we mean by Arctic cities. Part II includes chapters that test out various urban sustainability indicators in Arctic conditions to see how well they work. Part III discusses a variety of dimensions that are missing from the current international standard and suggests ways to provide a more comprehensive understanding of urban sustainability in Arctic conditions. Finally, the Conclusion pulls together the various strands of what we have learned and provides a comprehensive analysis of what an Arctic Urban Sustainability Index might look like, showing where ISO 37120 succeeds and where it falls short. The discussion below briefly lays out the arguments from each of the chapters.

Part I: Urban Sustainability in the Arctic

Chapter 1. "Arctic Cities," by Carrie Schaffner, George Washington University

This chapter explains how we define Arctic cities and lists the nearly fifty cities that meet our criteria. The chapter then explains how Arctic cities are different from other cities in the rest of the world. Most notably, their environment limits access, makes energy expensive, requires intensive attention to infrastructure, reduces the availability of labor, mandates reliance on vulnerable food supply chains, and threatens the maintenance of a strong community culture. Key drivers for development in the Arctic are the development of indigenous societies, resource extraction, and protecting national security. Finally, the chapter explains that, despite the harsh conditions, people remain in the Arctic, among other reasons in order to develop their place-based capital and benefit from subsidies. This overview of Arctic cities provides the context in which we proceed to test out some of the ISO indicators in various case study cities.

Part II: Testing Indicators of Arctic Urban Sustainability

Chapter 2. "Shrinking Cities, Growing Cities: A Comparative Analysis of Vorkuta and Salekhard," by Nadezhda Zamyatina, Moscow State University; and Luis Suter, Nikolay Shiklomanov, and Dmitry Streletskiy, George Washington University

The authors apply several of the ISO indicators to two Russian cities: Vorkuta, a declining coal-producing city, and Salekhard, a booming natural gas regional capital. Vorkuta reached the peak of its productivity in the 1950s and 1960s and has been shrinking along with Russia's coal industry ever since. Salekhard is now developing as global demand for natural gas grows. This case study of two cities helps refine our understanding of how ISO 37120 works in Arctic conditions by focusing attention on the determinative indicators of transportation links to southern cities and diversification of the economy into export-oriented resource extraction, provision of administrative services, and locally oriented economic development. The chapter also stresses urban design and attachment to place. The authors argue that the ISO set of indicators would better apply to the Arctic by taking into account the remoteness and inaccessibility of Arctic cities, their frequent reliance on a single factory, the way the cities are laid out, and the emotional links people feel toward their cities due to the social capital they have developed over time.

Chapter 3. "Norilsk: Measuring Sustainability in Population Size and Well-Being," by Marlene Laruelle, George Washington University

As the largest city built on permafrost, one of the most polluted in the world, and a destination for a range of diverse emigrants, Norilsk puts a heavy burden on its social network. This chapter examines a wide range of ISO indicators in the context of Norilsk. It finds that the index provides a useful overview of the state of the city. However, the indicators fall short because they do not measure the effort stakeholders make in trying to improve their sustainability performance, the emotional attachments based on a sense of place, the social fabric of the city and its residents, the remoteness of the city locations and transportation accessibility, and the cost of goods in the city in relation to local salaries. Additionally, the ISO measures do not provide an overall sense of the dynamics in the city.

Chapter 4. "Yakutsk: Culture for Sustainability," by Vera Kuklina with Natalia Shishigina, V. B. Sochava Institute of Geography of Siberian Branch of Russian Academy of Sciences

This chapter applies the culture components of ISO 37120 to Yakutsk. The chapter develops four indicators for culture: cultural institutions, cultural diversity, cultural economy, and contact with nature. The analysis shows how each of these elements functions in the city context. Counting cultural institutions is an easy way to compare cities, but the numbers hide much of the richness of cultural life in Yakutsk. The cultural diversity section addresses the questions of ethnic and rural identities, linguistic and religious landscapes, and institutions in the urban context. Cultural economy includes economic activities that use culture as a resource. Finally, contact with nature examines how Indigenous peoples bring their practices into the city. Ultimately, the chapter shows that the quantitative indicators can be useful in providing an introduction to the city and in launching a discussion of culture, but that qualitative studies must complement the indicators to provide a more comprehensive understanding of how culture can contribute to sustainability.

Chapter 5. "Assessing Energy Security in Nome and Lavrentiya: How Breaking Down Energy and Governance Silos Makes a Difference," by Katherine Weingartner, George Washington University; and Evgenii Antonov and Alexey Maslakov, Moscow State University

This chapter examines how two small, geographically similar cities near the Bering Sea, one in the United States and one in Russia, ensure their energy security by investigating the ISO 37120 parameters for energy and governance. The primary focus is on how the different governance structures of the two cities impact energy resilience. Both city structures are remote from higher-standing regional and federal governments, but Nome has more autonomy than Lavrentiya in devising local solutions. The chapter concludes ISO 37120 would be more effective in addressing energy governance issues if it included a way to measure the availability of financing for renewable energy projects at the municipal level.

Part III. Extending the International Standard for Measuring Urban Sustainability

Chapter 6. "Fate Control and Sustainability in Arctic Cities: Recasting Fate Control Indicators for Arctic Urban Communities," by Andrey N. Petrov, University of Northern Iowa

This chapter examines in detail the concept of fate control, defined here as the ability to guide one's own destiny by making choices and transforming those choices into actions and outcomes. The chapter develops a method to measure each city's capacity to make choices and the resources it has to implement them. The chapter contributes to the theoretical dimension of the discussion by extending the international standard for measuring urban sustainability by adding a measure of the ability of communities and individuals to govern themselves. Petrov applies the Fate Control Index to twelve Arctic cities, demonstrating what this tool can tell us and illuminating the road forward for future applications.

Chapter 7. "What Do ISO Indicators Tell Us About Corporate Social Responsibility and Sustainability in Cities of the Yamal-Nenets Autonomous Okrug, Russia?," by Stephanie Hitztaler and Veli-Pekka Tynkkynen, University of Helsinki

This chapter uses several ISO 37120 indicators to measure the contribution of corporate social responsibility to the cities of the natural-gas-producing Yamal-Nenets Autonomous Okrug. Some of the indicators show the benefits of such programs, especially in the area of building new sports facilities. But despite this improvement in the sustainability ranking as measured by this indicator, the ongoing fossil fuel extraction and Gazprom's overall impact on the area reduce the city's sustainability. In this sense, ISO indicators can be cherry picked in ways that are deceptive in terms of a corporation's overall impact on urban sustainability.

Chapter 8. "Planning for Sustainability: The Russian Case," by Alexander Sergunin, Saint Petersburg State University

Sergunin's chapter points out that ISO 37120 does not pay sufficient attention to the planning process. He provides an overview of how the urban planning process works in the comparative context of several Russia Arctic cities—Arkhangelsk, Murmansk, Monchegorsk, Nickel, Norilsk, Salekhard, Severodvinsk, and Vorkuta. He examines how these cities implement the concept of sustainable development; which governmental and societal institutions are involved and the degree to which they are open to public input; which aspects—economic, environmental, or social—are prioritized; and whether the policies are short-term efforts or are conducive to the sustainable socioeconomic and environmental development of the northern urban areas that actually improves the human condition. The analysis finds that the planning offices are typically understaffed and lack the resources for the comprehensive work to which they aspire, not all the plans emphasize the role of civil society input, the level of concern about environmental issues varies with the level of pollution in the cities, and despite some clear successes, there is a long way to go toward increasing transparency and involving public participation in the overall process.

Chapter 9. "Transport Connectivity and Adapting to Climate Change in the Russian Arctic: The Case of Sakha Republic (Yakutia)," by Aleksandra Durova, Massachusetts Institute of Technology

ISO 37120 does not pay much attention to connectivity between cities, a key problem in the Arctic. Durova's chapter addresses this issue in detail. Existing transport connectivity gaps in combination with climate change impacts make communities vulnerable to connectivity disruption risks. The livelihoods of communities in this context are largely affected by government policies in the Arctic and adaptation actions in the transport sector across various scales. This chapter examines the nature of adaptation actions in the transport sector of the Sakha Republic (Yakutia). Findings of the study demonstrate that adaptation planning remains in its infancy. When adopted, adaptation measures are shaped by a combination of stressors, including safety and emergency risks, as well as efforts to make money from climate change rather than simply addressing its deleterious impacts. Adaptation actions responding to urgent needs may reduce sensitivity and exposure to climate change risks, but do not address the root causes of vulnerabilities. Adaptations driven by potential opportunities can increase resilience of the transport system, but also both run the risk of becoming dysfunctional and increase the potential of negative implications in the long term.

Chapter 10. "Sustaining Sustainability in Whitehorse, Yukon, Canada," by James Powell, University of Alaska Southeast

Sustainability planning has little value unless the strategies prepared are actually implemented. ISO 37120 pays little attention to this issue. Whitehorse is a leader in implementation, drawing on funds from Canada's national gas tax. Key to successful plan implementation is identifying priority indicators and issuing regular reports to determine to what degree they were actually implemented. The Whitehorse program's key components include a strategic sustainability plan initiated by citizens and the city government and institutionalized with a joint Planning and Sustainability Services Office, a comprehensive list of sustainability indicators that reach across all programs, and a website for sustainability with dashboards for each indicator. Whitehorse's ability to meet many of its benchmarks makes it a good model for other Arctic cities.

Conclusion. "Next Steps for Arctic Urban Sustainability," by Robert W. Orttung, George Washington University

The conclusion ties together the major findings of the case study analyses and links them back to the theoretical introductory chapter. It then lays out the directions for future research. A key shortcoming of ISO 37120 is that it lacks a theory of sustainability that defines the drivers of sustainability. Other shortcomings include a lack of forward-looking dynamics and a failure to explain how the various components of sustainability work together. The standard does not always make sense in Arctic contexts because it does not take into account permafrost, the isolation of many northern cities, the lack of economic diversity, and the importance of Indigenous cultures. Future research will develop a comprehensive dataset that brings together measures for the 128 indicators across the nearly fifty cities with populations over twelve thousand people.

Robert W. Orttung is research professor of international affairs at the George Washington University Elliott School of International Affairs, and director of research, Sustainable GW.

Luis Suter graduated from the George Washington University with a master's degree in geography.

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CHAPTER 1

Arctic Cities

Carrie Schaffner

Introduction

When people think of the Arctic they are more likely to envision icebergs and polar bears than cities, and yet 8.5 million people live in urban areas in the circumpolar region. This chapter will provide an overview and definition of Arctic cities; consider the impacts of the unique environmental challenges affecting Arctic cities; identify what drives urban development in the Arctic; and finally, discuss why individuals choose to live in Arctic cities beyond employment alone.[1]

An Overview of Arctic Cities

There are numerous definitions of the term "Arctic" based on a combination of geographical and climatic factors. The Arctic can be demarcated by the Arctic Circle, the northernmost tree line, the permafrost line, the July isotherm, or sea ice extent. Most of these definitions incorporate an Arctic that extends well south of the actual Arctic Circle. The US Arctic Research and Policy Act of 1984, and revised in 1990, uses a strict definition following the Arctic Circle, except in Alaska where significantly more territory is added (Gaylord 2009). Previous research, such as the *Arctic Human Development Report* (Larsen and Fondahl 2015), considers these variations and adopts a wider region to be Arctic. However other prominent organizations, including the Arctic Council Emergency Prevention, Preparedness, and Response working group, the Arctic Monitoring and Assessment Programme, and the Conservation of Arctic Flora and Fauna draw the border differently as well. This project defines the Arctic region as the largest possible area encompassed by this agglomeration of Arctic research organization borders.

Defining the terms "city" or "urban" may be even more troublesome than defining "Arctic." There is no common global definition of urban settlement, and definitions vary significantly across countries and over time. Criteria might include administrative qualities, a minimum population threshold, the presence of infrastructure such as roads and power grids, the provision of services such as education and health care, and the percentage of the population employed in nonagricultural sectors. Population size and density are the most common criteria, but administrative criteria are included as a component in most national definitions of urban. Functional infrastructure and economic criteria are less common, and while urban agglomeration may be an ideal measure, it is difficult to use because of the variation in how well it is reported (United Nations Department of Economic and Social Affairs 2014).[2]

Places like New York, Singapore, London, and Dubai skew the idea of cities toward megametropolises or megacities, but settlements that are too far from these megacities to benefit from their concentration of resources and services must develop to provide those functions. It is therefore important to think of cities more fundamentally in terms of the functions they serve. Any densely populated area that serves diverse social, cultural, economic, and political activities can be considered a city. In remote regions, such as the Arctic, urban areas with smaller populations are more likely to serve many of these functions because no other city exists in proximity. Recognizing that because Arctic cities serve similar functions to larger cities in less-remote areas, our Arctic project, which is part of the National Science Foundation's Partnerships for International Research and Education (PIRE), includes any city with a population greater than twelve thousand people.

Setting quantitative parameters for Arctic cities is necessary to identify cities that should be considered, but it does have some drawbacks. There are many arguably urban places in the Arctic with populations of less than twelve thousand that have been excluded. However, we did make a few exceptions. We included Anadyr (population 8,288) because it is usually considered an important Arctic city. For similar reasons, we included Yakutsk, Magadan, and Oulu that were outside the Arctic boundaries that we otherwise used.

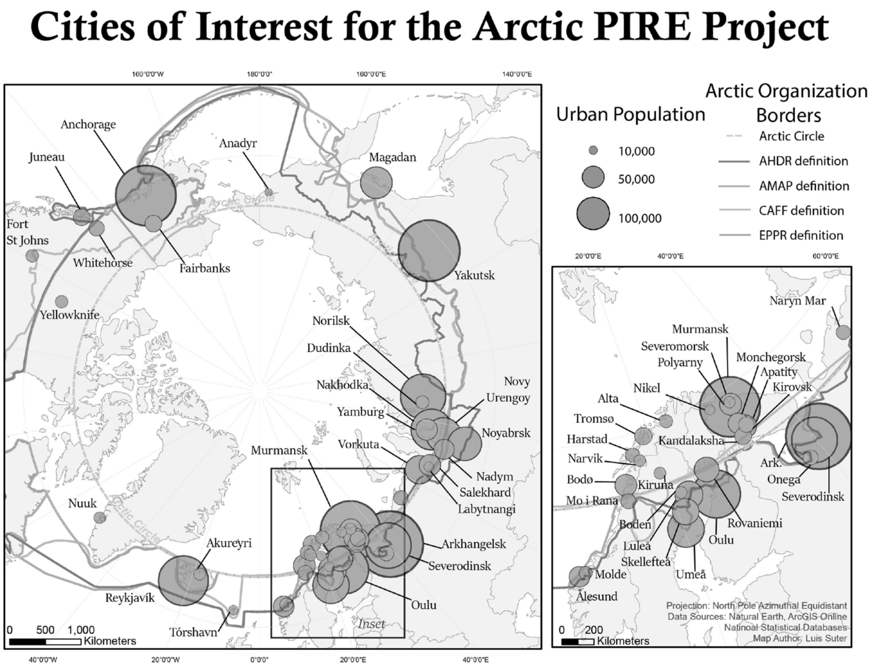
Table 1.1 | *Population statistics for Arctic cities*

Country	Total no. cities	Percentage of Arctic cities per country	Total population (Arctic cities)	Percentage of total Arctic urban population
Canada	3	6.00%	67,949	1.75%
Greenland (Denmark)	2	4.00%	29,749	0.77%
Finland	2	6.00%	262,871	6.76%
Iceland	2	4.00%	230,727	5.94%
Norway	8	16.00%	243,902	6.28%
Russia	25	50.00%	2,364,549	60.84%
Sweden	5	10.00%	323,119	8.31%
United States	3	6.00%	363,411	9.35%
Total	*50*		*3,886,277*	

There are fifty cities that meet these criteria (see table 1.1 for an overview). According to the *Arctic Human Development Report* (Larsen and Fondahl 2015), nearly two-thirds of the Arctic population live in cities. The population of Russian Arctic cities accounts for 60 percent of the Arctic urban population according to our definitions. The rest of the urban population is distributed in smaller cities throughout Northern Europe and North America. Of the twelve Arctic cities with populations greater than a hundred thousand people, Russia has eight while Finland, Iceland, Sweden, and the United States have one each. With twenty-five qualifying cities, Russia has far more cities than any other Arctic nation and these cities are generally larger than their counterparts elsewhere. There are many other differences, both striking and subtle, in the nature of Arctic cities that will be discussed in greater detail in the chapters that follow. Map 1.1 provides a visual overview of the cities included in this project.

The Impact of the Arctic Environment on Urban Development

Arctic cities contend with environmental challenges including remoteness, climatic extremes, permafrost, and polar night. Climate change exacerbates these environmental challenges. The Arctic is warming faster than any other region in the world (Adger et al. 2011; Borgerson 2013; Hassol 2004) and these changes promise to cause seasonal unpredictability, decrease snow and ice cover, destabilize permafrost, and increase the frequency and severity of storms (Descamps et al.



Map 1.1 | *Arctic cities that meet the spatial and demographic criteria of this research project. Map created by the author.*

2017; Hassol 2004; Morello 2013; Streletskiy and Shiklomanov 2016). Changes in precipitation rates and annual flow rates impact aquatic food sources, cause ice jams and resultant flooding, and increase erosion.

Loss of snow and ice has profound impacts on the Arctic. The decline of sea ice means less shore protection and increased flooding of coastal villages. As coastal villages and other remote settlements suffer the most acute effects of climate change, residents are migrating to Arctic cities; this migration is expected to increase as climate change worsens. The decline of ice and snow also reduces albedo, which is the reflectance of incoming solar irradiation. The reduction in reflectance "causes greater heating of the land and sea and therefore an acceleration of high-latitude climate warming and its attendant ecological and societal consequences" (Adger et al. 2011: 12).

The Arctic environment and the compounding effects of climate change present numerous challenges for Arctic cities. These environmental conditions impact access, energy, infrastructure construction, economic development, food security, and culture, increasing costs and complicating logistics for Arctic cities.

Access

The Arctic environment presents unique challenges for access to northern cities. Economic development in remote Arctic cities relies entirely on marine and terrestrial access, but for many Arctic cities access is seasonal because of the limitations of summer marine routes and winter roads. Conditions along these routes can affect the delivery of annual supplies, limit market access for those providing goods to cities (Goto 2017), inhibit commerce and tourism development, decrease access to education and employment opportunities outside the city, and limit residents' travel (Karlsson 2017). Though climate models vary, all predict a negative trend in ice extent and thickness in the Arctic, which is expected to lengthen the marine season and potentially open new navigation potential, particularly along the Northern Sea Route, but will also decrease terrestrial access because it undermines the reliability of winter roads (Stephenson 2016).

Winter roads, traversing ice or snow, are important modes of access for Arctic cities, allowing winter passage over bogs, rivers, and other terrain that is not passable in the summer. Some roads may be partially usable in the summer or shoulder seasons, but typically handle lower maximum weights than in the winter. This means that some heavy machinery or other materials may be able to travel only in winter; in summer fuel and cargo loads must be lighter (Stephenson 2016). Under new climate conditions, ice-roads and river crossings may not be economically feasible or physically possible (Anisimov and Kokorev 2016). As climate change shortens the seasonal viability of winter roads, communities could become isolated, not only limiting the delivery of fuel and goods, but also cutting off access to emergency services.

Arctic warming could open new maritime routes, increasing potential for delivery of fuel and goods to cities and offering new trade and commerce opportunities, but the shipping potential is likely exaggerated. Though warming, the Arctic climate remains unpredictable, and open water increases the amount of drifting ice in shipping channels, thus increasing the risk of collisions (Stroeve and Meier 2017), and increases fog in the region, making navigation difficult (IPCC 2007; Morello 2013; Stephenson 2016).

Weather variability is not conducive to contemporary just-in-time supply models. Shipping is more likely to be effective for shipping oil and minerals that are not as time sensitive, but poor mapping of the Arctic Ocean floor, additional structural requirements for ships, high insurance costs, and the need for specialized navigators and crew will keep costs high. Currently, there is also inadequate infrastructure for robust marine traffic in the Arctic including icebreaker assistance, infrastructure for refueling and repairing ships, and search and rescue capabilities (Pamel and Wilkins 2011). Increased Arctic marine traffic also increases the environmental risk to wildlife and humans.

Open water could also mean increased access for tourist cruise ships, thus expanding the potential tourism sector in Arctic cities. However, tourism increases human impact on the Arctic environment, and climate change could threaten the very landscapes and traditional cultures that draw tourists in the first place (Garcia-Rosell et al. 2017; Notzke 1999; Qu, Villumsen, and Villumsen 2015).

Energy

Most Arctic cities obtain a significant portion of their electricity from fossil fuels, including oil, diesel, petrol, kerosene, coal, and natural gas, but the remoteness, terrain, and climate complicate the logistics of getting fuel to Arctic cities. The logistics of fuel delivery, including river and marine navigation, ice-roads, railroads, pipelines, and 1,000-kilometer (km) routes, significantly increase the time and cost for fuel delivery to remote polar cities, and also increase environmental risk. The delivery period for coal to the Russian Arctic can range from three to thirty months, with three to four transshipments. This extended transportation timeline implies enormous losses in both quality and quantity (Barakaeva, Batugina, and Gavrilov 2015). Delivery schemes must also allow for seasonal variability in the availability of transportation routes: delivery of fuel by tanker to Yakutsk and Anadyr, Russia, means vulnerability to changes in navigability of waterways due to climate change including drifting ice, ice jams, increased fog, and more-severe storms. In the United States, the Alaska railroad eases dependency on waterways for the transportation of fuel and cargo, but railroads are not feasible for all Arctic cities.

While oil and gas extraction for energy production dominates the Arctic landscape, Arctic cities struggle to provide reliable, affordable electricity for residents. Alaskan residential and commercial consumers pay an average of 80 percent more than the US national average cost of electricity, while industrial customers pay almost 150 percent (US Energy Information Administration 2019); those in the Northern Territories of Canada pay up to ten times the Canadian national average for their electricity. Since 2003 Russia has been providing federal funds to offset the cost of fuel delivery for electricity generation to Arctic cities like Yakutsk and Anadyr, lowering the price for local populations (Barakaeva et al. 2015).

Energy demands are high in the Arctic, particularly in the winter when temperatures plunge and days are dark. Energy production in Arctic cities varies considerably by location and the resources available. Yellowknife, Canada, uses a combination of hydropower, diesel, natural gas, and, increasingly, renewable sources other than hydro (Northwest Territories Power Corporation n.d.). Salekhard, Russia, relies on gas-fired power plants, though a planned nuclear power plant could alter the energy portfolio. Local fuel production could strengthen energy security and decrease expenses for northern cities. While coal mining in the Arctic is an option, it creates broader concerns for Arctic sustainability. Renewable sources including solar, wind, hydropower, and tides might offer better fuel sources (see chapter 5 in this volume).

Reykjavik and Akureyri, Iceland, and Luleå, Sweden, are leaders among Arctic cities in sourcing 100 percent of their electricity from geothermal, hydropower, and other renewable resources. Increasing investment in renewable energy around the circumpolar region and the development of new renewable technologies creates opportunities for Arctic cities to lower their energy costs. In a recent assessment of renewable energy in Nunavut, Canada, World Wildlife Fund Canada found that investment in renewable energy in northern communities reduced operation and maintenance costs, making renewable energy more economically viable than fossil fuels alone (McDonald and Pearce 2013). Hydropower is an important energy source for many parts of Northern Canada and Scandinavia, and could benefit from climate change as increased runoff in winter yields greater power generation during the heating season (Anisimov and Kokorev 2016).

Infrastructure

Urban infrastructure is impacted by the Arctic environment in three ways. First, Arctic cities demand specialized architecture and engineering to accommodate the unique environmental conditions. Second, building costs are high because construction materials are more expensive in that region. Finally, the remoteness and climate pose unique challenges to developing and maintaining effective urban transportation networks.

The extreme Arctic climate creates significant challenges for building design and construction. Requirements include accounting for permafrost, high winds, extreme temperatures, and, in the case of offshore infrastructure, pack and drifting ice. Conventional architecture and infrastructure design are not always appropriate for the Arctic environment. Arctic cities were historically designed around service provision and often ignored traditional knowledge and values, climate, and geography. In many places, Arctic design focused on insulating against the environment, yet often neglected indigenous understanding of wind patterns and access to resources (Sheppard and White 2017). Continuity of planning in the long-term has been problematic in the North American Arctic where development has been episodic, driven by military, scientific, and economic activity (Jull 2016: 215). Conversely, planning for Russian Arctic cities was highly centralized under Soviet rule, and large cities were developed around extraction industries. Kiruna, Sweden, initially developed in an ad hoc fashion around an iron mine, but now as the city faces relocation due to destabilization as a result of mining, an eighty-five-year plan for the city exhibits conscious design for environment, functional land use, and the perpetuity of the city (Ghilardi + Hellsten Arkitekter 2014). Nearby Luleå, Sweden, is not starting over as Kiruna did, but instead has created a long-term vision for sustainable development (Luleå Kommun 2008).

The effect of climate change on permafrost presents a particularly unique challenge for Arctic cities. Warming undermines the bearing capacity of permafrost, weakening foundations and threatening the stability of buildings, pipelines, and transportation infrastructure (Grebenets, Streletskiy, and Shiklomanov 2012). Changes in permafrost have the most profound effects in areas of concentrated human activities. "As such, cities represent a nucleus of anthropogenic impacts on the fragile Arctic environment where climate-induced impacts on permafrost conditions are greatly amplified" (Streletskiy and Shiklomanov 2016: 205).

Appropriate design and construction require additional technical expertise and specialized materials and systems that are both more difficult to procure and costlier. Poor design in the Arctic has resulted in energy inefficient buildings that increase energy costs. There is a real need for Arctic design that would both represent the culture and identity of the Arctic and be appropriate to the environment and lifestyle (Berkowitz 2017; Jull 2016). Arctic-specific design could lower costs because materials could be used more efficiently, and could increase heating efficiency thereby decreasing energy demand.

Though the Arctic is rich in natural resources, nearly all building materials and consumer goods are transported over long distances via either ice-roads or ship, making construction materials expensive because of the amount of fuel required to cover the long distances, and the unique requirements of both shipping and winter-road trucking. As discussed above, ships that traverse the Arctic are more expensive to build because of structural requirements; in addition, because of ice conditions and shallow harbors, Arctic-bound ships are smaller and carry less cargo, thereby increasing shipping costs. Winter roads are vital supply links for many Arctic cities, but warming temperatures mean they are usable for fewer weeks each year. The decreased availability of roads due to warming temperatures further drives up costs as inland communities must then rely on air shipments of supplies (Stephenson 2016). Both overland and marine routes present unique challenges in terms of affordability and accessibility, and are highly sensitive to climate change.

Urban transportation networks are a key piece of urban sustainability, lowering per capita carbon footprint and increasing livability and accessibility, especially important given the remoteness of Arctic cities. However, urban transportation networks in the Arctic are undermined by environmental conditions. In building permanent transportation infrastructure, Arctic cities contend with the seasonal terrestrial access that precludes permanent transportation development and thawing permafrost that threatens roads, bridges, and railroads.

The comparatively low population density of most Arctic cities presents additional difficulties for urban transportation networks. High-density urban development is generally considered a prerequisite for effective transportation networks, with one oft-cited study showing that residential density should exceed 4,200 persons per square mile (Pushkarev and Zupan 1977). Cities like Anchorage, Alaska, struggle to create effective mass transit over long distances with much lower population density.

Economic Development

The Arctic environment impacts economic development not only by limiting access, energy production, and infrastructure, but also by affecting labor availability and increasing the environmental risks associated with pursuing the further development of extractive industries. Though all of the Arctic nations except Russia rank in the top twenty of the World Bank's ease of doing business index, the pace and scope of economic development in the Arctic in light of climate change are likely to be moderate due to complex logistical challenges (Käpylä and Mikkola 2015).

The cost of labor is often higher in the Arctic due to shortages of qualified personnel, high costs of living, and the specialized nature of the work, all attributed to the remoteness and environmental hardships of the Arctic. The shortage of qualified labor is due to the relatively undesirable living conditions and the lack of suitable training programs and educational opportunities in the Arctic (Emelyanova 2017). Financial incentives are often required to recruit workers with the necessary skills. Additionally, high wages are required to compensate for the high cost of living. Many of the jobs in the Arctic related to natural resource extraction, scientific research, or the military demand higher wages because of the technical expertise required, and hazard pay because of the added risk of environmental and occupational threats.

Arctic warming is yielding access to massive oil and mineral deposits (Borgerson 2013) that present economic development opportunities for Arctic cities, but developing those resources remains both costly and logistically challenging. While the Arctic is thought to contain about 13 percent of the world's undiscovered oil, 30 percent of its undiscovered natural gas, and 20 percent of its undiscovered natural gas liquids, 84 percent of those resources are estimated to lie offshore (Pamel and Wilkins 2011: 344). Arctic oil and gas are the most expensive in the world to develop and carry considerable environmental risks, particularly offshore (Stephenson 2016: 184). Developing offshore oil and gas makes economic sense only if the global demand for fossil fuels is high.

Food Security

The Arctic environment is not well-suited for agriculture and food production. While Indigenous communities have long relied on subsistence activities, including fishing, foraging, hunting, and whaling for food sources in the North, such subsistence activities are limited in the city, and are unable to meet the needs of all of the city's residents. According to one Canadian study, Arctic Indigenous households experience high rates of food insecurity, with households with children more food insecure than those without (Huet et al. 2017; Ruiz-Castell et al. 2015). "The issue of greatest concern to North American Arctic Natives today is how (climate) changes affect food security—that is, the relationship between changing climatic conditions, country food quality and quantity, and the ability of community members to access these resources as the physical geography shifts and changes literally beneath their feet" (Dinero 2013: 119).

The Arctic environment limits food production, but traditional local food sources continue to be a critical part of people's diets, including fish, seal, whales, and caribou, along with native plants and berries. Domesticated reindeer have also been an important part of the subsistence pattern of Eurasian Arctic peoples over the past two thousand years (National Museum of Natural History 2004). Reindeer herding among the Saami in Sweden and other parts of Scandinavia and Northwestern Russian are increasingly difficult because of competition for pasture lands and irregular melt and thaw cycles due to climate change that create ice layers through which reindeer cannot access grass. Changing ice patterns have affected other animal behavior and therefore hunting practices, and the northward migration of nonnative species because of warming temperatures has introduced new parasites and bacteria that further threaten native plants and wildlife (Adger et al. 2011). While most of these subsistence activities do not take place in cities, they continue to play an important role in cultural expression, social cohesion, and a varied diet for the Indigenous peoples who live in Arctic cities. For the 50 percent of Native Alaskans who live in Anchorage, many still identify with their ancestral villages and return regularly throughout the year to participate in whaling, hunting, and foraging (Biddison 2017).

Agriculture is limited by extreme temperature and light/dark cycles. Iceland is an anomaly in the Arctic with an unlimited geothermal resource that makes it possible to grow food in greenhouses year-round. For cities in other Arctic countries, food is imported, often with an exorbitant price tag. In Alaska, 95 percent of food is imported (Caster 2011), primarily from the "Lower 48," a term Alaskans use to refer to the conterminous United States. There is increasing interest in indoor farming using hydroponics, artificial light, and vertical growing systems as a means of meeting urban demand in the Arctic. Technological improvements for indoor growing increase the potential for these methods to produce food in hostile environments (Seefeldt and Helfferich 2013; Suter 2017), and indoor farming is already taking place in Anchorage, while plans are underway to build vertical greenhouses in Sweden (Caldwell 2016).

Culture

Climate change presents unique challenges to the sustainability of Arctic cultures, and has both economic and cultural impacts through the loss of nature, and a corresponding inability to continue traditional cultural practices. Cultural continuity is a key to wellness and well-being for Indigenous peoples. In diverse urban environments where there is pressure to assimilate, cultural continuity is even more important (Ogilvie 2017). Climate change poses risk to valuable and unique places, and could undermine the emotional, symbolic, spiritual, and intrinsic values of the environment (Adger et al. 2011).

Traditional ecological knowledge has allowed communities to adapt to changing conditions, but rapid, profound changes in the environment may push beyond the limits of this adaptability. The lack of predictability and the increasing use of technology have interfered with the passing of traditional knowledge to youth (Adger et al. 2011), so younger generations may not have the same adaptive capacity. Climate change is altering patterns of resource use and disrupting community institutions and ecological knowledge, and will change the cultures and environments of the Arctic irreparably.

Arctic Urban Challenges in the Global Context

Remoteness and other environmental challenges are not unique to Arctic cities, and it is important to situate urban Arctic issues in the global context. Cities like Darwin, Australia, and Jakarta, Indonesia, certainly do not contend with the extreme cold, snow, and ice that characterize Arctic cities, but they do share some similar challenges related to location and vulnerability to climate change.

The city of Darwin, Australia, contends with extreme temperatures at the opposite end of the spectrum from Arctic cities, but as a remote city in the otherwise sparsely populated Northern Territory, it relies heavily on long-distance shipments of goods and materials, and bears a similar burden to Arctic cities in terms of cost. Like the Arctic, Darwin is also vulnerable to climate change and is experiencing more storms, increased flooding, and rising temperatures. The hotter temperatures also heighten the demand for electricity production due to increased desire for air conditioning (Beer et al. 2013).

Jakarta, Indonesia, is another coastal city that is vulnerable to a high incidence of tropical storms and contends with frequent flooding. Coupled with poor infrastructure, flooding in Jakarta has caused not only loss of life, but also shortages of housing and basic services; flooding has also increased disease incidence because of the presence of contaminated water. Like Arctic cities, Jakarta is highly sensitive to the increased frequency and severity of storms due to climate change. Jakarta is likely to suffer increasing incidence of tropical storms, while the Arctic experiences more-frequent and more-severe storms because of increased open water (Morello 2013).

Drivers for Urban Development in the Arctic

In spite of all of the environmental challenges of building and maintaining cities in the Arctic, there are many reasons for cities to exist there. Indigenous settlements expanded from scattered subsistence-based groupings to dense urban areas because of a combination of economic incentives, modernization efforts, integration policies, and centralization of government services. Opportunities for natural resource extraction and concerns for protecting national security also played pivotal roles in Arctic urban development.

Expanding Indigenous Economies and Increased Centralization

The earliest evidence of humans in the Arctic dates to forty thousand years ago in Western Siberia. In North America, Alaska has been inhabited for at least fifteen thousand years, and researchers believe that Greenland and Canada were settled four thousand years ago. Numerous cultural groups live in the Arctic circumpolar region including Inuit, Inupiat, and Yupik in Alaska, Canada, and Greenland; Saami in Scandinavia and Western Russia; Nenets in Northwest Russia; Sakha (Yakut) in Eastern Siberia; and Chukchi of Far East Russia (National Museum of Natural History 2004). Iceland is the only Arctic nation without an Indigenous population. Early Indigenous groups used subsistence practices including hunting, fishing, whaling, and foraging; today subsistence practices continue to be an important part of Indigenous culture and livelihoods in the Arctic. Historically, Arctic settlements were low density with minimal environmental impact (Streletskiy and Shiklomanov 2016).

Many Arctic cities, including Tromsø, Norway; Rovaniemi, Finland; and Yellowknife, Canada, developed first as Indigenous hunting and trading centers. Centralization of government services and migration to these cities increased urbanization. Following the conquest of Siberia in the sixteenth and seventeenth centuries, Russia established frontier outposts based largely on fur trapping to defend its new territory (Reisser 2016). In Canada in the 1920s, after famine and epidemics had decimated the population of animals on which the fur trade had been built, the government intervened, leading to a more-centralized, less-nomadic lifestyle (Duhaime et al. 2004). In Nuuk and in Northern Canada, when subsidies dried up for consumer goods and services in small settlements, increasing the hardships for those living in smaller towns, populations became more concentrated in large urban centers in the Arctic. Across the Arctic federal governments forcibly consolidated populations in order to provide compulsory schooling for native children (Einarsson et al. 2004; Heleniak 2014).

As trade expanded and cities improved with the development of infrastructure, urban populations grew with increased rural to urban migration and the arrival of immigrants. In 1880 99 percent of the Alaskan population had been Native Alaskan, but after the discovery of gold around the turn of the century, that number dropped to just 26 percent by 1950. Northern Canada experienced a similar rush due to gold, though few miners stayed, so that by 1931 Indigenous peoples accounted for 86 percent of the population (Heleniak 2014). The expansion of mining in recent decades has led to population growth due to migration and high fertility rates among migrants. In Iceland new industrial opportunities prompted migration to Reykjavik by both rural Icelanders and foreign immigrants.

Extractive Industries to Satisfy Growing Southern Economies

The extraction of natural resources played a significant role in the founding of many Arctic cities and can be credited for the site selection of those cities. Rovaniemi, Finland, expanded quickly from a Saami trading center to a larger settlement because of both timber logging and gold. Kiruna, Sweden, is the site of a large seam of iron ore around which a city sprang up. The cities of Yellowknife, Canada, and Fairbanks, Alaska, boomed after the discovery of gold, while Anchorage also benefitted economically from the discovery of oil. In Russia the city of Norilsk owes its location and growth to nickel mining. Populations grew as people moved to Arctic cities for jobs in extractive industries.

While natural resource extraction has long been practiced in the Arctic, it was the growth of southern economies and the insatiable demand for oil, gas, and minerals such as iron and nickel that drove development of Arctic extractive industries. Demand for oil and gas spurred development in four Arctic nations: Canada, Norway, Russia, and the United States. Since the 1960s sixty-one large oil and gas deposits have been found in these four countries; more deposits will likely be found (Stephenson 2016). These deposits could be increasingly accessible because of the lengthening summer season, dwindling sea ice, and new technology development. Greenland may hold the world's last great oil reserve (USGS 2008), as well as a bounty of rare earth metals. Though currently Greenland is not mining, the expansion of Home Rule in 2009 has allowed Greenland to pursue commercial relationships with other countries including China and South Korea. Foreign investment and mining could eventually displace the annual subsidy from Denmark, allowing Greenland to assert political independence (Borgerson 2013).

Oil and gas extraction currently dominate the resource landscape in the Arctic. The demand for Arctic resources has dropped off in recent years because of the availability of shale oil, but in countries such as Japan where there is no shale oil resource, the demand for Arctic oil remains high. Unable to meet demand with current reserves, Russia is seeking to open new sites for exploitation, but the offshore location of these deposits comes with higher costs, more-severe climate conditions, and high environmental risk (Filimonova 2013). Sanctions following the hostilities in Ukraine have also slowed these efforts.

"Apart from oil and gas, the Arctic abounds in other mineral resources, including diamonds, gold, silver, tin, iron ore, zinc, uranium, and nickel. In addition, Canada has now become the world's third-largest producer of diamonds, with mines operating in Nunavut and the Northwest Territories" (Ruel 2011: 827). The LKAB mine in Kiruna, Sweden, contains 90 percent of the iron ore in Europe. As one of the largest underground mines, LKAB has developed much of its own mining technology and equipment and has marketed this expertise to other mining operations overseas. Fifty percent of the jobs in Kiruna are directly related to the mine, and starting wages are high—Kiruna is the second-wealthiest community in Sweden (LKAB representative, interview with the author, 15 June 2017).

The exploitation and extraction of natural resources not only spurred infrastructure development and encouraged migration, but also drove investment in transportation, including railroads and roads. Extractive industries continue to play a significant role in the Arctic economy. But even as rising temperatures attributed to climate change open new reserves and new opportunities for extraction, they also bring increased global attention to the practice of oil and gas extraction. Mining oil and gas in the Arctic brings with it additional environmental risk because of the fragile environment. Remote sites mean delayed response time in case of spills or other accidents; extreme cold and other unique factors can reduce the efficacy of clean-up technologies; and fragile and slow growing flora and fauna can mean delayed recovery.

Protecting National Security

Arctic urban development has also long been a national security strategy in the Arctic nations. In Russia the discovery of oil and gas reserves, coupled with the post–World War II fear of invasion, prompted intensified industrial development in the Arctic (Streletskiy and Shiklomanov 2016). The Soviet strategy for Arctic development was state-centric, with near total reliance on resource extraction and military modernization, a strategy that has seen revitalization in recent years under Vladimir Putin. Russia's relentless pursuit of military and industrial progress in the Arctic is a critical piece of the country's national identity (Conley and Rohloff 2015), and an important driver of urban development in Siberia. Under Soviet rule, populating Arctic settlements was considered an investment in national security, and Kremlin interest in settling the Arctic led to increased migration to the region. During the Stalin era, efforts to populate cities in the Far North also included sending prisoners to Arctic cities as forced labor in extractive industries in places like Salekhard and Norilsk (Reisser 2016).

Many other Arctic nations shared the USSR's concerns for sovereignty and security in the North. After the United States purchased Alaska from Russia in 1867, Washington established military outposts throughout the new state as an assertion of national sovereignty. Large military bases such as Fort Wainwright and Eielson Air Force Base in Fairbanks continue to play an important role in urban economies in Alaska by increasing the population and the consumer base for overall economic development, and encouraging ongoing infrastructure improvement. Though Nuuk, Greenland, was initially settled by Saqqaq and then Inuit Indigenous peoples, the city has served as an important administrative center for the Danish colonial government, though in recent years increased power has been transferred to the local Greenlandic government (Act on Greenland Self-Government 2009; Greenland Home Rule Act 1978).

Militarization is an important driver of economic development in the Arctic: Not only does it increase the population and the potential consumer base, but it also increases infrastructure investment. In Iceland airports at both Keflavík (serving Reykjavík) and Akureyri were built by the militaries of other nations (the United States and Great Britain, respectively). The Alaska–Canada Highway, or Al-Can, was built as an important corridor between Alaska and the Lower 48 during World War II; in Russia, the military built the first year-round airports in Siberia. These improvements to infrastructure increased access to the Arctic, thus enabling economic development, and continue to play an important role in the viability of Arctic cities. Military installations in the Arctic also serve important emergency and search and rescue functions, a need that increases parallel to increases in commercial, industrial, and scientific activity in the warming Arctic.

New and expanded human and commercial activity in the Arctic has also increased the need for military and security forces to monitor activity. Both the recent US and Canadian national strategies (Government of Canada 2009; USG 2013) for the Arctic prioritize national security interests; in Russia, recently deployed forces in the Arctic include troops from a variety of branches.

Why People Choose to Live in the Arctic

Most non-Indigenous people arrived in Arctic cities seeking employment opportunities, but for both Indigenous and non-Indigenous people the high cost of living, environmental extremes, remoteness, and the threat of climate change to traditional lifestyles adds hardship to life. Though employment and economic opportunity continue to be an important motive for living in many Arctic cities, people also live there for other social and economic reasons. Place attachment is one powerful incentive for people to stay in cities regardless of whether employment opportunities are abundant. For Indigenous Arctic peoples, the Arctic is part of their cultural history and allows the expression of identity, culture, and history through traditional practices. Though the cost of living in Arctic cities is high, subsidies offset the high costs and add economic incentive for people to move to or stay in Arctic cities.

Place-Based Social Capital

Despite variations in the economic and educational conditions of Arctic towns and cities, more people have chosen to stay in the region than observers anticipated, which suggests that there are social factors at play beyond conventional measures of human development (mortality, rates of poverty and unemployment, per capita GDP) (Duhaime et al. 2004). In addition to economic incentives, many people choose to live in Arctic cities because of important social factors including cultural heritage and place-based social capital. Social capital is the ability to secure benefits through membership in networks and other social structures (Portes 1998). Social capital is productive, like other forms of capital, and produces positive outcomes for individuals and societies (Adam and Rončević 2003), including economic growth, improved health and household welfare, stability, safety, and sustainability (Ganapati 2009).

With the exception of Iceland, every Arctic nation has a rich Indigenous cultural heritage that continues to play an important role in urban sustainability and development. For the nearly 50 percent of the Native Alaskan population that lives in the city of Anchorage, and the 30 to 35 percent of Indigenous peoples in Russia who live in urban areas (Streletskiy and Shiklomanov 2016; Shadrin 2017), social capital is place-based, tied to the Arctic, and extends beyond economic reasons to include ancestral histories, traditional subsistence livelihoods, and culturally significant geographies. In one study of Alaskan youth, researchers found that though youth would often leave to pursue higher education, many returned without completing their degrees because of the pull of place-based social capital, attributed in part to the remoteness of their hometowns (Lowe 2015). This place-based social capital could be combined with local educational opportunities and economic development in line with cultural affinities and values.

The remoteness and the geographical bounds of Arctic cities encourage patterns of intensive community interaction. "Our sense of identity is based on our interactions with the people that surround us through shared beliefs, traditions and language. Belonging is about belonging to a particular group of individuals. We define ourselves to a large extent by the communities we belong to. In small, homogenous societies in very remote locations, the parameters of belonging are so well defined that to be an outsider in some way may even be dangerous" (Leonard 2014: 139–140).

Place-based social capital plays an important role in individuals' ability to adapt to climate change and other environmental changes (Vorkinn and Riese 2001). The adaptive capacity and social safety-net present strong disincentives for people to leave their hometowns. Social capital in the form of social networks and cohesion, along with human and physical capital, can shape responses and the ability to adapt to environmental changes (Hamilton, Brown, and Rasmussen 2003). Canadian Inuit rank social factors like cultural identity as much more important than economic considerations (Edouard and Duhaime 2012), shedding light on why people might stay in a city in spite of an economic downturn.

Subsidies

While resource extraction remains indisputably the most significant economic incentive for continued urban Arctic development and population growth, subsidies also provide economic incentives. Subsidies in the Arctic range from formal federal funding provided to municipalities to financial assistance provided to individuals. These individual subsidies, which include the US Postal Service Alaska Bypass to keep shipping affordable, and housing allowances provided to residents of Akureyri, Iceland, are designed to alleviate some of the financial hardship of the high cost of living in remote Arctic cities.

In order to support urbanization and compensate for population decline after the end of forced labor, the USSR encouraged Arctic settlement through extensive northern subsidies. Incentives were provided to individuals to encourage them to move to and remain in the North, and to municipalities through large subsidies for transportation and basic economic resources. These subsidies for settlements included not only consumer goods but also industrial inputs such as coal for energy production and manufacturing (Reisser 2016). The Northern Benefits program included high wages, paid vacation, and leave time—all of which were unusual in other parts of the country (Reisser 2016). Government programs and incentives played an important role in the growing urban population of the Far North through the 1980s. The breakup of the Soviet Union and the end of subsidies provides a useful illustration of how this state policy affected population size. When subsidies for transport, wages, and consumer goods dried up, people fled smaller settlements, concentrating the population in large urban centers (Heleniak 2014).

Unofficial subsidies come in the form of investments made in infrastructure for commercial or military purposes but provide secondary benefits for residents. In parts of Alaska that were sparsely populated, the lack of infrastructure disincentivized migration and development, but as miners moved to more-remote areas in search of gold, company workers and later government personnel pushed for improvements to infrastructure such as roads, telegraph lines, railroads, and mail service that ultimately made parts of the state more enticing to migrants. The construction of the Trans-Siberian railroad in pre-Soviet Russia was the single most important factor in increasing settlement in the Russian Arctic, and the railroad both ensured reliable transportation and enabled large-scale trade (Stephenson 2016).

While official subsidies such as housing or energy allowances and investments in infrastructure are meant to ease hardship, they may also entice others to migrate to or encourage people to stay in places that may not be best suited for large populations. Offering incentives is a strategy that began as a way to settle the Arctic as an expression of sovereignty in Russia and the United States and has continued to ensure an adequate industrial labor force. From a sustainability perspective, it is questionable whether increased population density should be encouraged in the Arctic, given the long shipping distances, higher energy costs, and increased environmental impact.

Conclusion

As home to 8.5 million people, a wealth of natural resources to feed global markets, and a bellwether of climate change, Arctic cities demand greater attention. As these cities contend with ever-more-challenging climate conditions due to climate change, it is important to understand the nature and character of these cities, why they developed, and why people stay in them. Understanding Arctic cities will inform a more constructive dialogue about sustainability in the Arctic.

The extreme climate in the Arctic affects people living in the region by limiting accessibility to other parts of the world and other parts of the North. It dramatically increases energy needs. The cold and ice pose severe infrastructure challenges. And human societies living in this context face difficulties in maintaining overall economic development and food security.

Nevertheless, there are strong drivers for urbanization. These began with the expanding Indigenous economies and the need for increased centralization of administrative functions among both the Indigenous and settler communities. Other drivers include the resource extraction required to feed the economies of the south and the need for national governments to ensure the security of their borders and homelands.

People choose to live in Arctic conditions primarily because there are lucrative jobs available there. Subsidies to work and live there also make the Arctic attractive. However, once people are there, they often develop strong place-based capital that they are unwilling to leave.

Applying the ISO 37120 set of sustainability indicators, described in the book's Introduction, to the Arctic cities helps us to understand how climate change will affect the planet's cities in some of the most extreme circumstances and a place where the climate is changing most quickly. This effort will also provide insight into how useful the overall set of urban sustainability indicators are in practice. Part II of the book follows, and starts the process of testing out some of these indicators in a variety of case study cities.

Carrie Schaffner graduated from the George Washington University with a master's degree in international development studies.

Notes

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2. Urban agglomeration is defined as the number of people living within the contiguous land area that is inhabited at a population density sufficient to qualify as urban.

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Part II

Testing Indicators of Arctic Urban Sustainability

CHAPTER 2

Shrinking Cities, Growing Cities

A Comparative Analysis of Vorkuta and Salekhard

Nadezhda Zamyatina, Luis Suter, Dmitry Streletskiy, and Nikolay Shiklomanov

Introduction

This chapter showcases the main differences in the development of Vorkuta and Salekhard.[1] The main section of the analysis examines in detail four aspects of sustainability—transportation, economic diversity, urban design, and attachment to place. The conclusion draws out the implications for measuring Arctic urban sustainability. Along the way, we examine how well the ISO 37120 (see the book's Introduction) stands up as a useful guide for measuring the extent of sustainability in these Russian Arctic cities.

Transportation, economic diversity, urban design, and attachment to place are particularly useful in tracing the divergent paths of Vorkuta and Salekhard. In this context sustainability is a function of how the cities are connected to the rest of the world, how well they develop different aspects of their economy, the role design plays in their growth and shrinkage, and the emotional connections that residents feel toward their city.

This chapter examines the Russian Arctic cities of Vorkuta and Salekhard as case studies in the outlook for sustainability. Both cities are useful for our larger analysis because they are analogous to many other cities of the Russian North and broader Arctic region. As an industrial center that simultaneously serves as a central city for a vast territory, Vorkuta is typologically similar to Mirny (Sakha-Yakutia

Republic) and Norilsk (Krasnoyarsk Kray). Salekhard also has similarities to many smaller administrative centers in the Russian Arctic, such as Naryan-Mar (Nenets Autonomous Okrug), Khanty-Mansiysk (Khanty-Mansi Autonomous Okrug—Ugra), Dudinka (Taymyrsky Rayon of Krasnoyarsk Kray), Anadyr (Chukotsky Autonomous Okrug) and to international counterparts, such as Whitehorse (Yukon), Iqaluit (Nunavut), and Nuuk (Greenland). See chapter 3 for a case study analysis of Norilsk and chapter 10 for a case study analysis of Whitehorse.

Methodology

This chapter is based on 2017 fieldwork conducted in both cities. The fieldwork included nine expert interviews (five in Vorkuta and four in Salekhard),[2] work with documents in local museums and excursions studying the cultural landscape of both cities. In Salekhard we made three excursions to different parts of the city with guidance from the local museum's staff.

The methodological background of the chapter draws on three groups of works:

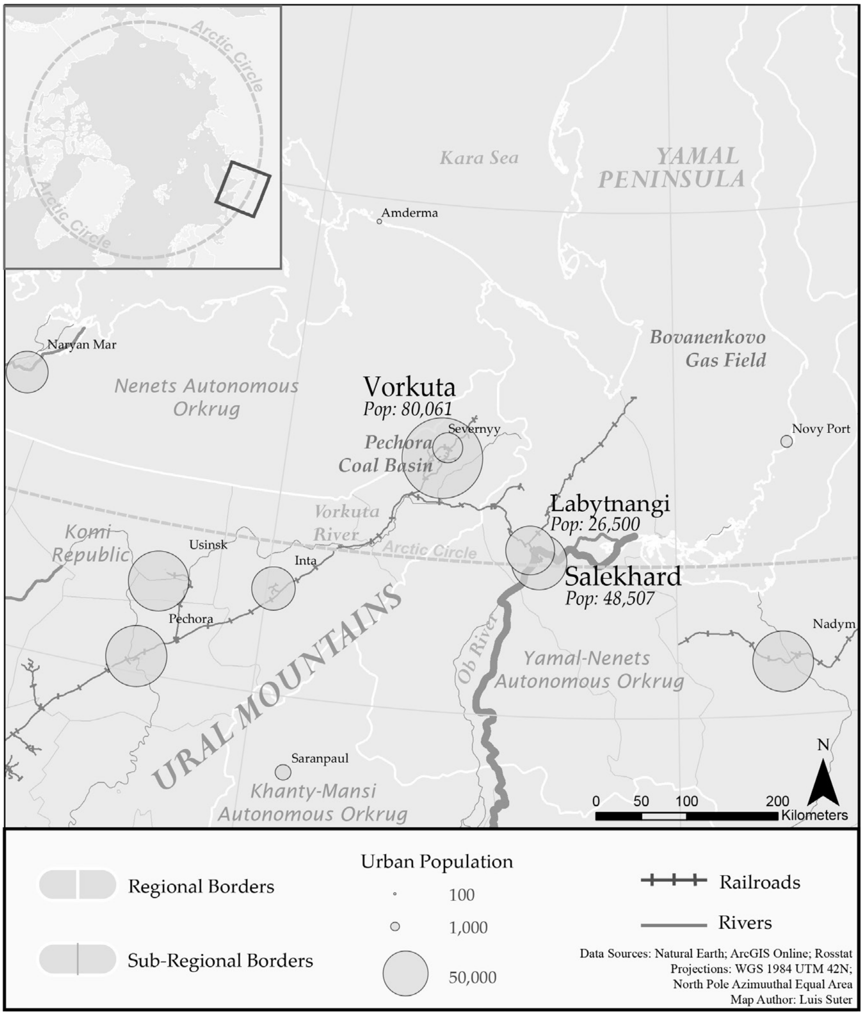
1. Overarching studies of Arctic urban sustainability and its key components (Giddens 2008; Orttung 2016; Petrov et al. 2017; Urry 2015) and especially the sustainability or resilience of the Russian Arctic cities (Baburin et al. 2016; Badina 2017; Zamyatina and Goncharov 2018b).
2. Publications addressing the development of Arctic cities, especially those that develop the concepts of remoteness and modern frontier studies (Ardener 2007; Baburin and Zemsov 2015; Berman 2013; Berman and Howe 2012; Berman, Kofinas, and BurnSilver 2017; Hansen, Rasmussen, and Weber 2013; Heleniak 2009; Humphrey 2014; Huskey 2005, 2006, 2017; Huskey and Morehouse 1992; Huskey and Taylor 2016; Jull 2017; Larsen and Fondahl 2015; Pelyasov 2011; Taylor et al. 2016; Zamyatina and Goncharov 2018a, in press).
3. Previous Russian and Soviet works on the development of the Far North explaining the genesis both of the cities and their role in the national economy and ideology in different periods (Gromov, Burhanov, and Chudnovskii 1982; Kosmachev 1974; Slavin 1961; Vasiliev and Selin 2013: 226–32; Yanovskii 1969).

The majority of works addressing both the sustainable development and remoteness of Arctic cities use statistical tools, but do not deal with institutional and other local factors (with the exception of some papers by Huskey, Berman, and Jull). Applied economic theory (e.g., see Clark, Feldman, and Gertler 2000; Fujita, Krugman, and Venables 1999) pays a great deal of attention to local factors, including the local institutional system, networking, and local capacity to produce and absorb innovation and new knowledge (see also: Zamyatina and Pilyasov 2015). Similarly, large-scale and global factors (especially remoteness and economic cycles) are important to the survival of Arctic cities (Berman 2013; Hamelin 1979; Huskey 2005, 2006; Taylor et al. 2016); these factors also constitute an important feature in the development of Arctic cities.

Accordingly, this chapter is an attempt to bring together the local and global as well as the institutional and economic factors shaping the sustainable development of Arctic cities. The novelty of this work lies in the use of local-scale research, taking into account institutional and landscape factors of sustainability, which are not typically included with standard statistical approaches. The main contribution of this chapter is the identification of specific, grassroots mechanisms for ensuring the sustainable development of the urban system, rooted in the specifics of the interaction of individual elements of the urban system (the knowledge production infrastructure, management system, urban landscape, behavioral attitudes of residents, etc.) in the global framework of the transportation system and economic and political transitions of the Soviet system. These grassroots factors are compared with statistics that are commonly used to both measure sustainability and help clarify the genesis of the numbers in the statistical tables.

Vorkuta and Salekhard: Divergent Trajectories of Development

Vorkuta and Salekhard are located on opposite sides of the Ural Mountains, which divide Russia into European and Asian parts (map 2.1). Vorkuta is geographically in Europe, in the northeast corner of the Komi Republic; Salekhard lies in Asia within the Yamal-Nenets Autonomous Okrug, on the bank of the world's seventh longest river—the Ob. The straight distance between these cities is only 140 kilometers (km), but the railroad connecting them runs approximately 300 km. The city pair is unique in Arctic conditions because, within close proximity, they host significant urban populations in remote and



Map 2.1 | *Vorkuta and Salekhard, their railroad connections, and their 2016 urban population. Map created by the authors.*

environmentally challenging conditions. Both cities are also exceptional in terms of their urban landscape, since they are designed to withstand extreme conditions and are built on permafrost. While large urban centers are characteristic of the Russian Arctic, they are less common throughout the broader circumpolar region, where smaller settlements are more common. However, behind the cities' apparent similarities lies immense distance in terms of transport connectivity and socioeconomic development.

Vorkuta's population is in decline. It has one of the highest rates of emigration in Russia. According to the last Soviet census, in 1989, the city's population (without adjoining settlements) was 100,200. The larger metropolitan area administered by the Vorkuta City Council included the satellite communities of Vorgashor (18,500), Severny (17,000), and several others. This larger region, including the satellite communities, had a population of 216,200 people. Vorkuta, as the major population center, provided medical and other vital services to communities as far as Inta, more than 300 km away. In 2016 the population of the metropolitan area had fallen to only 81,400, with 59,200 in the city of Vorkuta, 10,000 in Vorgashor, and 8,400 in Severny. Thus, over the past thirty years the city of Vorkuta has lost almost half of its inhabitants while the population of the greater metropolitan area has shrunk by two-thirds.

In contrast, Salekhard is one of the most rapidly developing urban centers in Russia. Its population grew from 24,900 in 1989 to 48,700 in 2017, and has become one of Russia's wealthiest cities per capita. The city of Labytnangi, separated from Salekhard by the Ob River, had an initial decline in population in the early 1990s, but has stabilized to around 26,500. The settlements of Kharp and the Indigenous village of Aksarka house an additional 10,000 inhabitants.

The same dramatic differences are observable in contemporary indicators of well-being within the cities. In 2016 the average monthly salary of workers in Vorkuta was only 30,300 rubles, while in Salekhard the average was nearly three times larger, at 88,500 rubles. This economic disparity impacts the cities' budgets; the 2016 per capita municipal budget in Vorkuta was only 43,300 rubles, while Salekhard spent 116,200 rubles per person, according to the Federal Service for State Statistics (Rosstat) database. The age structures of the cities' population provide a further contrast, in part reflecting the economic situation. Vorkuta has a much older population, while Salekhard has a higher share of population younger than age eighteen. These divergent trajectories of development are rooted in the geographic position and economic functions of each city.

Speaking about frontier resource cities, Alaskan economist Lee Huskey identified the possibility of a leap from an unstable resource-based economy to a more sustainable economic structure, via what Huskey calls the Jack London effect (Huskey 2017). The essence of this effect is that during the boom phase of resource extraction and accompanying growth of the economy of the frontier city, it is possible to accumulate a critical volume of local population and local demand. When the volume of local demand surpasses the critical point (considering economies of scale), local production becomes more profitable than importing certain goods and services. As a result, the local economy becomes more diversified and, consequently, more stable. As Huskey describes it:

> The Jack London hypothesis can be stated as “Resource development changes the support sector in ways that last beyond a particular resource boom and encourage future economic activity.” The first part of the hypothesis was tested by comparing the changes in the support sector of the Alaska economy to changes in the overall economy and its staples component. . . . As London predicted, the support sector was changed in ways that lasted beyond the resource boom. Economic resilience in northern resource-based economies is still a concern. . . . The boom-bust story predicts that finite resources place a limit to the growth of the local economy. The Jack London hypothesis presents the possibility of a more optimistic post-resource-boom story. Structural changes that occur during the resource booms may change the economic environment in ways that promote future opportunities. Local policymakers may wish to pay attention not simply to resource development but also to the part of the economy that is left behind after the boom. (Huskey 2017: 344)

The driver for Vorkuta’s economic development was coal mining. Stalin’s government founded the city using forced labor in the 1930s as the country prepared for possible war with Germany. During the postwar Soviet period, the city experienced the Jack London effect, and became an important center for providing social, cultural, and educational services. The city developed a factory producing apparel, various forms of agriculture, and significant research centers. The accumulated local knowledge in the fields of northern construction, planning, architecture, permafrost, and ecology was critical for long-term sustainability. While Vorkuta did not become an official administrative center, it won the privileged status of a city of republican subordination as early as 1943, and later became a city district, benefitting from budgetary independence and self-management to the maximum extent possible within the Soviet and Russian economic systems.

Salekhard has followed a different trajectory. For centuries it was both the economic center of the Lower Ob River and the region’s commercial and cultural center. Several merchant dynasties developed in the area, and periodically Salekhard experienced small bursts of development in export industries such as fishing, fur-trading, and even railway construction. The development of extensive oil and gas production in the eastern districts of the Yamal-Nenets Autonomous

Okrug transformed its economic role. Against the backdrop of the rapid growth typical of resource cities during the boom phase of their development, Salekhard changed from a local center into a major recipient of budget transfers, and therefore the wielder of powerful administrative authority. During this process, the city shed some of its previous functions, such as training agricultural personnel. In recent years, there have been some attempts to develop new locally oriented sectors, including scientific research, education, and food production in Salekhard. But these amount to nothing more than a half-hearted attempt to restore the previous achievements of Salekhard before the current fossil fuel boom.

Measuring Sustainability

We find the key indicators for measuring sustainability in Vorkuta and Salekhard to be connections to the outside world, economic diversity, urban design, and attachment to place. These four metrics provide a convenient way to understand the different paths that the two cities represent, showing the strengths and weaknesses in each urban area.

Transport Connectivity

The differences in transport connectivity linking Vorkuta and Salekhard to the outside world had a dramatic influence on the development of these cities. Transport connectivity is an important element of the quality of life in Arctic cities and can be a key factor that inhibits or stimulates their development (see chapter 8 for an in-depth discussion of this topic). The critical importance of transport connectivity between northern cities and regions that are more densely populated is even reflected in the Russian language. Colloquially, inhabitants of northern regions compare the North to *Materik* (mainland) Russia, or to the *Bolshaya Zemlya* (Great Earth), referencing the island characteristics of extreme isolation from the rest of the country. In the scientific literature, the North is usually contrasted with the main zone of settlement (Kosmachev 1974; Slavin 1961).

The example of Salekhard vividly demonstrates the relationship between socioeconomic development and transport connectivity. Salekhard differs from other administrative centers in the Russian Arctic, as well as from its geographic neighbor Vorkuta, in its relative isolation from its respective region. At first glance it may seem surprising that Salekhard—the capital of one of the richest regions of Russia—has worse transport access conditions than a provincial industrial center like Vorkuta. However, Salekhard, as the capital of the Yamal-Nenets Autonomous Okrug, is in fact disconnected from the main economic production areas within its own region. One can even say that Salekhard is located in the middle of nowhere in relation to the largest cities and industrial centers of the Yamal-Nenets Autonomous Okrug—Novy Urengoy, Noyabrsk, Nadym, and others.

Currently, from the perspective of transport accessibility, Salekhard is an island city: it can be reached almost exclusively only by air with connections to Moscow, Saint Petersburg, large cities within the Yamal-Nenets Autonomous Okrug, and a few others. Other forms of transportation links are ferries (in summer) and ice/winter roads (in winter). Winter roads link Salekhard to Nadym and the resource-rich eastern and northern part of the district, but this mode of transport can be dangerous and unreliable. The main ground access channel to Salekhard is a ferry crossing over the Ob River to the city of Labytnangi, which houses the terminal railway station. About an hour-long trip to the railhead, it would seem, is quite a favorable situation for Northern inhabitants. However, seasonal changes greatly inhibit the accessibility of this rail station. In summer the Ob is crossed by ferry and in winter by car on the ice-road. In the autumn and spring, when the ice is not thick enough to reliably withstand the weight of cars and the operation of ferries is not possible, Salekhard's primary connection with the city of Labytnangi and the railroad is by small hovercraft (figure 2.1). These are inconvenient for passengers because they have relatively low carrying capacity. The spring brings its own challenges since the slow breakup of the ice can hinder even the operation of the hovercraft, because its surface becomes choppy and uneven. In these scenarios, helicopters are sometimes used to transport people across. During this period there can be shortages of fresh food in Salekhard (as interviewees told us in November 2016), which numerous studies show is an important factor that influences the subjective quality of life in the Arctic. Unfortunately, this issue is not often reflected in official statistics and research papers.

For many years there has been discussion about the construction of a bridge across the Ob, but the prospect is intimidating. Building a bridge across this river—one of the most powerful in the world—would be expensive and challenging. Not only would the structure need to span more than 2 km, but it also would have to be built to withstand the enormous force of the annual ice dams, which form during the spring melt. As the river gradually thaws from south to

Figure 2.1 | *Seasonal transformation of the crossing of the Ob River between Salekhard and Labytnangi. Photographs by Nikolay Shiklomanov.*

north, ice floes are carried north by the current until they jam and pile behind still stable ice cover. These ice dams have the potential to become so dangerous to infrastructure that they are sometimes preemptively removed with explosives.

In summer, there is one additional, longer, ferry route linking Salekhard to the railhead at Priobye Station. This ferry must travel south, against the current of the Ob River, for more than forty-eight hours. It is used almost exclusively for the transfer of vehicles from Salekhard to the more southern regions where there are connections to the national road network. Immigrants, especially those moving to the North for high-paying employment, will often ship their vehicles for use while living and working in Salekhard, but retain a residence and vehicle registration in their southerly home region. Such behavior is indicative of nonpermanence and is observable among some population of the Russian Arctic. Many workers are attracted to the North for high wages during periods of economic growth, and plan to eventually retire to the South. These skilled workers are also likely to have the means and desire to emigrate, should economic prospects become tougher.

It is obvious that the cost of cargo or transit to and from Salekhard is more expensive than in cities directly connected with the larger Russian railway and automobile networks. Therefore, along with other isolated cities of the Russian North, Salekhard is one of the most expensive in terms of prices for food and services in the Yamal-Nenets Autonomous Okrug, and even in Russia. Table 2.1 compares several cities and districts within the Yamal-Nenets Autonomous Okrug,

Table 2.1 | *Prices of various consumer food products within the Yamal-Nenets Autonomous Okrug and its subdivisions*

	Products (Rubles 2017)							
Location	**Beef**	**Chicken**	**Butter**	**Flour**	**Rice**	**Potatoes**	**Carrots**	**Apples**
Yamal-Nenets Autonomous Okrug	412.77	186.01	305.53	45.4	83.59	31.29	37.07	113.11
Salekhard (City)	416.67	190,86	398.04	48.95	89.9	30.67	35.33	121.25
Labytnangi (City)	370	149.49	230.04	41	77.99	32.71	36.67	119
Novy Urengoy (City)	354.75	159.32	312.45	39.65	67.75	25.72	31.12	101.85
Noyabrsk (City)	348.09	141.63	327.2	33.75	56.65	22.17	30.53	87.13
Gubkinsky (City)	300	151.5	181.33	42.61	69.26	24.06	32.38	80.73
Nadym (City)	429.58	173.3	529.67	41.07	97.63	24.89	38.81	95.54
Muravlenko (City)	321	164.14	253.59	38.22	60.31	22.06	30.89	91.46
Purovsky District	315	170.57	259.31	35.49	77.37	26.48	35.05	96.53
Priuralsky District	455	203.22	320.56	57.88	96.5	40.5	40	127.25
Tazovsky District	348	197	224.86	40.71	94.99	30.86	36.57	123.29
Yamal District	515	258.82	341	58.59	108.5	45	46.11	149,44
Krasnoselkupsky District	590	197.6	189.8	51.5	95.64	28.25	29.32	119
Nadym District	539	224	479.03	50.35	90.18	40.56	52.6	144.35
Shuryshkarskiy District	476.67	222.67	230.5	55.76	87.63	44.17	43.6	126.67

Source: Open Data Portal of Russia 2018.

showing that only the neighboring Yamalsky and Priuralsky Rayons (Districts) have higher food prices than Salekhard. These regions are even farther away from the railroad, and the modes of delivery of goods to them is further complicated.

The current economic situation in Vorkuta is significantly worse than that of Salekhard, but its transport connectivity is better due to its geographic location. With a high degree of probability it can be assumed that, if Vorkuta were less accessible, the current economic situation in the city would be catastrophic. In other words, the transport connectivity has a multidirectional impact on Vorkuta and Salekhard: Salekhard has powerful drivers of economic development (see below) and that development or growth occurs despite the city's isolated position. In Vorkuta drivers of economic development have deteriorated, but apparently the established railway connection—and reduced transportation costs—have somewhat slowed the decline.

Vorkuta acquired the railroad due to extraordinary circumstances. The connection of Vorkuta with the main zone of the country by a full-fledged rail link made the delivery of cargo much cheaper and put an end to the extreme isolation of the northern city. An all-season road connection between Vorkuta and the rest of the world, however, does not exist. Vorkuta was developed primarily as an industrial center, and for the extraction of coal. For industry, the railroad connection was much more important than an automobile link, because relative transportation costs for heavy goods were reduced.

Overall, we find that the transportation indicators included in ISO 37120 do not provide much insight to the problem of isolation that we discuss here. The transportation indicators focus on the extent of public transportation within a city. Such metrics certainly make sense when examining how much local transportation a city provides to its residents and that number helps determine the extent to which a city is sustainable. However, the exclusive focus on those measurements requires the assumption that the cities themselves are linked to a well-developed transportation network. In the Arctic context that assumption does not hold across cities and instead should be an object of measurement. In this sense the ISO is missing a way to measure the remoteness of a city, which is crucial to measuring its sustainability in Arctic circumstances. The only indicator along these lines is commercial air connectivity, which counts the flights arriving and departing from the city. While such flights are crucial for the city economy, they give only a partial picture of the remoteness of a city and its ability to sustain itself.

Economic Diversification

Another key factor promoting the sustainability of Arctic cities, particularly those in Russia, is the balance among three main sectors of their economy: the presence or absence of resource-oriented industries primarily concerned with exports, administrative centers, and locally oriented economic sectors. These economic attributes have fundamentally different effects on the sustainable development of the cities. The division of the urban economy into these three sectors is not a common practice in urban development research. The expediency of such an approach arises from an analysis of the literature on remote communities and is fully confirmed in the examples of Vorkuta and Salekhard (Danson and Souza 2012; Huskey 2005, 2006; Huskey and Morehouse 1992; Taylor et al. 2016).

The *resource-oriented industries* primarily concerned with exports make the city's economy dependent on conditions affecting international commodities markets. Resource-oriented cities, especially remote ones, are therefore subjected to boom-and-bust cycles, depending on macroeconomic conditions, and have large fluctuations in their budgets. Such vulnerability to external conditions naturally reduces the sustainability of Arctic cities because they are reliant on factors beyond their control.

The *administrative centers* are generally the most stable: Even during periods of severe economic downturn, they retain a relatively constant level of budgetary financing. Unless there are higher-level decisions to change administrative and territorial structure, these cities always retain a certain percentage of funds. Of course, their well-being also depends on economic cycles, because in the lean periods of economic downturn, budgetary opportunities are obviously in decline. However, in general such recessions are still milder than those in industrial centers that specialize in the production of one good.

Locally oriented economic sectors are also related to the stability brought by cities' functional specialties. However, the locally oriented industries only partially offset volatility associated with export-oriented economies. The collapse of the main resource industry, as well as changes in the political regime, may also have a profound influence on the development of the locally oriented sectors of the economy, as seen in both Vorkuta and Salekhard after the collapse of the Soviet Union.

Although Salekhard began from a small locally oriented economy, the booming gas economy and the political reorganization of territories in the late 1990s/early 2000s saw the city transform into an important administrative center. With this new role as regional capital the city enjoyed stability in its economic prospects, even in the face of fluctuating gas prices—which is the region's primary export commodity. However, this administrative specialization has been developed at the cost of some locally oriented industries that were labeled unprogressive.

Vorkuta, on the other hand, was founded and built purely as a resource-oriented economy specializing in coal. While Vorkuta grew, it underwent the Jack London effect, and began to fulfill many functions of an administrative center. Though Vorkuta expanded and remains larger than Salekhard, it never gained true administrative status and thus remained under the authority of regional and national leaderships. This lack of self-governing authority with guaranteed income meant that the city was not able to compensate for the collapse of the coal mining industry. Though a locally oriented industry had developed in Vorkuta, it was not at a scale large enough to sustain the city.

One area where Vorkuta has moved ahead of Salekhard is in small business development. The Vorkuta administration has allowed local residents to engage in a wide range of business activities, essentially as a survival method. This has led to a profusion of cafés and other service industries in the city. The city administration in Salekhard maintains tight control over the local economy, providing fewer opportunities for individual citizens to engage in developing their own small-scale entrepreneurship.

A more detailed examination of the cities' age structure and level of employment concentration gives additional insight into the level of economic diversity. As mentioned earlier in this chapter, the age structure of these cities is highly indicative of the economic situation. While Vorkuta and Salekhard have a similar number of working-age citizens, accounting for about 64 percent of the population in 2016, Vorkuta has a much larger proportion of pensioners compared to Salekhard (figure 2.2). This difference can impact the cities' ability to levy taxes and generate revenue from the working-age population.

For the past several years the employment concentration in Salekhard and Vorkuta has been dynamic, revealing several interesting trends. In both cities several major industries tend to dominate the economy (figure 2.3). However, Salekhard has seen a relatively stable employment concentration over the past decade, while Vorkuta's employment situation has been much more volatile, with surges in

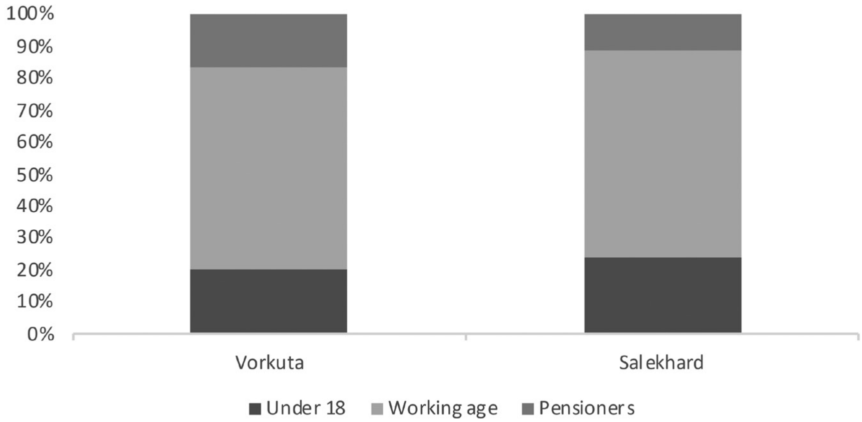


Figure 2.2 | *Vorkuta and Salekhard population age structures. Figure created by the authors.*

the construction and transportation sectors along with declines in the mining sector and several other secondary sectors. Typically, workers in Vorkuta earn significantly less than those in Salekhard across all sectors. Both cities are characterized by the dominance of a few major industries, with the largest three sectors accounting for more than 50 percent of employment. It is especially significant that the highest paying sector in Vorkuta—real estate, at 78,273 rubles in 2016—employs less than 5 percent of the population. In Salekhard the high-paying public administration sector employs 26 percent—the greatest share of the population and pays 121,405 rubles. These economic disparities are the foundational difference between these cities, and Salekhard is much more economically sustainable in this sense.

As with the transportation indicators, the ISO metrics do not consider the diversity of a city's economy in measuring its sustainability. Rather, the indicators focus on measures of unemployment, the assessed value of commercial and industrial properties, number of businesses, number of patents, and number of hotel night stays. The ISO does track population demographics, including a profile measure for the number of pensioners.

Overall, a measure of economic diversity would be crucial to identifying a city's reliance on one industry for its survival. This is a major problem in the Arctic overall and in Russia in particular. One-industry towns are extremely vulnerable to gyrations in international commodity markets and therefore have little control over their own fate. While levels of employment give a general picture of a city's economic

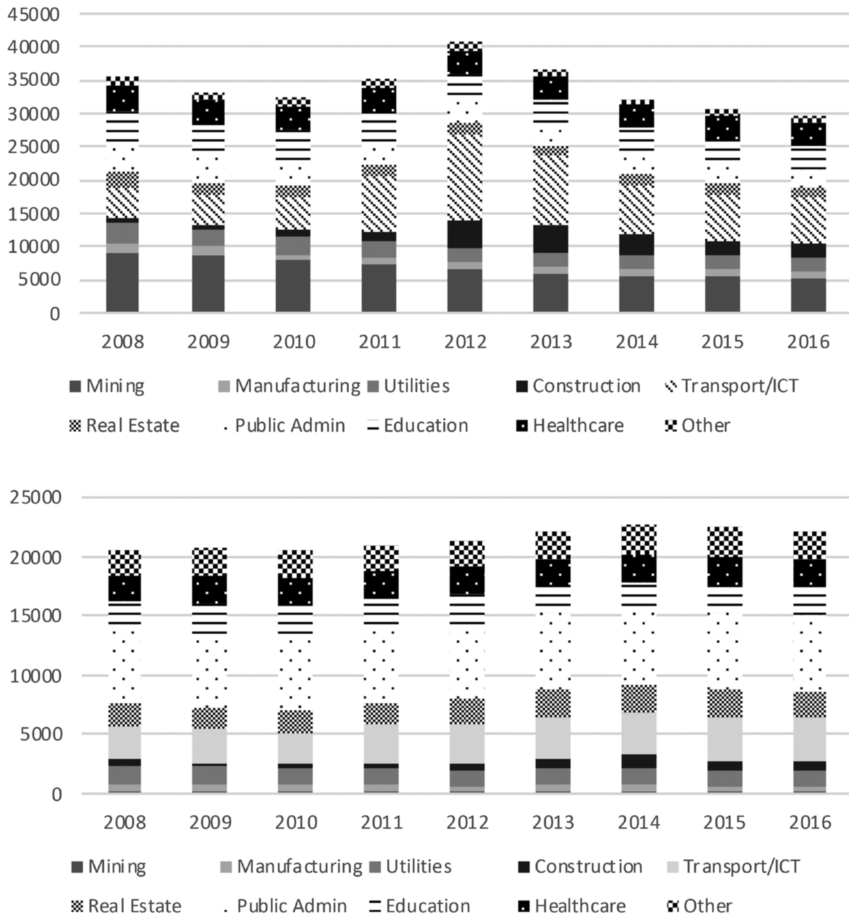


Figure 2.3 | *Vorkuta and Salekhard employment concentration. Figure created by the authors.*

health, understanding the city's ability to survive over the long term requires a more comprehensive picture of economic diversity in the city.

Urban Landscape

Urban design has played a key role in the sustainability performance of Vorkuta and Salekhard. The peculiarities of both cities' functional specializations and economic development propagated dynamic urban planning changes that took the cities in different directions.

Figure 2.4 | *Ruins of the abandoned Vorkuta Ring. Photographs by Luis Suter and Nikolay Shiklomanov.*

Vorkuta benefited from the way that it developed. At the center was the core city, which hosted the key functions. Around an outer ring were approximately a dozen coal mines, with as many as ten thousand individuals living in settlements near the mines. Since the 1990s Vorkuta has experienced intense compression of urban space, promoted by programs such as the Northern Restructuring Project financed by the World Bank and Russian federal government. The central core, in general, was preserved, but most of the settlements in the ring were closed and abandoned. After residents moved away, these buildings were often purposefully destroyed to discourage informal use (figure 2.4).

It should be noted that the concentric design of the Vorkuta agglomeration can be considered a success; it allowed for the relatively easy transition to a more compact version of urban planning following a drastic reduction in the population, without much emptiness in the fabric of urban space. While the gloomy ruins remain on the periphery, the city has been able to maintain a relatively comfortable urban environment in its center. In this respect, the urban landscape of central Norilsk has changed more dramatically, but the cause of the destruction was largely due to the influence of permafrost processes rather than to the mass migration of population. The urban areas of central Vorkuta remain pleasant and active, making the city seem rather vibrant. Nevertheless, even in the city center the repairs cannot hold back the degradation completely, with damaged or abandoned buildings sometimes directly flanking their still-inhabited counterparts (figure 2.5).

Salekhard, in contrast, has undergone significant spatial growth, especially in the downtown area. After the arrival of the regional administrative organizations, the city began to build up a business district on the right bank of the Shaitanka River. Most of the old part of Salekhard, on the headland between the Polui and Shaitanka



Figure 2.5 | *Downtown Vorkuta. In downtown Vorkuta it is common to see neighborhoods with completely abandoned structures (top left) next to inhabited units being repaired (above) alongside newly constructed dwellings (left), providing stark contrasts. Photographs by Luis Suter and Nikolay Shiklomanov.*

Rivers, was converted into a historical and cultural area with museums, educational institutions, offices, and hotels. Additionally, there has also been significant private developments, for example the area just above the mouth of Polaibta flowing into the Polui River. Here the city also built a public beach that, although unexpected for anyone unfamiliar with life in Arctic cities, was highly appreciated by the townspeople. Beach accessibility is a criterion for a high quality of life desired by both Soviet and post-Soviet people in the North, leading to the construction of beach zones in many cities of the Yamal-Nenets Autonomous Okrug, and even in Norilsk. In this area, a luxury cottage development was also built.

The cityscape of Salekhard continues to grow and change quite dramatically, with construction sites common across the urban landscape (figure 2.6).

In the city center of both Vorkuta and Salekhard, a rather positive scenario has been realized. Vorkuta, thanks to the concentric structure of the agglomeration, effectively avoided holes and ruins in the central squares, the historical nucleus of the city on the banks of the Vorkuta River, and along the railway, with some exceptions. The degradation occurred mainly in the satellite settlements. In terms of the prospects for future urban development, we can consider, given the severity of the process, such concentration to be an ideal option to smooth the city's shrinking phase.

Salekhard, with the advent of the new business district, managed to avoid the degradation of the old city center and retained a traditional

Figure 2.6 | *Downtown Salekhard. Photograph by Luis Suter and Nikolay Shiklomanov.*

urban environment. In this sense, the somewhat ambiguous removal of government buildings into a clean field seems justified. A distinctive feature of Salekhard, compared to other cities of the Russian Arctic, is the presence of private development—mainly in the area along the Polui and Polaibat Rivers. Residents of these private homes often conduct small-time agriculture, growing potatoes and vegetables. Thus, these two neighborhoods, in a sense, represent two stretches of "traditional" Salekhard, while the place between them along the Shaitanka has turned into the façade of the capital of the Yamal-Nenets Autonomous Okrug. This neighborhood also contains significant symbols of the power of the city administration.

However, Salekhard is not without challenges, particularly in the sphere of housing. The continued construction of government buildings in the large downtown park could well occupy and exhaust resources necessary for building residential units. Though the city has continued to build residential space, in 2016 there were still 1,709 families registered as in need of housing. The number of citizens receiving state support for housing in Salekhard has steadily risen, nearly doubling from 5,347 in 2008 to 10,255 in 2016. The city has been addressing this problem, commissioning an average of 32,850 square meters (m^2) of new housing per year since 2006, when records began. In contrast, Vorkuta has reduced the number of families in need of housing from 6,038 in 2006 to only 210 in 2017, while only adding about 1,100 m^2 of new housing per year.

Although ISO 37120's core urban planning metric involves measuring green space, which is not relevant in discussing this city, certain ISO urban planning profile indicators can be usefully applied to Vorkuta and Salekhard. Results for indicators evaluating population density per square kilometer and built-up density as seen in table 2.2 reveal important differences between these two cities. The indicator data show that Salekhard is much more densely populated and boasts greater building density than Vorkuta, suggesting that the natural gas city is much more likely to be sustainable than its coal-producing cousin.

Table 2.2 | *Urban planning indicators for Salekhard and Vorkuta*

City	Population density per square kilometer (ISO 37120: 21.5.1)	Built-up density (ISO 37120: 21.5.3)
Salekhard	48	0.93
Vorkuta	3	0.065

Source: Calculated from Rosstat.

Attachment to Place

During the rapid decline of Vorkuta in the 1990s and 2000s, many experts predicted the city's disappearance (Barenberg 2014). However, this has not been the case, and the city looks increasingly likely to exist in some form far into the future. Most planners expected programs such as the Northern Restructuring Project to be far more effective, but the implementation was limited in part by the attachment to place that had built up over the years in these communities. There is a distinct sense of pride in the history of Russia's northern cities, their contributions to national well-being, and their toughness. Given its basis in emotions rather than rationality, this sense of connection with a city or region is extremely difficult to quantify, but is a critical factor influencing the long-term sustainability of these cities. In Vorkuta especially, this pride of place is self-evident in the form of advertisements of proud coalminers and the branding of the city as a capital of the North.

This attachment to place and local pride in the city further resulted in several tangible efforts to improve its sustainability. While funding for such initiatives is scarce on regional and national levels, local administrations have undertaken several popular initiatives to improve the quality of life in the city. One notable project started by the popular mayor Igor Shpektor in the 2000s involved the fertilization of large swaths of green space, including derelict building sites. Warming climate and fertilization efforts allowed the growth of trees, which are not normal for the tundra environment, and have noticeably changed the urban environment. This greening of the city represented an ideological step forward for Vorkuta, which had often been labeled as hopelessly polluted and ugly (figure 2.7).

While ISO 37120 does not directly measure attachment to place, it does seek to measure some proxy variables. In this case the number of trees per hundred thousand population (ISO 37120: 21.5.2) could be a good measure of attachment to place, drawing on the assumption that cities where people plant more trees have greater attachment

Figure 2.7 | *Evidence of greening in Vorkuta's central park from time-lapse photos. Photographs by Luis Suter and Nikolay Shiklomanov.*

than places where there are fewer trees. Unfortunately, we have not been able to count the number of trees in the cities where we are conducting research, but hope to do so in the future.

Other Sustainability Indicators

Salekhard has a better outlook when considering other statistical indicators of urban sustainability identified by ISO 37120. Health-care services are much more available in Salekhard than in Vorkuta, with about 20 percent more doctors and nurses per capita. Salekhard has nearly twice as many residents with higher education degrees per capita than Vorkuta.

Vorkuta is highly polluting, producing 2.21 tons per capita of carbon dioxide equivalent per year since 2008, compared to Salekhard's 0.05 tons per capita. This statistic is slightly biased given the two cities' legacies and economic specializations. Coal is inherently more polluting and therefore, it is obvious why the level of pollution in Vorkuta, whose heating is based on the use of coal, has a higher level of pollution. However, Salekhard's economy depends heavily on the extraction of oil and gas and these fossil fuels are consumed and burned elsewhere, contributing to climate change and driving ongoing processes that negatively impact Northern regions. While Vorkuta pollutes far more as a municipality, these statistics do not fully account for each city's contribution to fossil-fuel-related emissions.

One factor that is important to the Arctic, but that is not considered in ISO 37120, is permafrost. Two permafrost monitoring sites located near Vorkuta report one of the largest increases in thaw depth in Russia since the beginning of measurements in 1996. Likewise, the non-permafrost areas near Vorkuta show a shortening of the seasonal freezing period and a decrease of the freeze depth of almost 1 meter (m) over the past fifty years (Streletskiy et al. 2015). The increase in the thaw depth and increase in permafrost temperature is also evident in regions of West Siberia, including the area near Salekhard; that thaw has been especially evident since 2010. These changes are driven primarily by the ongoing increases in air temperature west of the Polar Urals and by both temperature and snow increases in West Siberia. These changes contribute to the damage of infrastructure built on permafrost, as the ability of foundations to support buildings and structures decreases (Streletskiy, Shiklomanov, and Nelson 2012). The capacity of the ground to hold the foundational piles on which buildings are anchored has declined in both cities as temperatures have warmed. This bearing capacity is projected to decrease an additional 30 percent by the middle of the twenty-first century. Combined with anthropogenic factors—including maintenance—these environmental changes can have profound impacts on the urban landscape and sustainability.

Conclusion

In assessing the urban sustainability of these two cities, it is critical to use a mixed-methods approach. The ISO 37120 urban sustainability indicators provide a useful quantitative basis from which to comparatively analyze two Arctic cities within a country, where equitable statistical indicators are available. However, such measures must be combined with qualitative data that addresses the context of historical developments and ongoing processes in order to comprehensively evaluate the sustainability of an Arctic city. Measures such as employment concentration can be used to describe and visualize the current state of a city and reveals interesting patterns about the stability of the economy. Similarly, we must also regard statistical measures such as a city's carbon dioxide concentration within the larger context of the region's economy, as in the case of Salekhard where the emissions do not reflect the economy's profit from fossil fuels. Unfortunately, such statistical measures cannot fully describe how these conditions developed. For such an analysis, the context of historical and ongoing processes—economic, social, and political—are necessary. Such context is best provided by communications with local peoples, historians, and policymakers, and stresses the importance of field work and experiential research in these unique locations.

Some of the most critical components of this analysis, from the description of historical processes to the concept of attachment to place, can only be studied through travel to these places and interactions with people who live there. Cities evolve and change, and these changes are often not reflected in the official statistics collected every year. Moreover, statistics cannot describe how inhabitants feel about their cities; in the case of Vorkuta inhabitants' opinions are one of the strongest remaining stabilizing forces within the city. Many scholars have argued that, according to logic, the city should have closed or relocated years ago, but a strong sense of pride in the city's past and present toughness fights against this logic.

Nadezhda Zamyatina is senior research fellow in the Department of the Social Economic Geographies of Foreign Countries, Geography Department, Moscow State University.

Luis Suter graduated from the George Washington University with a master's degree in geography.

Dmitry Streletskiy is associate professor of geography at the George Washington University.

Nikolay Shiklomanov is professor of geography at the George Washington University.

Notes

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2. In Vorkuta the experts were: 1 and 2: two employees of the municipal administration: the head of the Youth Department and an adviser to the head of administration; 3) the chief architect of the city and 4) his staff and 5) an employee of the Vorkuta Mining and Economic College. In Salekhard we interviewed the deputy director of the Arctic Research Center of the Yamal-Nenets Autonomous Okrug, two employees of the local museum center, and the head of the Youth Department (the last was a telephone interview).

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CHAPTER 3

Norilsk

Measuring Sustainability in Population Size and Well-Being

Marlene Laruelle

Introduction

A complex process with several bottom-up and top-down dynamics, urban sustainability remains difficult to assess. Identifying accurate measurements depends on the definition of sustainability, as well as on the national context and historical trajectory of each city. To discuss these interactions this chapter focuses on a city considered one of the least sustainable in the world: Norilsk, the northernmost city built on permafrost, a former Gulag, and Russia's most polluted city, with a highly negative environmental footprint. Norilsk epitomizes the sustainability challenge of industrial cities built to exploit resources, whose future depends on the availability of that resource as well as international demand for it.

Some may consider that Norilsk's continued existence does not make sense in light of its environmental footprint, and therefore say its sustainability objective should simply be to disappear. Yet national context matters: There is no way that Russia, which plans to make the Arctic its resource base for the twenty-first century, as then-president Dmitry Medvedev said in 2008 (Arctis Knowledge Hub 2009), would stop exploiting the resources of its huge Siberian landmass. A new Arctic urban sustainability project launched by the expert group Pora and Moscow State University's Faculty of Economics recognizes that sustainability in Russia has to be understood as being balanced against the fact that the conquest (*osvoenie*) of the Arctic—in the sense of exploiting its resources—remains a national priority. This reality leaves no room for the "eco-utopia" of a clean environment with no human and industrial footprint ("Poliarnyi indeks" 2018).

Although shaped by a Soviet legacy of heavy industrialization, some Russian cities have nevertheless been able to improve their overall sustainability. Looking at six big cities in the Asian part of Russia (Yekaterinburg, Novosibirsk, Krasnoyarsk, Omsk, Irkutsk, and Khabarovsk), Fan et al. (2018) conclude that these urban areas have experienced enhanced economic growth despite having a declining population, and that they balance economic development with environmental awareness and social advances. Cities such as Norilsk, however, find it more difficult to strike this balance: Based as they are on a single extractive industry, they struggle to achieve economic diversity.

Since traditional definitions of sustainability are a poor fit for Norilsk, more-modest goals should be sought. This chapter defines the following sustainability goals for the city: (1) Reducing the industries' negative environmental footprint; (2) Planning a progressive shrinking of the population in order to make the city small and efficient, organized around a limited but skilled workforce; and (3) Improving the well-being of the population.

Collecting data on Norilsk poses at least four challenges. First, Rosstat offers rich data at the level of each administrative subject of the Russian Federation, but not systematically at the municipal level. Local administrations do collect their own data at the city level, but they do not do this in a consistent way across the country. Second, regular institutional reshuffles at the federal level may impact data collection. The dismantlement of the Federal Migration Service in 2016, now integrated into the Ministry of the Interior, for instance, has limited collection of and access to data on migration flows (Glavnoe Upravlenie 2018). Third, municipal authorities can choose whether to make data publicly available depending on the status of the city and the level of securitization they deem necessary. Since Norilsk is considered a "strategic object"—a term used by Russian authorities to refer to critical military and industrial assets—information about the city is more controlled than data about cities that are more open, such as Murmansk. The city is also restricted to foreigners, who are allowed to visit only after obtaining a permit from the Federal Security Service.

Last but not least, the City of Norilsk has undergone several changes in its administrative status that often blur the available data. In 2004 the three satellite towns of Talnakh, Kayerkan, and Snezhnogorsk lost their city status and were incorporated into Norilsk. This process of combining towns is a classic tool used to streamline small settlements into larger agglomerations, especially at a time of demographic decline. The new entity is called Greater Norilsk or the Norilsk Industrial Area; Norilsk itself has become Tsentral'nyi, or the center. The data collected at the city level now includes the former satellite towns, complicating the comparison of statistics from before and after the 2004 status change. A few years later, in 2007, the Taimyr Autonomous District—to which Norilsk belongs—merged with the Krasnoyarsk Kray, becoming part of a huge region. As a result, some district-level data has disappeared: data on urban trends may now include other big cities such as Krasnoyarsk, and Norilsk is not always singled out.

This chapter introduces the city's trajectory and the main actors in charge of sustainability before delving into a series of indicators. It applies the ISO indicators for city sustainability and discusses their utility and the need to develop other indicators to capture grassroots activities, perceptions and behaviors.

Introducing Norilsk

With 178,000 inhabitants in 2017, Norilsk is the second-most populous city in the world built on permafrost after Yakutsk, making it a textbook case for discussing urban sustainability in polar latitudes. It is located in Central Siberia at 69°51' N latitude, above the Arctic Circle. It experiences the normal change between day and night for only 146 days; the rest of the year is divided between polar day (sixty-eight days) and polar night (forty-five days). The city is characterized by a harsh Arctic climate (the mean annual temperature is around −10°C), with only 84 days a year where the temperature reaches above freezing. In an average year Norilsk is covered by snow for 247 days.

The history of the city is illustrative of Soviet and post-Soviet population and urban management. In terms of population, it has experienced the three main stages common across the Russian Arctic: first the sending of a forced workforce—prisoners in the camps, or Gulag—to provide free labor; then the incentivization of (usually young) citizens to settle there with the promise of material benefits and promotions; and most recently the management of the post-Soviet market economy—which has seen mass departures from

Arctic cities and the arrival of foreign labor migrants to whom the region is still attractive—including by letting private firms rebalance their workforce needs. In terms of urbanism, the city provides a visual representation of several major trends in Soviet design, from the Stalinist neo-classical architecture of the late 1940s and 1950s to the prefabricated concrete panels of the 1960s, 1970s, and 1980s. Today it struggles to maintain this architectural legacy in the face of crumbling infrastructure and deteriorating environmental conditions, including urban heat islands and climate change.

The first prisoners to be sent to the Putoran Mountains, known for their copper-nickel sulfide ores, arrived in the early 1930s to complement a small settlement created a few years earlier under the auspices of scientific and geological expeditions led by Nikolay Urvantsev. The first Gulag camp opened in 1935 under the control of the Soviet secret police, the People's Commissariat for Internal Affairs. It remained relatively small until World War II, when the smelting plants of the Kola Peninsula, threatened by the German-backed Finnish army, were evacuated to Siberia. At its peak in the early 1950s, the Norilsk corrective labor camp, the Norillag, hosted between 50,000 and 75,000 prisoners, scattered across seventy camps laid out in eight vast complexes spread out over 5,000 kilometers (km) (3,100 miles) that spanned from the north to the south of the Krasnoyarsk region (Applebaum 2004). At that time, 68,000 of Norilsk's 77,000 inhabitants were convicts (Krichevskii 2010). Several thousand non-convicts, principally engineers, also worked there.

Starting between 1954 and 1956 and tapering until the end of the 1950s, the Norilsk de-Gulagization saw the progressive dismantling of the camps. Of the 500,000 people who spent some time at Norillag (Ebedzhans 1996), most eventually returned to European Russia or to their republic of origin. Some decided to stay, including those who had no other place to go or who wanted to continue working in the mineral extraction sector. In 1955 Norilsk became a city (Poluektov 2011), and its industrial complex was transferred from secret police supervision to the Ministry of Metallurgy. With the release of tens of thousands of prisoners, the city and the mining complex faced an abrupt labor shortage, which slowed down housing construction and mineral extraction. Concerned about this trend, the Soviet authorities decided to send the Komsomol (All-Union Leninist Young Communist League) to replace the Gulag workforce. In 1956 alone, during the sixth five-year plan, 29,000 Komsomol members arrived in Norilsk, a mass phenomenon referred to as the landing of the Komsomol (*komsomol'skii desant*).

In the 1960s rapid production increases turned Norilsk into one of the principal mineral producers in the Soviet Union, a trend accelerated by the discovery of the Talnakh deposits, 25 km north of Norilsk, in 1960. Around the same time, in 1963, Norilsk became a closed city, meaning that Soviet citizens could not visit without a professional or family reason. This was the city's golden age: Its population boomed from more than 100,000 inhabitants at the 1959 census to more than 250,000 two decades later. Workers were motivated by the significant material advantages offered: salaries were based on the Nordic Coefficient, with the highest in Norilsk (2.0, a double salary), and were supplemented by the *polyarki* (additional salary) based on the number of years spent in the Far North. There were also paid vacations in southern Russia (Gras 2013).

From that point until the collapse of the Soviet Union, wage increments were one of the driving forces behind the urbanization of the city and its satellites. These were complemented by growing efforts by the Soviet authorities to improve the livability of Arctic cities. From the end of the 1960s living conditions in Norilsk began to improve dramatically. Annual figures for housing construction doubled due to prefabricated construction technologies, and cultural life was vivid. These policies caused the population of Greater Norilsk (Norilsk and its two main satellite cities, Talnakh and Kayerkan) to increase by 55 percent between 1971 and 1980, a growth rate far exceeding that of the Krasnoyarsk Kray as a whole (21.2 percent) and even the Russian Soviet Federative Socialist Republic (17.8 percent). In 1971 Norilsk recorded the second-highest urban birth rate in Soviet Russia, a number explained both by the high natural fertility rate and by the arriving migrant population (Bond 1985).

In the 1980s, however, Soviet programs to stimulate social and territorial mobility slowed. Norilsk's migratory balance turned negative, with more people leaving than arriving. Large urban projects for new satellite cities never took off due to a lack of inhabitants, and have become ghost towns. Yet the population of Norilsk, accustomed to a certain quality of life under the protective umbrella of the industrial complex, felt the impact only at the fall of the Soviet regime in 1991. The city's closed status was repealed that year, and government subsidies were terminated almost from one day to the next (Zamyatina 2007). The collapse of state support and subsidies, combined with the company's struggle to transition to a market economy, accelerated the departure of all those who could find employment elsewhere in the country or who could shift to the emerging private sector. The city's demography declined dramatically: Its population fell by 37 percent between 1989 and 2010, from 267,609 to 175,365 inhabitants.

Who Is in Charge of the City's Sustainability?

Norilsk can be considered the largest Arctic monocity, a designation that indicates that 25 percent of the city's population works in its primary industry, more than 50 percent of total town production is generated by this industry, and more than 20 percent of the municipal budget is dependent on it (Didyk, Ryabova, and Emelyanova 2014). Its foundational firm, Norilsk Nickel, is now Russia's largest mining company and the world's largest and lowest-cost producer of nickel. It accounts for 20 percent of global nickel production and, in Russia, for 90 percent of nickel, 55 percent of copper, and 95 percent of cobalt.

While private, the company is owned and run by oligarch Vladimir Potanin, a figure close to Vladimir Putin, making Norilsk Nickel a state-protected firm intimately connected to the Kremlin's policies. As one of the most important mineral centers of Russia, whose production is considered strategic to the Russian state, the City of Norilsk answers directly to Moscow, more than to Krasnoyarsk, even if it is part of the Krasnoyarsk Kray. This political proximity to the Kremlin offers advantages in terms of getting things done and securing state subsidies: Norilsk has, for instance, a relatively high municipal budget (17 billion rubles), exceeding that of cities such as Yakutsk and Murmansk, whose populations are almost twice as large. However, this protective policy toward Norilsk also constrains the city's ability to manage its own internal affairs (Humphreys 2011).

As a company town, Norilsk showcases a symbiotic relationship between the municipal authorities and Norilsk Nickel, with the latter providing about 90 percent of the municipal budget (City of Norilsk 2018c). The corporate identity of the city is evidenced by Norilsk Nickel's main administration being hosted in the most prestigious and imposing building in the city's downtown; the streets are also lined with billboards celebrating the mining firm's production. Norilsk Nickel supports many of the cultural activities offered in town, works closely with the Orthodox Church, and, in the early 1990s, funded a small commemorative monument on the site of the erstwhile Gulag (author's fieldwork and interviews with local associations and the city council, Norilsk, in July 2013 and July 2015). As we will see below, Norilsk Nickel also controls the demographics of the city by gradually shrinking its workforce. Norilsk Nickel is thus *the* central actor of urban politics in Norilsk, while the municipal authorities find themselves in a subordinate position with limited decision-making autonomy.

Norilsk Nickel is also the main stakeholder in anything related to sustainability. Its environmental records are poor: the Blacksmith Institute (2013) includes Norilsk on its list of the world's ten most polluted cities, stating that 500 metric tons each of copper and nickel oxides, as well as 2 million tons of sulfur dioxide, are released into the air at the site of the Norilsk Nickel plant on an annual basis (data from 2007). According to Rosstat, Norilsk Nickel produced 1.8 billion tons of pollutants in 2016 (Goskomstat 2017d). Even if the plant cleans almost half of its emissions, the remaining pollution has contaminated the soil in at least a 60-km radius, creating a technogenic desert, and a large number of residents are exposed to particulates, sulfur dioxide, heavy metals, and phenols, leading to increased levels of respiratory diseases and cancers of the lungs and digestive system. Globally, the city epitomizes the obstacles to improving the environmental footprint of former Soviet industries: It is the most polluted city in Russia.[1]

This situation can be partly explained by the Soviet legacy: It is difficult and expensive to modernize the aging infrastructure left over from the Soviet period. But blame can also be laid at the feet of Norilsk Nickel due to its mismanagement of industrial waste. Until recently, the company was able to pay the—quite modest—financial penalties imposed for its pollution. However, new Russian environmental legislation passed into law in 2015 ("Rasporiazhenie Pravitel'stva" 2015) makes this more difficult: By 2023 the firm will be paying penalties 100 times higher than those it is paying today if it does not cut its emissions by two-thirds. This reality pushed the firm, in 2016, to close its old smelter (dating back to 1942), that had produced around 120,000 tons of refined nickel per year, while emitting 380,000 tons of sulfur dioxide annually (Norilsk Nickel 2016). It also decided to build a new $1 billion processing plant, to be completed in 2022, to convert the sulfur dioxide produced during the metal smelting process into gypsum, a safer product (Foy 2018).

More importantly, international environmental pressures, combined with the drop in the world prices of minerals, have contributed to a radical overhaul of the company's nickel operations, refocusing refining on the metallurgical complex of the Kola Peninsula and the Harjavalta complex in Finland (Staalesen 2016). In the case of a firm producing such a strategic material, only international pressure from investment funds—the firm is listed on the London Stock Exchange—is powerful enough to force it to take such a drastic, costly measure. The decision directly impacts the sustainability of the city, not only in terms of its environmental footprint, but also in terms of its very survival: If extraction and processing factories close down, the future of the city, at least at its current size, will be called into question.

In such a context, the municipal authorities do not enjoy much room for maneuver. In 2017 the city council released a municipal program, Formation of a Contemporary Urban Environment (*Formirovanie sovremennoi gorodskoi sredy*), for 2018–22. This program does not use the term "sustainability" ("*ustoichivoe razvitie*"), though it does insist on several occasions on the need to improve well-being (*blagoustroistvo*). It defines the contemporary urban environment to be reached as being composed of eight pillars: (1) citizen participation (through the creation of a social commission for the development of the urban environment); (2) a holistic approach to the city's territories; (3) courtyards (*dvory*) as centers of everyday life; (4) the creation of public spaces that reinforce citizens' responsibility for the city's overall ambiance; (5) the individual responsibilities of landlords and political leaders in charge of programs; (6) attracting local producers and small and medium-sized enterprises to invest in the city; (7) the adoption of best practices; and (8) engaging the younger generation in the city's new design. As we can see, the city's plan remains focused on social and societal issues and does not address environmental challenges and industrial prospects, because they do not belong to its area of responsibility (Norilsk Nickel City Council 2017).

Sustainability Indictors

The ISO indicators for urban sustainability described in this book's Introduction give us a comprehensive idea of what it would take to assess sustainability in the context of Norilsk. In this chapter I leave aside the environmental indicators, on which Norilsk performs poorly, to focus on the two other criteria of sustainability discussed in the chapter introduction: planning a progressive shrinking of the population in order to keep the city small and efficient, organized around a limited workforce; and improving the well-being of the population, measured in terms of the indicators listed in table 3.1 and figure 3.1. Table 3.1 presents the available indicators for Norilsk: those that correspond to ISO norms, those that are similar but measured on a different scale, and those are not on the ISO list. Some indicators are known for the city, others are available at the regional level only.

Table 3.1 | *List of ISO and other indicators for Norilsk*

Demographic indicators	
11.1 Average life expectancy	70.1[a]
Population under 18 years old (ISO 13.4.3 Population under 15)	24.3%
Population over working age (55 for men, 60 for women) (ISO 13.4.3 Population over 64)	9.2%
5.1 Unemployment rate	5.00%
Health, housing, and crime indicators	
11.2 Number of in-patient hospital beds per 100,000 people	0.01416
11.3 Number of physicians per 100,000 people (data from 2007)	0.00785
11.5 Number of nursing and midwifery personnel per 100,000w people	0.02333
12.5.4 Living space (square meters) per person	24
Infant mortality per 1,000 births[b] (ISO 11.4: under-5 mortality)	5.9
Alcohol abuse rate per 100,000 people	743
11.6 Suicide rate per 100,000 people	16
15.8 Property crime total per 100,000 people	923.9
Violent crime total per 100,000 people	49.2
Juvenile violence total per 100,000 people	63.9
Cultural and socioeconomic indicators	
5.5 Number of businesses per 100,000 people	27.36
6.6 Number of higher education degrees per 100,000 people	0.00237
17.1 Number of cultural institutions and sports facilities per 100,000 people	292
Number of kindergartens, schools, universities, technical institutes[c]	90
Number of public gathering places per 10,000 people (indoor and outdoor)[d] (ISO 14.2: square meters of public recreation space per capita)	1.8
Percent of adults with postsecondary education	65.2
Broadband Internet penetration (number of households) (ISO 18.1 Internet connections per 100,000)	69%
Political indicators	
10.4 Voter participation in most-recent municipal election (as a percentage of registered voters)	16.5
Quality of life indicators	
19.5 Transportation deaths (regional level)—number of deaths by transportation per 100,000)	14.36[e]
Transport capacity of public transportation system (regional level) (ISO 19.6 percentage of population living within 0.5 km of public transport)	20,610[f]
Amount of food produced locally in rubles (ISO 20. 2 Amount of food produced locally)	2,660,514

Social inclusion indicators	
10.1 Women as a percentage of total elected to city-level office[g]	23.5%
Women in workforce	48.3%
Women's salary compared to men's salary	69.6%
13.4.4 Percentage of population that are new immigrants	0.9%
13.4.5. Percentage of city population that are noncitizens	0.7%[h]
13. 3 GINI coefficient (regional level)	0.392[i]
13.2 Number of people under poverty line (regional level)	18.7[j]

Source: Data compiled by the author and Alexandra Poturaeva.
Notes: The ISO indicators are indicated by their number: 5.1–19.5.
[a] "Prodolzhitel'nost' zhizni" 2015.
[b] City of Norilsk 2014.
[c] City of Norilsk 2017a.
[d] Document no longer available.
[e] FedStat 2015.
[f] City of Norilsk 2017b.
[g] City of Norilsk 2018b.
[h] "Gost' v zakone" 2016.
[i] Fedstat 2017.
[j] Goskomstat 2016.

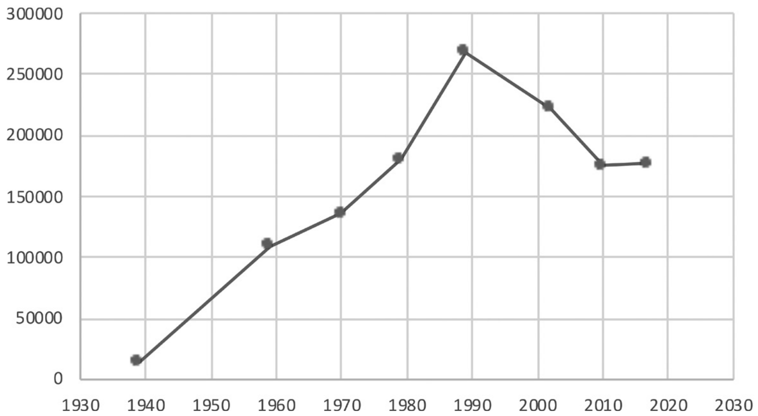

Figure 3.1 | *Norilsk population from 1939 to 2017: rise, decline, stabilization. Figure created by the author.*

Planning Progressive Population Shrinkage

For a city like Norilsk, demographic sustainability means finding a way to keep the city population small and efficient, organized around a limited but qualified workforce and free of people who are, for production purposes, "non-necessary." Of course, it is inevitably difficult to strike a balance between attracting the right workforce and pushing away “non-needed” residents.

The portfolio of professions offers a comprehensive view of Norilsk’s social fabric. Of the city’s 178,000 inhabitants, 50 percent, or about 90,000 people, are in the workforce—a lower share than in previous years, but nevertheless a share that is high compared to other Arctic cities, which host greater non-working-age populations. Of these 90,000, about 32,000 people—one-third—work in the mineral extraction sector (Norilsk Nickel employs two-thirds of these workers and its subsidiary companies the other third; City of Norilsk 2018a). In addition, many businesses depend on the firm, among them construction, transportation, and storage, which together employ a further 15,000 people, or almost 17 percent of the city’s workforce. The rest of the workforce is divided between the private sector linked to consumption—retail, leisure, and so on (23,079 people, or 25 percent)—and public administration (19,846, or 22 percent). These numbers confirm that Norilsk is a much more diversified city than the cliché of an industrial monocity might suggest; it has developed consumer and public services sectors. But in terms of the share of adults with a postsecondary education, the city scores toward the low end of the Russian average, 65 percent.

Since post-Soviet privatization, Norilsk Nickel has gradually been shrinking its workforce. The number it employs plummeted from 140,000 during the Soviet period to 122,000 in 1996, 84,000 in 2001, and 56,000 in 2014 (Norilsk Nickel 2014), before rising slightly to 78,000 in 2017 (Norilsk Nickel 2018c). However, these numbers do not tell the whole story: the firm has been outsourcing many of its activities to semiprivate subbranches that are not considered part of Norilsk Nickel but still work entirely for it. This outsourcing has allowed the firm to limit the number of workers to whom it must give social benefits (author’s interviews with representatives of Norilsk Nickel in Norilsk in July 2015, and in Nikel in July 2016). The firm has also cut several entitlement programs inherited from the Soviet system (pensions, health care, public transportation, and other services), shifting those costs to the municipality.

At the same time, the firm still needs to attract qualified engineers, a difficult task given that it offers an average salary for such professions (about $1,800/month for a miner or around $2,000/month for an engineer in 2015, according to informal discussions with miners and engineers in Norilsk in July 2013 and July 2015) and that many prefer the better living conditions elsewhere in Russia. As such, Norilsk Nickel has had to develop a strategy for recruiting engineers from abroad, mostly in Ukraine and Kazakhstan. It has also tried to attract Russian citizens by building and fully furnishing apartment complexes in Norilsk and offering generous cofunding policies for apartments in another region of Russia for those who have worked for the firm for at least ten years (author's interviews with representatives of Norilsk Nickel in Norilsk in July 2015, and in Nikel in July 2016).

Pushing away those who are no longer needed is even more complex. Norilsk's social fabric is largely shaped by its working identity: one lives in Norilsk to work. The city thus has a relatively young population, with an average age of 33, compared to the Russian average of 39.7 (City of Norilsk 2016). According to the city's own data, an impressive 69 percent of inhabitants are of working age (18 to 60), with 24 percent younger and only 9 percent older (City of Norilsk 2017b). Moreover, two-thirds of those who are officially retired continue to work, performing small jobs for which the city would otherwise have to recruit migrants. There is only 5 percent unemployment, Russia's average.

Toward the end of the 1990s, Norilsk Nickel undertook some unsuccessful large-scale resettlement programs to reduce the city's population (Glazunov 2010; Parente 2012). From 2002 to 2009, and with the assistance of the World Bank, it tried out a federal voluntary relocation program in three pilot areas (Nuykina 2011). Between 2011 and 2015 the company invested $128 million in resettlement programs with the goal of sending "populations from Norilsk and Dudinka towards regions in the Federation which have more suitable living and climatic conditions" (Norilsk Nickel 2015). The company transfers funds to the Krasnoyarsk Kray, which purchases apartments in other regions in Russia for the resettled families. More than 11,000 persons were expected to be transferred under the program in 2015, yet only about 5,000 of them benefited from the project between 2011 and 2015. The firm has also invested modest sums (less than $100,000 in 2015) in charity, scholarships for local youth and Indigenous populations, and environmental programs in partnership with local associations (Norilsk Nickel 2015).

Yet all these efforts on the part of a firm cannot alter residents' feeling of belonging to their city. Other resettlement projects—such as the Northern Restructuring Project launched by the Russian government with the help of the World Bank, which aimed to assist the voluntary resettlement of Vorkuta's, Norilsk's, and Magadan's nonworking-age population to more southerly towns—have faced limited success. Emotional attachment to place remains an important identity marker for individuals, and the romantic feeling of having built socialism in harsh climatic conditions on a pioneering front may hamper mobility: It is not easy to reconstruct place-specific social capital and many people have refused to leave the region where they have built their lives, despite the deterioration in living conditions (see Bolotova and Stammler 2010). Moreover, many of those who have been resettled have experienced difficulties in adapting (Heleniak 2009). In Norilsk, where the feeling of embodying the last frontier was strong during the Soviet era, local patriotism and pride remain an element that pushes some people to refuse to leave.

Today, the city seems to have stabilized demographically, both in terms of natural growth and in terms of in- and out-migration (City of Norilsk 2018a). Table 3.2 shows that the departures and arrivals almost result in population equilibrium. The facts that those leaving the city now do so largely through established mechanisms rather than uncontrolled flight, as occurred in the 1990s, and that workforce shrinkage is now planned and controlled by Norilsk Nickel suggest that the city has achieved some degree of sustainability, in the sense of maintaining control over the fate of the city and preparing for its population decline. On the third criterion for sustainability—improving the well-being of the population—however, the city has achieved only moderate results.

Improving the Well-Being of the Population

Health, Housing, and Crime Indicators

On the health-care front, the city does not rank very well. Life expectancy stood at seventy years for both sexes in 2015—which is Russia's average—with an impressive eleven-year gap between men, who die earlier, and women, who die later (Trubetzkoy 2018). Yet the real number is difficult to assess because many people leave before retirement age and therefore will pass away in another region of Russia. The health-care system remains weak in terms of the number of in-patient hospital beds and the number of physicians: It is below Russia's main Arctic cities but on a par with Yamal's gas monocities for beds, and lower than them for physicians. The municipal authorities and Norilsk Nickel have been working to address these issues by providing financial and professional incentives for medical specialists to settle in town, which has improved the situation in recent years (author's interviews with representatives of Norilsk Nickel in Norilsk in July 2015, and in Nikel in July 2016).

Table 3.2 | *Migration flows in Norilsk, 2010–15*

Year	Arrivals, number				Departures, number				Net migration
	Total	International	From another region of Russia	From another place in this region	Total	International	To another region of Russia	To another place in this region	Total
2010	10,987	1,680	8,164	9,844	12,198	231	10,235	1,732	−1,211
2011	11,008	1,520	8,261	9,781	13,872	374	11,532	1,966	−2,864
2012	12,056	1,822	9,222	11,044	14,094	332	11,641	2,121	−2,038
2013	12,586	1,799	9,416	11,215	13,126	504	10,766	1,856	−540
2014	12,469	1,668	9,385	11,053	13,405	549	10,936	1,920	−936
2015	13,395	1,929	10,220	12,149	13,233	648	10,762	1,823	162

Source: City of Norilsk 2018a.

Norilsk's average infant mortality (5.9 per 1,000) constitutes a good indicator of the state of health-care institutions and basic hygiene—drinkable water, protection against widespread basic infections, vaccinations, and so on. Yet it does not provide any insight into the general health of the population, especially the impact of living in a highly polluted environment. For that, one would need to add new data points such as the prevalence of chronic diseases. In 2015, for instance, heavy metal, dioxide, and sulfur waste were still between eight and forty-four times higher than existing standards permit ("Russian Ministry Demands" 2015). The city has a high rate of cancers and diseases of the lungs, blood, and skin. There were, for instance, 497/1,000 incidence of respiratory illness in Norilsk in 2012 compared to 379/1,000 for Russia as a whole, and 38/1,000 incidence of circulatory illness compared to 17/1,000 nationally (Goskomstat 2017e: 30; Kurkatov, Tikhonova, and Ivanova 2015). The long-term impact of pollution, however, is difficult to gauge, because many workers leave Norilsk for warmer climes when they reach retirement age.

There is only one traditional domain in which Norilsk finds itself better equipped: the number of nursing and midwifery personnel per 100,000 population, which is higher than in many Russian Arctic cities and even higher than in Novy Urengoy and Noyabrsk. This can be explained by the still lively Soviet legacy of improving motherhood and early infancy, and the municipal authorities' desire to present Norilsk as a child-friendly city. Krasnoyarsk Kray's motherhood capital (*matkapital*) is 137,000 rubles (about $2,000), which is about average for Russia, but the region provides it to families upon the birth of the second child and all subsequent children, like the federal award, whereas almost all other regions provide it only on the third child (Materinskii Kapital n.d.). Linked to the relatively young workforce, the number of young children in Norilsk is also relatively high, with children ages birth to five years comprising 9.1 percent of the city's population whereas they make up only 7.7 percent for the Russian population as a whole. More globally, children ages birth to thirteen years represent 20 percent of Norilsk residents, but only 16 percent of the country (Goskomstat 2018a).

In terms of space, housing conditions in Norilsk are average for Russia, with 24 square meters (m^2)/person. This says nothing, however, about the quality of that housing: a large part of the urban fabric is deteriorated due to low-quality construction and the difficulties associated with the changing temperature of the permafrost that lies below the buildings. In several neighborhoods, infrastructure degradation has been such that tens of multistory buildings have had to be evacuated and demolished (Grebenets, Streletskiy, and Shiklomanov 2012). Around 10 percent of buildings are identified as having progressive deformations (Kronik 2001). The majority of housing offers a low level of energy efficiency, compensated for by overheating, and some buildings have water-related problems. At the same time, Norilsk spends five times more of its municipal budget than Yakutsk and twelve times more than Murmansk on transport and infrastructure management and repair to keep its roads, water pipes, and heating systems functioning during the long, cold winter. Other ISO indicators, such as the percentage of people living in affordable housing and the prevalence of homelessness, do not appear in Russian statistics.

Norilsk spends four to five times more on law enforcement agencies and national security issues than cities such as Murmansk or Yakutsk, a sign of its strategic status and the heavy control that reigns there. This security focus is largely appreciated by the population, which perceives it as guaranteeing a low level of petty criminality. Yet the numbers do not support the link between higher spending on law enforcement agencies and lower criminality. In terms of property crime, Norilsk has the highest rate of all Russia's Arctic cities; it is also on the high end of average for violent crime. Only on juvenile criminality, which is said to have halved since 2016, does the city score well (City of Norilsk 2017b). The city's suicide rate is average for an Arctic city: It is higher than in the Kola Peninsula but lower than in more-depressed cities such as Vorkuta and Magadan. Interestingly, alcohol abuse is quite low, as it is in all extraction cities compared to more economically diversified Arctic cities. In Norilsk this can be explained by the heavy control exercised by Norilsk Nickel and other extraction firms over their employees, who are subjected to breathalyzer tests every morning before being authorized to work.

Cultural and Socioeconomic Indicators

In terms of socioeconomic and cultural indicators, Norilsk finds itself in an average ranking between more-depressed extraction monocities—Vorkuta, Apatity, Monchegorsk, and Nickel, as well as Dudinka, which is not yet a monocity—and more developed and diversified cities such as Murmansk, Arkhangelsk, and Yakutsk and better-equipped new oil and gas extraction cities such as Noyabrsk and Novy Urengoy (Goskomstat 2017a, 2017b, 2017c).

The city scores poorly in terms of educational institutions. It does not have enough kindergartens (43 in 2017, or one per 4,140 people, compared to Russia's average of one per 3,021) or primary and secondary schools (37 in 2017, or one per 4,811 people, compared to the Russian average of one per 3,434, in 2015; Goskomstat 2018b). The city's five colleges offer both traditional specializations (pedagogy, medicine, arts) and professions linked to the city's own identity (an industrial technologies and services college). For higher education, the most famous institutions are the Norilsk State Institute of Industry, which provides professional training for the careers available at Norilsk Nickel, and several subbranches of technical universities based in Moscow or Saint Petersburg.

The amount of space available for public gatherings is below average for a Russian city. If public squares are excluded, the city has only four small parks, five cultural institutions (one theater, two cinemas, and two museums, one of local history and one of arts), six sports facilities, one municipal library (with nine branch locations), and one big commercial mall. Only in the sector of sport facilities does Norilsk score well, on a par with Noyabrsk and Novy Urengoy: Extraction cities traditionally invest more in sport than in culture. As noted by Nadezhda Zamyatina, compared to Russia's other Arctic cities, Norilsk has a low level of grocery stores and malls, fewer museums and theaters, and fewer cultural professionals per capita (Zamyatina 2007). This data could be refined by collecting figures on the number of commercially oriented leisure places—cafés, restaurants, nightclubs, spa salons, and so on—to provide a better overview of the spectrum of services available to the population: with a registered 101 restaurants and cafés, the city scores relatively high, but less well than Yakutsk or Novy Urengoy (Zamyatina 2007).

Turning to the number of nonprofit organizations registered by the Ministry of Justice at the city level, the picture looks quite negative: Norilsk has only 213 nonprofits compared to 569 in Murmansk and 753 in Yakutsk (Ministry of Justice 2018). This data illustrates well the limited civil society sector in Norilsk compared to the dynamism of urban entrepreneurialism in Yakutsk and to a lesser extent in Murmansk. The more diversified a city's economic outlook becomes, the more diversified and dynamic is its social fabric, leaving more room for private initiatives, be they economic or social. Norilsk is also quite low in terms of Internet penetration, with 67 percent of inhabitants connected in 2017. Given its extremely remote location, it was one of the last big cities in Russia to get satellite Internet, at an average of one gigabyte/second. It was only in the second half of 2017 that a 956-km fiber-optic line running from Novy Urengoy reached Norilsk, thanks to a 2.5 billion ruble investment by Norilsk Nickel. Full-speed Internet was available citywide by mid-2018 (Ibragimov

2017). Yet it remains to be seen to what extent this will accelerate Internet penetration at the household level.

A similar trend appears when one explores the number of small and medium enterprises. Norilsk ranks quite low, as do all extraction cities. It has, for instance, only a third of the microbusinesses of Murmansk or Yakutsk (5,000 compared to 15,000 for Murmansk and 18,000 for Yakutsk) and fewer small businesses (164 compared to 660 and 519, respectively; Federal Tax Service 2018). This data should, of course, be taken with some caution, as it does not capture the shadow economy. Fieldwork observations confirm that Norilsk is much more entrepreneurial than the official number suggests, but this entrepreneurship is often informal (author's fieldwork and interviews with local entrepreneurs from ethnic minorities, in Norilsk in July 2013 and July 2015). That said, the difference between the three cities is striking. In terms of per capita spending to develop and support small and medium entrepreneurship, Yakutsk spent 252 rubles, Norilsk 39 rubles and Murmansk 17 rubles in 2012 (Goskomstat n.d.; "Raskhody na razvitie" 2012). No more-recent data are available.

Many of the ISO indicators that help calculate quality of life cannot be applied in the Arctic context (kilometers of bicycle paths or urban agricultural areas, e.g.) or else have to take into account the Russian context (e.g., the number of people using personal cars cannot be compared with the broad use of cars in the United States).

Political Indicators

Norilsk also finds itself at the bottom of the Fate Control Index—making its own decisions and having the ability to implement them—developed by Andrei Petrov (see chapter 6 in this volume) for twelve Arctic cities. Yet the concept is probably too normative—that is, too Western-centric—and is based on selected data that does not take into consideration some subtle adjustments between the stakeholders of different urban regimes (Laruelle in press). It is tricky to measure political life in contemporary Russia, since the country is a so-called managed democracy, or in other words, a partly authoritarian system. Moreover, comparing circumpolar politics is difficult given the diversity of political situations, among which Russia finds itself at the bottom in terms of classical democracy.

Yet this does not mean that there is no value in trying to capture urban political life. Direct elections at the Taimyr District level were abolished in 2007; Norilsk itself no longer elects a mayor and is run by a hired city manager. Norilsk's new head of the city's council, nominated in 2017, is Rinat V. Akhmechin, a Tatar who has worked in several Norilsk Nickel companies and subsidiaries (City of Norilsk 2018d). The fact that the head of the city council comes from the industrial realm typifies the company town identity of Norilsk. Yet contrary to what one might expect, the city has—or at least had—its own political culture, with developed protest sentiments—probably a legacy of the industrial workers' world. Notwithstanding its noted extremely low turnout, in 2003 the residents elected rebellious trade union leader Valerii Melnikov as the city mayor—despite the local administration's efforts to disqualify him. Melnikov successfully advocated for Norilsk Nickel to spend more on the city's welfare. In 2007 Melnikov won a seat in the lower chamber of the national parliament on the pro-Kremlin United Russia ticket, but died of a heart attack in 2008.

The regional democracy index developed by Nikolai Petrov, first at the Moscow Carnegie Center and then at the National Research University Higher School of Economics, put Taimyr District in the middle of the list in terms of democracy ratings. Since elections are presumed to be rigged, the region is infamous for its extremely low turnout on election days. All the same, in the regional democracy index, the city ranked "more democratic than Taimyr and almost as democratic as Krasnoyarsk Kray as a whole, despite being a closed company town" (Petrov 2016: 23). In the most recent municipal elections, in 2017, voter participation dropped to 16 percent of eligible voters (Krasnoiarsk Vybory 2017)—a figure among the lowest in the Russian Arctic, on a par with Arkhangelsk, Severodvinsk, Dudinka, and Onega. Although it would, for the reasons given above, be difficult to develop a scale capable of capturing levels of local democracy across the circumpolar region, a scale for Russian cities alone would offer valuable insight into one important aspect of sustainability. Data on strikes or street protests could complement this analysis.

Social Inclusion Indicators

The ISO index does not cover all aspects of social inclusion, but it does include the main ones, such as gender balance and number of migrants. In terms of gender parity, the Soviet legacy means that women have largely been brought into the workforce: Women represent 48.3 percent of the workers in Norilsk, a good number for a city based on extraction professions usually considered masculine. As in many other developed countries worldwide, including the United States and some countries in Europe, women's salaries are about one-third less than men's, a number that should be refined to see whether these salary differences are for performing the same job or for performing other jobs that are deemed less prestigious and are therefore less well-paid. As in many other countries worldwide, women in Norilsk dominate professions such as health care and education—state-funded jobs that are usually low paid.

At the political level, Russia lags far behind the most advanced countries—such as the Nordic states—in terms of gender parity but is more or less on a par with the European countries of the Mediterranean Basin. With only eight women on its thirty-four-member city council (23 percent), Norilsk finds itself on the lower end of Russia's Arctic cities in terms of political gender parity, along with Magadan, Monchegorsk, Kirovsk, and Novy Urengoy. This data could be refined by looking at the sectors in which Norilsk female politicians work to see if they are confined to conventionally feminine fields—education, family affairs, health care—or if they are also represented in the security and industry sectors. It would also be interesting to look at gender parity at the highest echelons of Norilsk Nickel and explore the firm's strategy of offering jobs to the wives of the engineers that the city recruits, in order to keep the couple in the city and reduce turnover among the qualified workforce. Other aspects of social inclusion remain understudied, including support for people with disabilities.

Social inclusion also relates to the arrival of foreign migrants and their integration into the urban fabric. There is a circumpolar trend of Arctic cities becoming increasingly multicultural (Laruelle 2019). This is the case with Norilsk, which hosts an important community (about 15 percent of the city's population) of migrants or former migrants from Azerbaijan, Central Asia, and the North Caucasus who have settled in the city and become Russian citizens.[2] In 2016 the city officially counted only 1,660 immigrant permanent residents, as well as 1,265 foreign citizens with temporary residency; this is a low number that hides some undocumented flows. The Ministry of Interior noted a slight rise in the number of foreign migrants in the city in 2017 (2.1 percent over 2016; City of Norilsk 2017b).

Migrants' associations are recognized as part of the local social fabric. Although the House of Friendship (Dom druzhby)—the name given in Russia to institutions hosting associations of all nationalities—closed in 2012 ("Ulitsa laureatov" 2013), members of different nationalities can exhibit their folklore and know-how annually during the July holiday celebrating the anniversary of the city. A mosque, considered to be the northernmost one in the world, was erected in 1998 and now hosts a large and diversified Muslim community comprised of Tatars, Bashkirs, Dagestanis, and Chechens, as well as Azerbaijanis and Central Asians (Laruelle and Hohmann 2019). Migrants occupy important niches in the city's economy and are visible on its urban landscape, working in fruit and vegetable kiosks, supermarket chains, cafés, and restaurants, as well as selling second-hand items in the market. Yet the majority of them live in the most degraded neighborhood of the city, in the old Komsomol apartment buildings (*gostinnaya*), often in single rooms and—since they are downwind from the factory—under poor environmental conditions.

Conclusion

In studying the case of Norilsk, one issue that emerges is that of the time scale for sustainability. Some structural variables are slow to change; others, such as in- and out-migration flows, can evolve dramatically in a short period of time. In many respects Norilsk has limited fate control, dependent as it is on external conditions such as world mineral prices and international environmental policies. The main dilemma is that, the more Norilsk Nickel is pressured to improve its environmental footprint, the less economically viable extraction becomes, and the more likely it therefore is that the company will decide to close its factories, which would push the city into a dramatic situation. Today's Russian regime is not the Soviet Union: It is not authoritarian enough to organize a mass relocation of citizens once a city collapses economically and cannot prevent people from staying there if they want to do so. The experience of the early 2000s showed that it was not easy to resettle entire villages, let alone towns. The government will thus continue to pressure Norilsk Nickel to maintain economic activities in Norilsk and therefore to pay for the city's everyday life, even if this is progressively less and less profitable and conditions deteriorate. The more the city shrinks, the more the municipality will have to come up with creative solutions for abandoning some urban spaces, concentrating urban life around its downtown center and moving it toward a logic of intensity rather than of extensiveness.

ISO indicators provide a good overview of the state of a city, but do not capture its dynamics. They do not consider any legacies, such as that, given the remoteness of Norilsk, it is almost impossible for today's stakeholders to remove industrial and construction waste, which is mostly concrete and metal, whose destiny is to remain in place and gradually collapse. Even more importantly, they do not take into consideration the presence or absence of efforts by the city's actors to improve sustainability, even though this is a critical component of the city's progress toward sustainability—or lack thereof. Only recently, due to international financial pressure, has Norilsk Nickel begun to tackle its environmental footprint. The municipal authorities have slowly begun to think about improving the livability of the city for its residents. It remains to be seen what gains they can make in terms of residents' well-being.

In theory, they can improve health and housing conditions, as well as quality of life, food security and safety, and cultural activities, since most of these gains require financial investment. They will face more difficulties in terms of citizen participation, attracting small and medium-sized enterprises, and engaging youth, since doing so would require changing the city's political culture. The case of Norilsk therefore reveals at least five fields that need new indicators to complement the existing ISO ones: 1. stakeholders' willingness to improve sustainability and policies for doing so; 2. the feeling of belonging to a place, which may hamper strategies aimed at moving populations away once the resources under exploitation are depleted; 3. the "civil society" fabric and multinational character of the city; 4. the remoteness of the city and its transport accessibility (specific to the Arctic region); and 5. the cost of the consumer goods basket relative to the average salary.

Marlene Laruelle is research professor of international affairs at the George Washington University Elliott School of International Affairs. She is the director of the Institute for European, Russian, and Eurasian Studies.

Notes

1. See the Norilsk special issue of *Polar Geography* 40 (4) (2017).
2. North Caucasians are Russian citizens so not legally migrants, but they are included here due to their perceived social and cultural foreignness.

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CHAPTER 4

Yakutsk

Culture for Sustainability

Vera Kuklina with Natalia Shishigina

Introduction

The United Nations Educational, Scientific and Cultural Organization (UNESCO) recognizes culture as both an "enabler and a driver of the economic, social and environmental dimensions of sustainable development" (UNESCO 2016: 19).[1] While this report does not give a concise definition of the word "culture" and almost every team of researchers of culture bring their own meaning in how they understand it, we find the instrumental definition of culture given by Adger et al. (2013) to be the most useful: "The symbols that express meaning, including beliefs, rituals, art and stories that create collective outlooks and behaviours, and from which strategies to respond to problems are devised and implemented" (Adger et al. 2013: 112). In order to provide a concise understanding of cultural sustainability, in this chapter we will focus on those aspects of culture that contribute to urban sustainability or that serve as indicators of its absence.

Perhaps the most notorious examples of those aspects are the ideas of the creative class (Florida 2003) and the cultural economy (Zukin 1995). More-explicit links between urban sustainability and culture have been developed in recent decades. For example, some researchers studying sustainability issues see urbanization as a threat to the local culture and heritage (Nadarajah and Yamamoto 2006). Within the series "Routledge Studies in Cultures and Sustainable Development," culture is understood broadly, "from art-based definitions to way-of-life based approaches . . . not only as an additional component of sustainable development—as a 'fourth pillar'—but rather as a mediator, a cross-cutting transversal framework, or even as a new set of guiding principles for sustainable development research, policies, and practices" (Hristova, Šešić, and Duxbury 2015: xi). One of the books in this series is dedicated to studies of culture and sustainability in small and medium-sized cities in Europe (Hristova, Šešić, and Duxbury 2015). The authors call for policies that prioritize an inclusive cultural life that would consider such marginalized groups as refugees, and homeless people not only as consumers but also as cultural actors (Matarasso 2015). In the field of policymaking, the mayors and representatives of European cities and towns in the Basque Declaration (2016: 4) stated, "In order to support and accelerate the Socio-Cultural Transformation: We will develop a 'culture of sustainability' based on equal access to municipal services for all citizens regardless of their age, religious affiliation, ethnic identity or gender, and reflect this particularly in our budgeting and educational systems." In particular, the Basque municipalities use the phrase "percentage of the inhabitants who are Basque-speaking" among the indicators to ensure inclusive and quality education for all and promote lifelong learning (Basque Country 2018: 65). We find this call especially relevant for the studies of Arctic urban sustainability where some cities undergo increasing urbanization of local, predominantly Indigenous, people with rural origins as well as growing numbers of migrants with different regional, ethnic, and religious backgrounds.

In the Arctic, however, we find additional dimensions for integrating culture into the sustainability agenda. In particular, in the recent analysis of the studies of culture and sustainability in the Arctic, two different directions are distinguished: "'Sustainable cultures,' focusing on the prospects of cultural viability in Arctic contexts; and 'cultural sustainability,' which explores the role of culture(s) in broader sustainability contexts" (Gartler, Kuklina, and Schweitzer 2020). While the authors raise more questions than they answer about relations between the terms "culture" and "sustainability," the urban context further complicates the discussion. The only indisputable categories are the three major features of well-being listed by the *Arctic Human Development Report* (AHDR) that distinguish the Arctic from other countries: cultural vitality, fate control, and contact with nature (Einarsson et al2004). Specifically, the report focused on language and language vitality, spirituality and worldview, and the arts and sports that were related to Indigenous peoples and mostly to the rural areas that practice traditional land use and maintain nomadic and seminomadic practices. For instance, Indigenous people have been recognized as the traditional ecological knowledge holders and experts of climate change and its effects on local landscapes (Adamson, Hannaford, and Rohland 2018).

Researchers have described how the sedentary lifestyle of settled village life erodes the transmission of Indigenous knowledge, which requires "living on the land for migratory peoples (Ohmagari and Berkes 1997), and reduces their flexibility (Huntington and Fox 2005). An urban life is expected to interfere even more directly with Indigenous knowledge preservation. As Balzer (2013) has pointed out, local Indigenous peoples' traditional way of life conflicts with urban practices. However, the authors of the Arctic Social Indicators suggest the rate of publications in the Indigenous language as an indicator of cultural well-being, arguing that the availability of forms of popular culture that use the Indigenous language is an indicator of cultural vitality in the urban context (Larsen and Schweitzer 2010). The same could be applied to spirituality, arts, and sports in the city. In particular, Balzer considered the revival of shamanic practices in the city as a more convenient form of cultural revival than could be practiced in rural areas (Balzer 2011).

Another perspective on the urban lifestyles of Indigenous people is related to the additional resources available for a vibrant culture (Kishigami and Lee 2008). However, the city is not always helpful in this regard. Patrick and Tomiak (2008) examined the Inuit in Ottawa and argued that urban Indigenous peoples have limited opportunities to travel back home due to difficult transportation logistics and that their knowledge of Indigenous languages is rarely an asset in the job market, so preservation of their languages and cultures within the urban community is extremely challenging. If for the reproduction of traditional cultures in rural areas it is enough to use informal ways of transmitting the native language, in cities, on the contrary, the institutionalization of knowledge and ethnocultural values in standardized educational programs becomes decisive. Exploring the use of Vepsian language in Karelia, Laura Siragusa (2017) differentiates its role in the village and in the city. In the urban areas that language can serve as a political tool to gain visibility, as a symbol of group identity, and even as a secret code. We can add that the use of the Indigenous languages would support improved understandings of the local environment in the cities, despite their extensive infrastructural development.

The framework for quantifying culture derives from the standards of ISO 37120 (Sustainable cities and communities—Indicators for city services and quality of life) published by the International Organization for Standardization (ISO) in 2018. In the first edition of 2014 this indicator did not exist (ISO, 2018). According to ISO framework, sport and culture are measured together. The core indicator is the number of cultural institutions and sports facilities per one hundred thousand population. Cultural institutions include museums, art galleries, live performance centers, libraries, botanical societies, historical societies, and community cultural centers. The supporting indicators include the percentage of the municipal budget allocated to cultural and sports facilities and the annual number of cultural events per one hundred thousand population. However, the main reference for the choice of these indicators is the "2009 UNESCO Framework for Cultural Statistics" (UNESCO 2009), which places a greater emphasis on economic than on environmental issues of sustainability. While recognizing the importance of these indicators, we call for attention to a more holistic view of culture in the Indigenous cultures where education, language preservation, subsistence activities, and environmental problems are closely interrelated. We argue that sustainability is based on an appreciation of intimate relationships among humans and the local environment that evolved within Indigenous cultures but that, in the urban setting, these relationships have been mediated by infrastructural development. These cultures can be quantified in some ways, but have to be considered in specific national, regional, and local contexts for comparisons across different cities and countries. In particular, we focus on four aspects of culture: cultural institutions, cultural diversity, contact with nature, and cultural economy. We make our broader points about culture for urban sustainability by examining a case study of Yakutsk.

Studying Culture for Sustainability in Yakutsk

The Republic of Sakha in general and its capital city Yakutsk in particular have often been the center of attention for Arctic scholars. Local scholars actively engage in scientific discussions about the Arctic. The Siberian branch of the Russian Academy of Sciences has nine local divisions. The Sakha Academy of Sciences has six research centers and two departments. The Institute for Humanities Research and Indigenous Studies of the North, part of the Siberian branch of the Russian Academy of Sciences, conducts studies on local cultural heritage and provides assessments of federal and regional laws addressing issues related to the Indigenous peoples. Its senior researchers, F. S. Donskoi, V. A. Robbek, and R. I. Donskoi, were the lead authors of the development concept for the "Small-Numbered Indigenous Peoples of the North in the Twenty-First Century" (1999) and development concept of the "Small-Numbered Indigenous Peoples of the North, Siberia and Far North in the First Quarter of the Twenty-First Century" (2001) (as discussed in Donskoi, Robbek, and Sheikin. 2003).[2] In a more recent study, Tomaska (2017) examined rural migrants to the cities and noted the willingness of parents to integrate their children into urban societies and to provide them with better educational opportunities, a process that is also sometimes accompanied by the adoption of a different, dominant culture. Local sociologists also note that, among small-numbered Indigenous people moving to the cities, there are more women than men, creating a gender imbalance (Donskoi 2001; D. M. Vinokurova 2013; U. A. Vinokurova 1992).

The Research Center for Circumpolar Civilizations, part of the Arctic State Institute of Culture and Art in Yakutsk, is active in studies of the sustainable development of cultures of Russian Federation peoples living within the permafrost zone (Kul'tura i iskusstvo Arktiki 2017; Marfusalova 2002; Robbek 2000; U. A. Vinokurova 2015). Different features of circumpolar civilization, including subsistence cultures, identities, cultural policy, spatial images, environmental ethics, arts, and cultural landscapes were gathered in the book *Kul'tura Arktiki (Arctic Culture)* (Ignat'eva et al. 2014). Uliana Vinokurova's theory of Arctic circumpolar civilization identifies creativeness and beauty as the main sources of sustainable development (U. A. Vinokurova 2017).

In their case study of Sakha, Fondahl, Crate, and Filippova (2014) noted major problems in monitoring language retention: Statistics are not gathered on the settlement and even *ulus* (county) levels, and all the languages of the local Indigenous peoples are listed in the *Interactive Atlas of the World's Languages in Danger* (UNESCO n.d.). If we use only this indicator, we can miss other, more-positive, trends of cultural vitality. As for the urban/rural dimensions of social indicators, they noted, urban Evenks and Dolgans reported more use of their own language than the rural population, presumably "due to political positioning" (Fondahl et al. 2014: 76). Ferguson and Sidorova (2016) also noted the importance of language for the ethnic identity of the Sakha whereas religious beliefs have not been considered as important since most of the Sakha people converted to Christianity during the tsarist period.

We use secondary sources—censuses, statistics (from Rosstat unless other data sources are mentioned), municipal data, reports of the institutes of higher education, and Internet sources—and the results from field studies conducted in Yakutsk during the summer of 2017 and spring of 2018. These included two focus groups with students from the Yakut language departments and with students of the Department of Northern Philology, participant observations, and interviews with sixteen experts, five migrants from remote villages, four young people graduated from the Institute of Languages and Cultures of Peoples of the North-East of the Russian Federation, two young graduates from the Arctic State Institute of Culture and Art, five students from the Department of Northern Philology, and three students from the Department of Yakut Language and Culture. The duration of the interview ranged from twenty to ninety minutes and averaged about forty to sixty minutes. To collect the interviews, we used the social networks of local researchers.[3]

Cultural Institutions

The territory on which Yakutsk is currently located has long been used by the seminomadic Indigenous people of Sakha (Yakuts) for seasonal migrations. Founded by Cossacks in 1632 as an outpost, Yakutsk served as a Cossack command center for the large area spreading across Eastern Siberia to the Far East. Currently, Yakutsk is the capital of Sakha Republic (Yakutia), the largest region in the Russian Federation. It boasts the most territory within the Arctic circle, although this land is among the least accessible in Russia. Experts estimate that 60 percent to 90 percent of the republic's territory does not have access to permanent ground transportation (Kuklina and Filippova 2019). Yakutsk is the only city where infant mortality, suicide, and outmigration have decreased within Sakha Republic (Fondahl et al. 2014). Moreover, it is one of the fastest growing cities in the Arctic: From 1990 to 2012 the city population grew by 45.2 percent (Kul'tura i iskusstvo Arktiki 2017).

In terms of cultural assets, the city has forty-eight cultural institutions, including libraries, cultural and leisure centers, cinemas, a park of culture and recreation, and music schools. The number of cultural institutions varies across the Arctic and depends on numerous factors (figure 4.1).

The average number of cultural institutions in Yakutsk does not reflect its ambitions to become the cultural capital of the Arctic (SakhaLife 2015). Resources for such expenses are limited by necessary expenditures required by the deteriorating living conditions

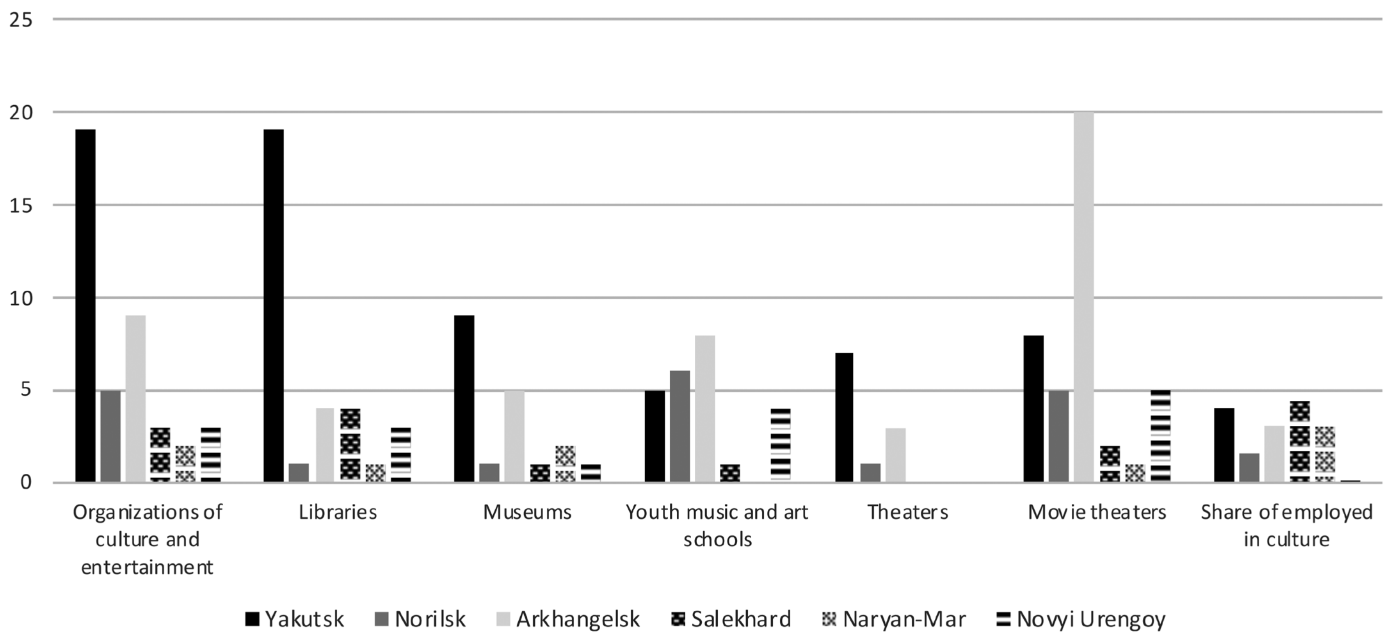

Figure 4.1 | *Cultural institutions per one hundred thousand population in selected Arctic cities.*
Source: Rosstat 2019.

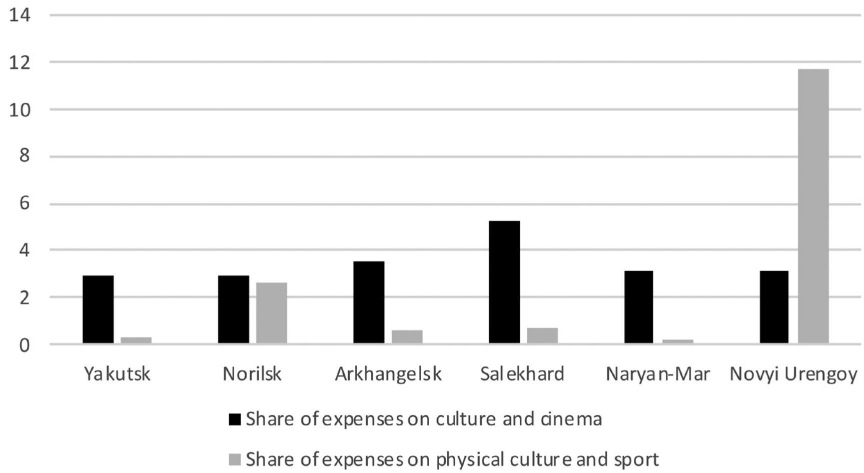

Figure 4.2 | *Percentage of municipal budget allocated to cultural and sports facilities.*
Source: Rosstat 2019.

in the villages that have led to an accelerating in-migration from rural areas or the environmental risks caused by the rapid growth of the city. Also, the amount of municipal budget allocated to cultural facilities would not reflect the real expenses on culture in the city because these are based not only on municipal, but also on regional and national budgets (figure 4.2). As one can see, the lowest shares are for Yakutsk and Arkhangelsk, which are both regional centers. On the other end, the high percentage of expenses allocated for sport in Novy Urengoy makes an observer suspicious about the real beneficiaries of the funds.

As the capital of the Russian region with the largest territory located above the Arctic circle, Yakutsk has developed a specific regional policy that emphasizes subsidies to increase transportation accessibility and expand the provision of food and supplies to the North, setting aside land for traditional uses, and the preservation and revitalization of Indigenous cultures. Republican status during the Soviet era made it possible to spend more on cultural development than in ordinary regions (oblasts). Beyond that, the region is rich in natural resources (diamonds, gold, oil, gas, rare metals, coal, and uranium). In the 1990s the republic directed taxes from diamond mining to the regional budget (Turovskiy 2015).

City authorities are responsible for the management of culture related to interethnic and interconfessional relations, library services, entertainment and cultural services, cultural heritage, local arts and crafts, and recreational activities, including the creation of public spaces (Semeunov 2016). The city's department of cultural management oversees municipal cultural institutions, including museums, centers for culture and entertainment, libraries, theaters, parks of culture and recreation, the circus, and youth centers (arts, choreography, music). The main indicators the city uses to assess the state of culture include the number and kinds of cultural institutions, their material condition, the average monthly salary of their employees, and the share of expenses for the development of culture and film industry in the local budgets (Semeunov 2016). Indicators for the assessment of the annual activity of local theaters include the numbers of performances, debuts, spectators, and tours.

In 2015, the regional government formulated a Cultural Policy Concept which stated Sakha's goal to become the cultural center of the Arctic, and Yakutsk to be its cultural capital (Theater Olonkho 2015). The strategy is based on the existing experience of organizing international workshops and conferences and strong international connections. In particular, Yakutsk has hosted conferences on *khomus* (an Indigenous instrument often called the Jew's Harp in English) music (in 1991), shamanism (in 1992), oral epic literature (in 1994), and has plans to develop an innovative cluster "Olonkho Land" (Vittorio Grassi Architetto and Partners 2015). The local library system has established an international book exchange with major libraries in foreign countries, such as the National Library of France, the US Library of Congress, and others. The international Association of World Reindeer Herders and the Northern Forum (a group representing subnational or regional governments from throughout the North) offices are located in the city. The Children of Asia Games have been organized in Yakutsk every four years since 1996 and is considered a form of cultural revitalization (U. A. Vinokurova et al. 2017).

The wealth from extractive industries together with the movement for cultural revival, made possible investments for urban development and the creation of a number of cultural institutions in the city: the Sakha national TV and radio company (NVK Sakha), the Sakha film studio, the National Theater of Dance founded in 1992; the Higher School of Music founded in 1993; the Academy of Sciences of the Republic of Sakha founded in 1994; and the Arctic Institute of Culture and Arts founded in 2000.

The Khomus Museum is an example of the creation of a cultural institution with limited state support. The first collection was formed by Professor E. A. Alekseev, who gathered *khomuses* during his research activities and founded the museum in 1990. Currently the collection has 1,342 instruments from various Russian regions and forty-five countries. One of the main contributors, the honorary president of the International Jew's Harp Society, Frederick Crane, donated his collection of 595 instruments to the museum (Shishigin 2013). Most donations were given without state support, while the city provided the space, facilities, and officially employed eleven staff members. The majority of visitors are local—2,977 of 3,665 in 2017, according to the Khomus Museum.

The epic of Olonkho, the Yakutian hero, is an example of the larger ambition of both local cultural elites and local authorities to actualize ethnic Yakut heritage on a global scale. The epic was recognized by UNESCO as a masterpiece of Intangible Cultural Heritage of Humanity in 2005 (ICH 2019). In 2010 the Olonkholand Foundation (with approximately forty cofounders, including representatives of the arts, culture, architects, and researchers) developed the project of the "Olonkho International Center" on land designated for that purpose in the southern outskirts of the city near Lake Saysary. To implement the plan, they invited several Western and Russian experts in this field, including John Howkins (the author of the book *The Creative Economy: How People Make Money from Ideas;* 2001) and Sergey Zhuravleuv (from the rating agency Expert-RA) (Yakovleva 2016). The Italian company Vittorio Grassi Architetto and Partners developed the master plan (Vittorio Grassi Architetto and Partners 2015). The effort has led to some criticism. Similarities of the epic with Central Asian cultures raises questions about how it fits the image of Yakutsk as an Arctic city. Additionally, the focus on Sakha culture also excludes other cultures, such as those of the small-numbered Indigenous peoples of the region and migrant communities.

Among state-supported cultural institutions dedicated to the development of the ethnic cultures of small-numbered Indigenous peoples of the North, one can recognize the state ensemble Savdie, the folkdance ensemble Gulun, the Museum of Music and Folklore of the Peoples of the North, and the Theater of Culture of the Peoples of the North.

Cultural Diversity

During the Soviet era there was a significant inflow of ethnic Slavic citizens from the western parts of the country who ultimately made up the majority in the city. With the breakup of the Soviet system, as with many other Arctic cities, Yakutsk experienced a wave of out-migration among workers who did not have a local ethnic background (Heleniak 2009). About 35 percent of the Russian population left the city (Laruelle and Hohmann 2017). Moreover, young Yakuts with sufficient resources seek higher education beyond the republic, in Moscow, Saint Petersburg, or abroad. For example, one can find realty advertisements with offers in three capitals: Moscow, Saint Petersburg, and Yakutsk. However, the migration outflow is more than compensated for by in-migration from rural areas within the region and former Soviet republics. As U. A. Vinokurova (1992) has pointed out, Yakutsk is the only city in the republic that serves ethnic integration functions with its numerous cultural institutions. It adds to the attractiveness of the city among Yakuts and representatives of small-numbered Indigenous peoples. The most discussed and evident division lies between the former rural and long-term urban population. According to Sidorova and Khlinovskaya Rockhill (2016), people coming from villages are more likely to be marked by otherness and a lack of local knowledge related to norms, expectations, and rituals; and often have socially marginal status with lower education and income. Meanwhile, their knowledge of the natural environment has not been appreciated in the city.

In terms of the ethnic composition of Yakutsk, we can distinguish six groups: Yakut, Russian, small-numbered Indigenous, from other Russian regions (including Buryats, Tatars, Ingush), from the former USSR (including Ukrainians, Armenians, Kyrgyz, Uzbeks, Belarusians, Azerbaijanis) and foreigners from other countries (table 4.1). In order to represent the interests of these various ethnic groups, Yakutsk authorities have registered forty-three cultural entities—public organizations dedicated to preserving and promoting ethnic cultures, languages, customs, and traditions (Dom druzhby narodov 2017). Some of the ethnic groups are visible to the city's overall population because they occupy specific economic niches: Armenians dominate the construction sector, the car repair business, and the shoe mending sector; Uzbeks and Azerbaijanis lead the fruit and vegetable import market; and a prominent Korean family is well known for its local vegetable production. These groups also gain visibility by organizing ethnic associations, which are based at the official House of Friendship (Dom Druzhby), and by attending religious services at the Armenian church, various mosques, and the Buddhist temple (Laruelle and Hohmann 2017). In 1996 the public-private Academy of Spirituality (Akademia dukhovnosti) was founded in the city and included the leaders of its cultural, educational, research,

Table 4.1 | *Ethnic composition of Yakutsk*

Category	People	Percent
Total	295,664	100
Did not mark ethnicity	10,473	3.54
Marked ethnicity, among them:	285,191	96.46
Sakha (Yakuts)	140,272	47.44
Russians	113,624	38.43
Evenks	2,870	0.97
Evens (Lamuts)	2,176	0.74
Dolgans	189	0.06
Chukchi	59	0.02
Yukagirs	211	0.07
Small-numbered Indigenous people from other regions	67	0.02
Buryats	2,573	0.87
Tatars	2,071	0.70
Ingush	733	0.25
Ukrainians	3,935	1.33
Kyrgyz	3,004	1.02
Armenians	2,328	0.79
Uzbeks	1,952	0.66
Tajiks	1,860	0.63
Belarusians	627	0.21
Azerbaijanis	552	0.19
Koreans	847	0.29
Chinese	732	0.25
Other groups	4,509	1.53

Source: Census-2010, Federal Service of State Statistics for Sakha Republic. Retrieved 13 December 2019 from http://sakha.gks.ru.

and religious institutions (Akademia dukhovnosti 2019). In 2002, the center of Yakutsk spiritual culture Archy House began operations a short distance from the city center and focuses more on secular than religious activities (Yakovleva 2005). Its ethnic architectural design and interior now attracts tourists. In 2014 the Russian Ministry of Justice officially recognized the traditional shamanist Sakha beliefs Aar Ajyy as a religion and registered their followers as a religious organization (NewsYktRu 2015).

Questions of cultural diversity have been at the core of regional policy and social activities. In 1994–2002 those questions were handled by the Ministry and then by the Department of the Peoples of Sakha Republic (Yakutia) and Federal Relations. In 2016 governance of interethnic relations shifted to the new Ministry for the Development of the Institutes of Civil Society of the Republic of Sakha

(Yakutia). The ministry includes several offices and two departments: the Development of Civic Initiatives and Nationalities Affairs, and the Small-Numbered Indigenous Peoples of the North. According to the minister for Peoples Affairs and Federal Relations, between 1991 and 1997 more than seven hundred public organizations were registered in the Republic of Sakha, among them about a hundred who set their goals and tasks to address ethnic and cultural issues.

The multilingual landscape of the city is ensured by the regional law on the languages of the Republic of Sakha (Yakutia) (Ferguson and Sidorova 2016). However, as Robbek (1998) has pointed out, the republic has a distinctively complex language situation with numerous examples of bilingualism and polylingualism combined with significant language loss among the nonnumerous Indigenous peoples. In an extensive study of the use of the Yakut language in Yakutsk, Ivanova pointed to the use of information-communication technologies to help preserve the language as it competed with a variety of other languages (Ivanova 2017). She noted that those Yakuts who lived more than ten years in the city were less likely to choose only Yakut as a native language. Only 57 percent of Yakuts born in Yakutsk chose Yakut as a native language, while among Yakut rural migrants 100 percent of respondents chose Yakut as a native language. There are numerous efforts to promote Indigenous languages among the Yakut city residents.

Within the city the official buildings have signs in Russian and Sakha languages; the tourist signs also include English. The TV and radio programs of the NVK Sakha are transmitted in Sakha language with some programs in Even, Evenk, and Yukagir languages. The book agency Bichik and a number of regional newspapers publish in Sakha, Even, Evenk, and Yukagir languages. The regional library in Yakutsk stores a disproportionally higher share of books published in the languages of the small-numbered Indigenous people of Russia (1,956, or 17.7 percent), while the rest of those books are stored in twenty-five other Russian regions (Samsonova 2013). However, the number of titles available in these languages in the library is still quite meager: 294 books in Even language, 157 in Evenk language, 68 in Yukagir language, and 21 in Dolgan language. The common database of books in the twenty-five languages of the nonnumerous Indigenous people of Russia coordinated by the Russian national library accounts for just 3,525 titles. The book collection in Sakha language contains 57,889 books. Currently, there are several initiatives seeking to create online databases in Indigenous languages following the development of mobile phone apps for studies of Sakha and Evenki.

Language education is one of the most pressing issues among the local Yakut families. Of fifty schools in the city there are seven with Sakha as a language of instruction, including the prestigious Sakha urban national gymnasium; and twenty-two schools with Sakha language instruction, including Sakha-Canadian school #38 with classes in Evenk. At the preschool level, of fifty-nine organizations there are five with Sakha as a language of communication and thirty-two with groups that use Sakha as a language of communication (Plan kompleksnogo 2017). According to the municipal estimates, the demand for Sakha classes will increase in the near future and will reach 35 percent by 2025 (currently 24 percent of pupils study in Sakha language). The cultural and regional components of education are filled with classes on the history and cultures of Yakutia and its peoples. Despite the programs for teaching these classes, however, textbooks explaining the cultures of Indigenous people are not developed yet.

With the introduction of the Unified State Exam to increase the fairness of the college admissions process, many parents and high school teachers prioritize learning the Russian language over native alternatives, because even if the pupil would like to apply for a position studying the Yakut language, she must first pass the Unified State Exam in Russian. However, at the elementary and preschool levels parents we interviewed note the competitiveness of gaining admission to the Sakha classes where Sakha language is taught three hours a week. In ordinary elementary schools children take two hours of classes on Sakha language, two hours of Sakha literature, and one hour on cultures of the peoples of Yakutia. Classes on Yakut literature are taught up to the ninth grade. As one of their teachers complained,

> As the 4th grade is completed, they are already focused on the USE [Unified State Exam], and if there are classes on Yakut language or literature, then two more subjects are added. Parents do not want that. This is the third-year practice. The current 9th grade refused to take Yakut language class in grade 7. They have 4 hours of Russian language. If there were one hour of Yakut and one hour of literature, then it would be 3 hours of Russian, and they need to take the exam in Russian. We also have migrants in our school: Uzbeks, Kazakhs, Kyrgyz, Buryats—a multinational school, the district is exactly like that. But there are also problems there, for example, the Uzbeks cannot master the program, and in the 9th grade they return to their homeland. (Interview with a teacher of Yakut language, female, age 30, Yakutsk, 2018).

The specialists teaching native languages and cultures are trained in two pedagogical colleges and two institutes of higher education: the Institute of Languages and Cultures of Peoples of the North-East of the Russian Federation in the North-Eastern Federal University and the Arctic State Institute of Culture and Art. The main mission of the first institute named is to train Indigenous language and culture teachers in educational institutions. The second institute named is more focused on the preservation and development of the centuries-old culture of the peoples of the Arctic and, on this basis, is focused on promoting new forms in the global educational and cultural space (Arctic State Institute of Culture and Arts, 2019). For those learning Yakut and Yukagir as second languages, special classes now offer instruction at the North-Eastern Federal University. Gradually, it is becoming the center of training for representatives of nonnumerous Indigenous peoples (Evenks, Evens, Chukchi, and Yukagirs) not only in the republic, but also across other Arctic regions, second only to the Herzen State Pedagogical University in Saint Petersburg. In addition, as part of the implementation of the State Order of the Ministry of Education and Science of the Sakha Republic (Yakutia), a series of multimedia textbooks native literature (called The Library of Literature) was created for middle schools with a native (non-Russian) language of instruction (Yezhegodnik 2016).

Contact with Nature

According to the Arctic Social Indicators studies, contact with nature is measured in consumption of traditional food (per capita intake of traditional food in kilograms) and harvest of traditional food (total weight of traditional food harvested in a given period (in kilograms) (Larsen and Schweitzer 2010). Although these indicators are not available on a city level, the orientation on rural communities is evident. Since most of the cultural heritage of Indigenous peoples is related to subsistence and symbolic land use, the main concerns of the local authorities are related to questions of how to incorporate traditional worldviews, images, and practices into the urban environment. At the same time, as a center for information resources and decision making, the city is a focal point for environmental activists and Indigenous leaders concerned with the problems of their homelands (Balzer 2013).

Rural migrants to the city often occupy housing that does not meet traditional urban standards. According to Yakutsk data, in 2007 the share of housing with central heating was 88.9 percent, and hot water was available for 70.8 percent of housing (Respublikanskaia tselevaia programma 2008). Currently, there are growing areas with wooden houses without access to standard urban utilities, especially in the city's margins. For rural immigrants, such districts are a way to reduce the costs of housing and satisfy their desire to live on the land. The residents often build houses themselves or with the support of relatives and friends. In the yard, they can grow their own vegetables and build *lednik* (ice cellars to store food and fur). Living in the city outskirts provides easier access to traditional subsistence activities (hunting, fishing, and gathering), although it leads to overexploitation of the hunting grounds around the city (Gosudarstvennyi doklad 2015). An increasing number of individuals living in the suburbs threatens local water quality. While the city built new water treatment facilities, opening in 2006, the villages forming the city's suburbs do not have access to them.

At the same time the rural migrants want access to city services. The migrants themselves explained that Yakutsk attracted them by the contrast to the rural lifestyle, availability of utilities, services, and numerous opportunities not available back home in the village: "Everything is so easy, nothing needs to be done," one said (interview with a student, female, age around 20, Yakutsk, 2018). Darbasov (2006) noted the city has high housing costs balanced in part by relatively low costs for heating and water thanks to substantial municipal subsidies that cover the critical situation with the deteriorating heating and housing infrastructure. The water supply system was built in 1973 when the population of Yakutsk was about 126,000 people (about one-third of what it is now), and a new water supply system was expected to be built in 2018 (Guseva 2017). According to the Ministry of Ecology, Nature Management and Forestry of the Republic of Sakha (Yakutia), during the winter, the manganese content in water in the Lena River exceeds the norm by 3.7 times (Gosudarstvennyi doklad 2015). Meanwhile, Yakutsk tap water sometimes has a dark brown color, dubbed the color of Pepsi. Households able to afford bottled water buy it, while others filter their water.

The poor air quality in the winter is caused by the Yakutsk coal-burning power plant and the practice of car owners to leave engines running 24/7 during the coldest days to avoid having the engines freeze. Some car owners stop using cars during the cold season because the expenses for gas and maintenance peak this time of year. Instead they may rely on InDriver (a local analogue of Uber) or may use public transportation. In the city center, the local authorities constructed fourteen bus stops with heating that were criticized on local Internet forums for attracting homeless people. Other challenges of living in a city with extreme climatic conditions include the limited use of open-air public spaces, high costs of heating (required nearly nine months a year), poor water quality, and polluted air in the winter time. The parks and squares are hardly walkable in the winter, when temperatures drop below –40 C, or in the summer, when temperatures rise above 30 C and there are few trees to provide shade. While wealthier urbanites socialize in cafés, shopping malls, and movie theaters, the poorer ones have fewer options, although they may participate in cultural and sports events and visit the Technopark, a regional center for the development of innovations (Technopark Yakutia 2019).

According to U. A. Vinokurova (1992), satisfaction with the environmental conditions in the city depends on the social background of urbanites: Those who have witnessed higher levels of infrastructure development are more critical about current environmental conditions, while migrants from rural areas are more accustomed to enduring even worse conditions.

Cultural Economy

The countryside remains one of the most important elements of everyday life in general and the local economy in particular. Products of traditional subsistence activities (e.g., hunting, fishing, and reindeer herding) are widely used by local citizens. As Ventsel (2016) pointed out, the traditions of reciprocity have been transformed in urban conditions. Currently the urban residents are using the urban–rural networks to develop a division of labor and circulation of money between the city and the village. Their circulation at the individual level depends on social networks and transportation accessibility. Those who have relatives in more-accessible villages can receive traditional products from there, sending in return goods that they buy in the city.

Some of these village products, such as fur coats, shoes, *unty* (shoes made of reindeer skin), and *torbaza* (shoes made of felt) are predominantly produced in Yakutsk. Among the companies working in this sector, one can differentiate between enterprises that receive subsidies from the republican and city budgets, and those that receive subsidies from independent companies. Despite their similar output, they pursue different economic strategies. Among the republican enterprises there are “Taba” (Reindeer) and “Sakhabult” (Hunter) (Sirina 1999). With republican-level support, they collect fur and antlers, operate processing plants to produce reindeer meat products and process antlers to make vitamins, para-pharmaceuticals, and beauty products. These efforts have not yielded a profit. Among the independent companies are numerous small enterprises, and the largest of these, Sardaana, specializes in producing traditional clothes and souvenirs. In contrast with the state-backed companies, they do not take risks by investing in new production that may not be economically viable. Sardaana has stable income and has worked with the same customers and partners for years.

The importance of access to culturally relevant food has been emphasized in numerous works. According to the most popular tourist site (tripadvisor.ru), there are 257 restaurants (including cafés, fast food restaurants, etc.) in Yakutsk. The city boasts the most such institutions in the Russian Arctic cities; for example, in Arkhangelsk there are 163 and in Murmansk there are 200. With development of the Arctic sea route there are hopes not only for resource extraction, but also for opening new connections for local communities. In particular, the Northern Forum supports the culinary traditions of the Arctic peoples presented in such restaurants as Muus Khaya, where a chef experiments with local products, such as the salad Indigirka featuring *stroganina* (raw frozen fish), dishes with reindeer meat, *salamat* (sour cream cooked with flour), and other delicacies. Despite being promoted as locally produced food, it is actually produced hundreds of kilometers away. However, these dishes are superior to fruits and vegetables of questionable quality grown thousands of kilometers away. While few individuals are employed in traditional food production, efforts to promote traditional activities in this sector are significant in terms of both budget expenditures and cultural value.

Images of the extreme local environment are used by local products such as the gaming app Dirt On Tires (Andi Game) or the YouTube video Seekers Notes (MyTona) about Sakha villagers (AyalAdamov 2017), as well as a variety of music, songs, and dance performances (Ventsel 2014), and especially in the film industry. Although movie theaters are part of the official statistics, there has been no information available online about their presence across Russian Arctic cities since 2013. Nevertheless, Sakha films are increasingly visible on the global scene. The republic's Ministry of Culture organizes an international film festival that hosts participants from most of the Arctic countries and beyond. The twenty film studios operating in Yakutsk produce ten to eighteen films every year (Kuvshinova 2016), with some achieving commercial success. For example, the film *Heroes: Battle for the Prize,* cost 100,000 rubles to make, but sales revenue brought in 5 million rubles. *Paranormal Yakutsk* likewise cost 60,000 rubles to make and went on to earn 2 million rubles (Moiseev 2014). The films are popular with local audiences since they depict local landscapes, social problems, beliefs, and familiar faces. Predominantly, the films are made in the Sakha language since those made in Russian less frequently achieve economic success. As the quality of the films improves, they reach larger audiences. For example, the film *Bonfire* received the ImagineNATIVE award for the best dramatic feature. At the Busan International Film Festival in 2017, twelve films represented Sakha Republic (NewsYktRu 2017).

Another way of capitalizing on local environment is through cultural tourism development, which is considered one of the main prospects for economic development. Numerous delegations and tourists visiting Yakutsk are taken to Ytyk-Khaya, a park 6 kilometers (km) from the city that displays traditional Sakha housing and infrastructure, or to the Permafrost Kingdom, a tourist area 13 km from the city center. Some may believe that only outside the city is it possible to experience the real Yakutia. This trend is supported by the tourism industry, which is more oriented on exploring the republic's natural resources than on its cultural riches. For example, the extreme cold, permafrost, mammoth remnants, and diamonds are advertised as tourist attractions. The Kingdom Permafrost museum, the Mammoth museum, and the Treasury of The Republic of Sakha (Yakutia) are among the most popular tourist destinations in the city, according to the tourist site TripAdvisor (Tripadvisor 2019). Among the events attracting the most visitors one can distinguish the Children of Asia Games, the national holiday for the celebration of the Sakha new year—Yhyakh—and the Winter Starts in Yakutia festival.

The Children of Asia Games in 2012 was used as an opportunity to build a 26,000-square-meter sports complex that includes an indoor stadium with a capacity of three thousand people, halls for boxing and wrestling, a cafeteria, medical aid station, conference room, press center, hotel with 122 rooms, and other facilities under a single roof. Its cost is estimated around 2.5 billion rubles (Ponomareuva 2012). It is the only stadium built on pilings, a form of construction on permafrost to avoid warming the ground beneath the buildings. With winter lasting six months, the indoor recreational facilities form an important part of the public spaces in Yakutsk. Moreover, the sports complex's central part simulates traditional Sakha housing since it has a watchtower resembling a *serge* (traditional Sakha construction). The facility serves to separate Yakutsk visually from other cities. What really distinguishes the urban landscape around the stadium, however, is the increasingly boggy Lake Saysary on one side, and poorly maintained automobile roads on the other.

The Yhyakh is organized during the last weekend of June, during the summer solstice, and lasts for two days. The event takes place in the specially built architectural-ethnographic complex Us-Khatyn about 20 km from the city. The complex includes more than 250 different buildings, including the hippodrome and center for *kumys* (horse milk) consumption, with ten thousand seats each, about one hundred *uraha* (light wooden houses) designed to host gatherings of different organizations (such as Yakutia Airline, the Communist Party, different *uluses* (municipal units in the Republic of Sakha (Yakutia), equivalent of counties), Ministry of Emergencies, and others). For the representatives of ethnic minorities, including small-numbered Indigenous peoples and old believers, a special area is allocated every year where the new construction is scheduled. For instance, there are houses created in traditional style for Evens, Evenks, and Dolgans; in addition, space has been set aside for the Yukagirs and Chukchis. As the biggest annual event in the city, with an estimated 150,000–200,000 visitors, Yhyakh has been used several times to set Guinness World Records—the most *khomus* players, participants in *ohuokhai* (a traditional Yakut collective dance), *kumys* consumption, and participants in national costumes. During the event, there are traditional collective *ohuokhai* dances, concerts, contests for Olonkho epic performers, and traditional cuisine, horse races, *kumys* consumption, traditional sports competitions, a fair, and various other activities. While these events have been criticized for their high cost, they are appreciated by others as an opportunity to promote and revitalize circumpolar cultures.

The Winter Starts in Yakutia festival includes the Diamonds of Yakutia fair, the Snow and Ice Sculptures International Competition, Diamond Notes Children's Creativity Competition, the Zero Arctic Biennale of Contemporary Art, the Taste of Yakutia Gastronomic Festival, and Games of the North Northern Multisport Competition. There are also round tables of Research, Intellectual Creativity and Artistic Practice; and forums to discuss issues of Yakutia ecotourism development (Winter Starts from Yakutia 2019).

Conclusion

Studies examining culture for sustainability make it possible to ask more questions about the social, economic, and cultural priorities in the city's development, planning, and everyday life. Based on a case study of Yakutsk, we highlighted the complexity of relations between culture and environment in the case of an increasingly urbanized Indigenous people.

The strong agency of the local cultural elites is apparent since they serve as spiritual leaders for the whole republic; and form the agenda for its development not only in the field of culture, but also in the economy, human environment, and social relations shaping city governance. This agency is materialized in the number of cultural institutions, production of books, and mass-media, and is strongly related to education that includes numerous programs and textbooks, qualified teachers, hours dedicated to learning native languages and cultures, choice of the language of instruction and so on. Simultaneously, we need to keep in mind the natural resource extraction that provides financial resources for such cultural development.

Contact with nature is another topic where more quantitative and qualitative studies are needed. Whereas the researchers preparing the Arctic Social Indicators (Larsen and Schweitzer 2010) used consumption or the harvest of traditional foods as a main indicator of closeness to nature, such data is not publicly available in the case of Yakutsk and does not embrace the variety of issues related to the urban style of life. The problems of preserving a city's unique mix of cultures as well as infrastructure on permafrost need further discussion. In particular, there is a need for updated publicly available data on the share of housing with central heating, hot water, water, and air quality.

The Archy House and other religious buildings, new stadium, ethnic restaurants, theaters, and linguistic diversity form the unique cultural landscape of the city. Meanwhile, other Arctic cities can learn from Yakutsk's efforts to provide farmers' food to the city, to build warm bus stops, and to invest in the knowledge economy. In the field of the cultural economy, we find numerous examples of using culture and environment as a symbolic resource. Proliferation of the cultural economy is reflected in the numbers of businesses selling ethnic clothing, kitchenware, jewelry, souvenirs, and films and music, as well as in the number of significant cultural and sports events. While the revenue generated by these enterprises is meagre in terms of income for the city budget, the business and sport activity play an important role in the image of the city and the identity of its citizens.

As a result, we find that it is important to use quantitative indicators of cultural development as points of departure for the preliminary assessment of urban sustainability. Furthermore, for deeper analysis and more-informed decision making, the quantitative data should be placed into the broader context provided by qualitative social studies focused on understanding the role of culturally specific desires, habits, strategies, and tactics of locals in producing, maintaining, and using cultural institutions, cultural economies, public and private spaces, and the architecture and landscape of the city for urban sustainability.

Vera Kuklina is research professor of geography at the George Washington University and a senior researcher at the V. B. Sochava Institute of Geography, Siberian branch of Russian Academy of Sciences, in Irkutsk, Russia.

Natalia Shishigina is an independent researcher in Yakutsk, Russia.

Notes

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2. The category of "small-numbered indigenous peoples" is the author's translation from "*korennyie malochislennyie narody*" – native groups with fewer than 50,000 members (Balzer 2013: 509).
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CHAPTER 5

Assessing Energy Security in Nome and Lavrentiya

How Breaking Down Energy and Governance Silos Makes a Difference

Katherine A. Weingartner, Evgenii Antonov, and Alexey Maslakov

Introduction

The greater a city's energy security, the more sustainable it is.[1] Recognizing the particularly high importance of energy security to Arctic cities and the critical role that governance plays in a city's energy state, cities stand to benefit from having a way to evaluate whether and to what extent their governance structures inhibit or advance their energy security. This chapter aims to highlight how ISO 37120's treatment of energy and governance as separate, siloed disciplines may impact a city's ability to fully account for differences in sustainability in relation to other cities. To do so, this chapter compares how Nome, Alaska, United States, and Lavrentiya, Chukotka Autonomous Okrug, Russia, perform on ISO energy and governance indicators. It also compares how successfully these indicators measure potential differences in energy security despite these communities having similar energy challenges, and if these indicators explain why one city may be more sustainable than the other. Based on the outcomes, the chapter offers an explanation of where the indicators succeeded, fell short, and can be improved. For the purposes of this chapter, energy security will be defined as the uninterrupted availability of energy sources at an affordable price (International Energy Agency 2017).

Two ISO energy indicators were found to adequately measure energy security differences between Nome and Lavrentiya while none of the ISO governance indicators informed our understanding of these energy security differences. Based on the two ISO energy security indicators, Lavrentiya and Nome reached similar levels of energy security. Recognizing that any Arctic index would benefit from including an indicator that captures the relationship between energy and governance, this chapter suggests a potential indicator be added that highlights government financing mechanisms for renewable energy projects. Given that energy challenges are ubiquitous throughout Arctic communities of all sizes, lessons learned from these case studies should have a level of transferability to other Arctic cities and indexes, both within and beyond the Partnerships for International Research and Education (PIRE): Promoting Urban Sustainability in the Arctic project.

Reasons for Selecting Nome and Lavrentiya

We selected Nome and Lavrentiya for several reasons. First, both communities lie in the Bering Sea region, an important yet understudied part of the Arctic generally and the Arctic PIRE project more specifically. Though the Arctic PIRE project limits its index analysis to cities with populations of at least twelve thousand people, this book provides an opportunity to expand the project scope to smaller populations that provide the economic, cultural, social, and political functions of a city for their citizens because no other city exists in proximity (see Carrie Schaffner's chapter on Arctic Cities in this volume). Nome is a city of 3,841 people (K. Morton, e-mail message to author, 3 January 2019; 2018 estimate) located on the Seward Peninsula's Bering Sea coast. Lavrentiya, a remote community of 1,185 people (Rosstat 2018; 2018 estimate), is the third easternmost settlement in Eurasia after Uelen and Ichoun. Although Lavrentiya is the only district administrative center in the Chukotka Autonomous Okrug that lacks urban status due to its small population, the community merited inclusion in this chapter because it functions as the administrative center of the Chukotka District of the Chukotka Autonomous Okrug and makes up around 30 percent of the district's total population (Rosstat 2018).

Second, the contrast between Nome and Lavrentiya sharing similar geographies and energy challenges while differing in governance structures makes it easier to assess how different governance approaches may influence community energy security. The comparison of Nome and Lavrentiya uses a most-similar approach that involves identifying largely similar case studies that differ in a key variable or variables of interest in order to explain how such similar cases may lead to varying outcomes (Koivu and Hinze 2017). Both communities have similar energy challenges and, as previously mentioned, comparably small populations, but differ in their governance structures. In terms of energy, both Nome and Lavrentiya are accessible only by barge or plane, meaning that all energy must be imported or produced locally. By contrast, the Russian political system is more centralized with its municipalities having fewer rights and responsibilities compared to US cities operating under the more distributed US political system. These governance characteristics are likewise mimicked in the municipal energy systems of each country.

Third, the fact that Nome's population is growing while Lavrentiya's is contracting highlights how communities may need to consider different approaches to enhancing their energy security depending on where the community is located on a boom-and-bust cycle. Nome's population sharply declined after its 1900 population boom but has had a slight but steady upward trend after the 1920 census (Population.us 2014). Lavrentiya's population peaked at 3,012 people in 1989 (Russian Census 2019); as of 2016 it had decreased by more than 60 percent (Rosstat 2018). Population growth rates can play a significant role in decision making to ensure citizens of a given community have access to the energy they need today, as well as in the future.

Finally, sufficient access to data for both case studies provided additional justification for their selection. Given data access limitations on the Russian side, it was critical to select a Russian city in which the PIRE team already had some expertise. For this reason, Lavrentiya was selected. Team contacts in Nome and its engagement in developing renewable energy sources (RES) also made it a logical selection for the study.

Introduction to Nome and Lavrentiya

Nome Short History

Historically, the Seward Peninsula has been occupied by the Malemiut, Kauweramiut, and Unalikmiut Eskimos. Though gold was known to be in the area, it was not until the great gold discovery of 1898 by the Three Lucky Swedes (Jafet Lindberg, Erik Lindblom, and John Brynteson) that Nome began to see significant development (State of Alaska 2017). In Seattle and San Francisco thousands boarded ships sailing for Nome, drawn by the possibility of wealth and prosperity, and the city rapidly grew (Visit Nome, Alaska 2015). The City of Nome was officially formed in 1901 (State of Alaska 2017). Mining continued to be Nome's economic base until the 1960s when rising production costs exceeded declining gold prices. The industry briefly reemerged in the 1970s before declining once more in the 1990s (Stinson 1991). In World War II Nome served as a stop on the route transporting US aircraft to the USSR to help the Soviets fight the Germans on Germany's Eastern Front. Attempts by Alaska to develop its oil industry had struggled since the early 1900s but gained momentum after the Trans-Alaska Pipeline System was completed in 1977 (American Oil and Gas Historical Society 2019; "Trans-Alaska Pipeline" 2019). The resulting infrastructure developments benefited Nome—as did the oil revenue. However, recent declines in oil prices have taken a toll on the Alaska state budget with consequences for its cities. Though Nome's economy still benefits from fossil fuel development, other areas both within and beyond government drive the economy, with the most common employment sectors in 2016 being public administration, retail trade, and health care and social assistance (DataUSA 2017).

Lavrentiya Short History

Lavrentiya is located in Saint Lawrence Bay, both sides of which were historically settled by the sea-hunting Chukchi people. The 1920s arrival of the Soviets in Chukotka launched the policy of sovietization aimed at creating a socialist society through population education and local economic development. During World War II the airfield in Lavrentiya was used as an intermediate point for the supply of goods under the Lend-Lease Program. Lavrentiya's development was accelerated by a campaign to transfer the Chukchi and Eskimo people into larger, more-concentrated settlements in order to optimize medical care and education access after World War II. Largely due to its strategic location, Lavrentiya was approved as a regional hub, the base for a border guard unit, and the host for a major military contingent in the event of a possible confrontation with the United States during the Cold War. After the Cold War and especially following the collapse of the USSR, the settlement's strategic importance decreased and the military presence there was significantly reduced. In response to both the disappearance of many services and enterprises when the military presence shrank, and to a dramatic decrease in living standards, including a lack of food in stores and high unemployment, most of the local population left for the mainland in search of a better life.

Methodology

This chapter uses preliminary energy data for Nome gathered from publicly available online sources, most of which were published by government entities. Although energy data is generally available at the state level, it was more difficult to find information specific to the city. This data availability challenge made it necessary to reach out to individuals working in the areas of energy and governance for the city, employees of the local utility, and other experts. Such contacts also enabled the chapter to collect the most up-to-date energy data as well as to better understand the nuances of the energy management process for Nome.

Energy information collected for Lavrentiya came from thematic literature on Chukotka's energy sector, public-access analytical data, and official information disclosed by local executive authorities within the framework of annual reports and in development program preparations where analytical explanatory notes were available. Chukotka region territorial planning documents, Lavrentiya's master plans including explanatory notes, and official statistical materials were also used. Finally, we incorporated information from the official website of the Municipal Unitary Enterprise Iceberg, which serves the communal sector of the settlement. Although Lavrentiya is an independent municipal unit within the Chukchi District, it lacks its own website, which forced greater use of the Chukotka District's website, municipal enterprises, and other official sources.

We used community expert consultations, government resources, public-access analytical data, annual reports, official statistical materials, and other resources to evaluate the governance processes for Nome and Lavrentiya.

Nome and Lavrentiya Energy Challenges

Nome and Lavrentiya face similar energy issues but have different approaches to addressing them. Given their isolated energy systems, limited accessibility by only barge or plane, and other geographic challenges, the cities are both largely dependent on high-cost fuel imports from outside their region. Each community has had varying and limited success in incorporating renewable energy into their energy mixes and neither has come close to fully realizing its renewable energy source (RES) potential.

Nome's primary energy challenge is cost. Around 95 percent of its energy production comes from expensive diesel generation. With the added expenditures of transportation and storage, the city's electrical production costs are almost three times the national average (K. Morton, e-mail message to author, 9 February 2018). The city's islanded microgrid of 2.7–6 megawatt (MW) power levels is unable to connect to the US grid system (University of Alaska, Fairbanks n.d.). Given Nome's remote location, shipping diesel and other fossil fuels to the city is expensive (Shaw 2017). The city's isolation also means that fuel delivery disruptions can pose a threat, as was the case in 2012. That year, Nome's winter fuel delivery failed to arrive before the harbor turned to ice. With no other alternatives, a US Coast Guard icebreaker guided a Russian tanker holding 1.3 million gallons of emergency fuel to Nome under difficult conditions (Yardley 2012). Nome's vulnerability to fuel delivery disruptions given its high dependence on diesel imports (Alaska Center for Energy and Power 2012), combined with increasing energy costs and demand for heat, electricity, and transportation fuel (Alaska Energy Authority [AEA] 2016a) have encouraged the city to bolster its energy security by incorporating more RES into its energy mix (Johnson et al. 2012). Despite constraints on its ability to augment its wind, geothermal, and solar energy resources, Nome's primary utility told chapter authors that it would support any reasonable proposal to reduce energy costs (K. Morton, e-mail message to author, 9 February 2018).

Lavrentiya shares many of Nome's energy challenges. The only energy resources currently produced in Chukotka are coal and natural gas. The region has oil fields but challenging Arctic conditions and a relatively small capacity for extensive oil field development prevent their use. The closest refinery is located in Khabarovsk Kray, almost 3,500 kilometers (km) from Lavrentiya, meaning that most of the community's energy relies on diesel. Since diesel fuel is not produced in the region, Lavrentiya is critically dependent on expensive imports by sea from other regions of Russia (mostly from Khabarovsk Kray) that run the community's diesel power generators and coal-fired boiler houses. As a result, the energy sector remains vulnerable, inefficient, and dependent on maritime transport during the limited navigation period. Like all subdistricts and settlements in the Chukotka Autonomous Okrug, Lavrentiya is not connected to the national grid, making it vulnerable to interruptions in the supply of fuel or equipment failure. Though the Chukotka Peninsula has one of the best conditions for wind power generation in Russia and the potential to develop geothermal energy (Polyak et al. 2010), there are currently no profitable RES projects in the region.

ISO Indicators

Recognizing ISO 37120's goal to provide a consistent and comparable approach to evaluating local sustainable development, this chapter has chosen to use ISO indicators to determine energy security levels in the selected communities. Table 5.1 includes the available data for each ISO energy and governance indicator for Nome and Lavrentiya, respectively. Based on this data, we examine if there are any critical gaps in the indicators, whether the selection of indicators is appropriate, and finally the effectiveness of each indicator. Before we evaluate the success of the indicators, however, we provide additional context for the energy and governance structures of each community.

Current State of Nome and Lavrentiya Energy Systems

Nome Energy Capacity and Funding

In terms of nonrenewable energy, Nome consumed 1,876,751 gallons of diesel in 2017. Net diesel-generated power (production less station service) was 30,542 megawatt hours (MWh), representing 95 percent of the city's energy needs. Though the city also uses fuel oil for heating and the majority of hot water systems, this chapter focuses specifically on fuel used for electricity production (K. Morton, e-mail message to author, 9 February 2018).

To meet the majority of its energy needs, Nome owns and operates the only commercial electrical generation operation in the community through its component unit Nome Joint Utility System (NJUS). This effort uses two primary 5.2 MW diesel generators, which run alternately, and an old plant containing 3.6 MW and 1.8 MW generator units, which can be used if needed. A single 5.2 MW unit is usually sufficient to meet peak loads (K. Morton, e-mail message to author, 9 February 2018).

Table 5.1 | *ISO energy and governance indicator results for Nome and Lavrentiya*

Energy indicators	Nome	Lavrentiya	More sustainable community based on indicator results
7.1—Total end-use energy consumption per capita (GJ/year, electricity only)	70.84 GJ/year (2018)[a]	61.15 GJ/year (2016)[b]	Lavrentiya
7.2—Percentage of total end-use energy derived from renewable sources	5% (2018)	0% (2018)	Nome
7.3—Percentage of city population with authorized electrical service (residential)	100% (2018)	100% (2018)	Equal
7.4—Number of gas distribution service connections per 100,000 population (residential)	0 (2018)	0 (2018)	Equal
7.5—Final energy consumption of public buildings per year (GJ/m2)	Unavailable	Unavailable	Insufficient data
7.6—Electricity consumption of public street lighting per kilometer of lighted street (kilowatt hours/year)	Unavailable	Unavailable	Insufficient data
7.7—Average Annual hours of electrical service interruptions per household	Unavailable	Unavailable	Insufficient data
8.3—Greenhouse gas (GHG) emissions measured in tonnes per capita (adapted for electricity sector only)	4.96 tonnes per capita[c] (2018)	4.55 tonnes per capita (2016)[d]	Lavrentiya

Governance indicator	Nome	Lavrentiya	More sustainable community based on indicator results
10.1—Women as a percentage of total elected to city-level office	33% (2019)[e]	60% (2018)[f]	Lavrentiya
10.2—Number of convictions for corruption and/or bribery by city officials per 100,000 population	Unavailable	Unavailable	Insufficient data
10.3—Number of registered voters as a percentage of the voting age population	91.3%[g] (2017)	100%	Lavrentiya
10.4—Voter participation in most-recent municipal election (as percentage of registered voters)	23%[h] (2018)	54.83%[i] (2017)	Lavrentiya

Notes:

GJ = gigajoule.

[a] Calculation: Net consumption of diesel (1,876,751 gallons), 1 gallon is about 3,785 liters, average density of diesel fuel is 840 kilograms (kg) per 1,000 liters, weight of 1 gallon is about 3.179 kg (Engineering ToolBox 2003), resulting in total consumption of about 5,966.94 tons. Maximum gross calorific value for diesel fuel is 45.6 megajoule (MJ)/kg, so total energy consumption is 5,996,940 kg * 45.6 MJ/kg=272,092.56 GJ or 70.84 GJ per capita (with Nome population 3,841).

[b] Calculation: see process for Nome. Value includes only diesel consumption (electricity). We use value of fuel consumption to produce heat and electricity for public consumption in public utilities (MUE Iceberg 2019).

[c] Accounting for diesel only.

[d] Accounting for diesel and coal only.

[e] Two out of six city council members were women as of 27 April 2019 (The City of Nome Alaska 2019).

[f] Value from expert research.

[g] We added Nome No. 1 and Nome No. 2 districts to get the total for December 2017 registered voters: (State of Alaska Division of Elections 2017). 2017 estimated population under 18 is 34.8%, 65.2*3690 (2017 population estimate) = 2405.88 (estimated 2017 population ages 18 and older). Sources - Nome population under 18: (United States Census Bureau. 2018).; est. 2017 population: Department of Labor and Workforce Development 2018).

[h] 643 votes cast/2788 registered voters (precinct No.1 + No.2) for 10/2/18 election (B. Hammond, City Clerk/Treasurer, City of Nome, e-mail message to author, 6 February 2019.

[i] "Elections, Referendums and Other Forms of Direct Will" 2017).

Table 5.2 | *PCE and effective residential rate for the first 500 kWh, selected years*

Fiscal year	PCE	Effective residential rate (per kWh)
2018	$0.1304	$0.25
2017	$0.0979	$0.23
2015	$0.1355	$0.23
2012	$0.1709	$0.20

Source: Nome Joint Utility System.

Recognizing the high cost of energy in remote areas of Alaska, the state established the Power Cost Equalization (PCE) program to lower rates statewide to the same level as in Alaska's major urban areas for the first 500 kilowatt hours (kWh) (PCE 2014). The PCE is reviewed every year and reflects a payment made by the State of Alaska on behalf of energy consumers. With the PCE, Nome ratepayers fund the operation and maintenance of the community power system (K. Morton, e-mail message to author, 9 February 2018). In fiscal year 2018 the effective residential rate of energy for Nome (residential rate after PCE) was $0.25/kWh for the first 500 kWh (AEA 2018) (table 5.2). For comparison, the average residential rate for Anchorage in 2018 was $0.23/kWh (Utilities Local 2018). Table 5.2 shows the PCE and effective residential rates per kWh in Nome for select years (K. Morton, e-mail message to author, 14 January 2019).

It is worth noting that, although Nome has energy tariffs, they do not vary by consumer base but rather on what services a consumer is receiving. Different tariffs do not exist for business consumers compared to residential consumers. Instead, consumer tariffs vary depending on whether a consumer is receiving single-phase or three-phase service (K. Morton, e-mail message to author, 9 February 2018). Whereas single-phase service is generally more efficient for units requiring up to 1,000 watts of power, three-phase service's higher carrying capacity allows it to provide power for higher load systems (AEGIS 2015). Any consumer receiving single-phase service pays a facility charge of $20 and an energy charge that depends on whether the power is being provided within or outside city limits. Those receiving three-phase service pay a higher facilities charge of $60, a demand charge of $10/kilowatt (kW), and lower energy charges both within and outside city limits compared to single-phase rates (K. Morton, e-mail message to author, 9 February 2018).

Nome Renewable Energy

In addition to diesel generation, Nome produces electricity using wind turbines. In 2013 NJUS assumed control of Banner Wind LLC, which had managed the city's wind energy operations. Banner Wind LLC resulted from the joint efforts of the Bering Straits Native Corporation and Sitnasuak Native Corporation who invested in wind energy as a means to create jobs, enhance overall power generation reliability, offer a tax credit and cash based revenue stream, and keep revenue in the community (Alaska Industrial Development and Export Authority 2008). To accomplish these goals, the project used private funding to install the original wind farm with a fleet of 50-kW Entegrity units in 2009; in addition, through partial support from the Alaska Renewable Energy Fund, NJUS installed two Emergya Wind Technologies (EWT)-900 wind turbines in 2014 (Holdmann 2015). Today these units account for 5 percent of Nome's electricity generation. Net wind generation in 2017 (production less turbine service) was 1,918 MWh.

The city is interested in introducing additional wind energy into its energy mix but doing so requires overcoming several challenges. First, smaller diesel generators need to be procured and used on windy days or during times of low load. Diesel generators in Nome do not run at less than 60 percent of rated capacity. During periods of low load and high winds, wind energy generation must be cut back to keep diesel generators operating above the 60 percent level. Second, energy storage is needed to supply the grid with power when baseloads rise or wind generation slackens. Third, the availability of excess energy can be aligned with times of additional power consumption. For example, a smart management system could use available excess wind energy to heat public buildings, power the community water supply, or for other uses. Additionally, an alternative electrical pricing structure could be used during periods of excess wind supplies to shift the load balance to these periods (K. Morton, e-mail message to author, 9 February 2018).

Organizations in Nome have also invested in solar projects but the generated solar energy does not provide power to the NJUS distribution grid (K. Morton, e-mail message to author, 9 February 2019). For example, the Bering Strait Native Corporation of Nome installed a solar photovoltaic system on their office building in 2008 that generated 16.8 kW of power, removing the need for about 1,000 gallons of diesel each year or around 0.05 percent of the city's 2017 diesel consumption. The corporation also installed two solar water heaters on local buildings (AEA 2016b). A utility-sized solar array could lower diesel use but faces issues with grid integration that are similar to those mentioned for wind generation (K. Morton, e-mail message to author, 9 February 2018).

Though there is potential for geothermal and hydropower generation, accompanying challenges have blocked their development. The Pilgrim Hot Springs, located around forty-four air miles northeast of Nome, was assessed as a possible source of geothermal energy to offset the city's diesel dependence, but the costs of building and operating a needed line extension and difficulties finding a satisfactory hot water source halted development. Some opportunities for hydropower have been identified, though local support for such efforts remains insufficient to overcome implementation challenges (Hirsch 2013).

Lavrentiya Energy Capacity and Funding

Although the Chukotka Autonomous Okrug has several large thermal power stations fueled by coal and a nuclear power plant, Lavrentiya continues to rely on diesel for its electricity production. Despite the existence of these other power plants in the region, the nearest one to Lavrentiya is an old system in Egvekinot and there are no power lines to connect the two. It is not economical to build new lines because of the small consumption on the Chukchi Peninsula. Consequently, diesel power generators make up 100 percent of electricity production in Lavrentiya and all other settlements in the region. In 2016 Lavrentiya's diesel generators produced 7 MWh of electricity. The entirety of Lavrentiya's heat energy comes from two coal-fired boiler houses located in the settlement.

Lavrentiya sells energy to customers at different rates. Until 2017 private business bought electricity and heat at full price. Prior to that year, residential customers benefited from tariffs that significantly reduced the price of energy from the actual cost through subsidies. In Lavrentiya, if the average worker had to pay the full cost for energy, the outlays would consume 70 percent of his or her income. In Neshkan, a more isolated area of Chukotka, for example, energy expenses would be even higher than the average income. Since 2017 the Russian government has introduced new tariffs for consumers in isolated energy zones that are not part of the national network that includes the Chukotka region. The goal of the new tariff structure is to revive the economy and create conditions for development in isolated zones. The subsidy for the tariff reduction is paid by all other consumers in the country. This decision should have a notable impact on local economies within these isolated energy zones, but it is too early to assess its results, including any impacts it may have on the development of alternative energy. For the purposes of this chapter, therefore, the following text refers to pre-2017 conditions. Though new rules facilitating the construction of RES may have a positive impact, it is unlikely to be much of one. The key problem remains in the rates and cost of energy produced.

High energy costs stem from the heavy reliance on energy imports in most of the region. If residential and business consumers paid full price for energy, it would be impossible to develop a local market economy. For this reason, the difference between the full and subsidized cost of energy as well as maintenance and equipment modernization costs are covered by regional and municipal budgets. Affordable energy sector tariffs, which consume approximately 10–15 percent of an individual's income, are possible only in the large cities of Chukotka. For example, the city of Anadyr has lower energy costs due to more efficient energy generation from its own large heating power plant. In general, the full price for energy resources in Chukotka is three to ten times higher than it is in mainland Russia (see table 5.3).

Lavrentiya Renewable Energy

Lavrentiya could benefit from potential undiscovered geothermal energy resources given its location within the Chukchi Municipal District, one of the richest geothermal energy sources in the Chukotka region, with two dozen known hot springs. One of the most famous and closest thermal water deposits is 20 km from Lavrentiya, in Lorino. Geothermal groundwaters can have a wide distribution from their original source. However, exploration drilling and other geothermal exploration activities stopped in the late 1980s due to the economic crisis of that era, resulting in a lack of reliable information on geothermal reserves and availability. Assessing the potential to incorporate geothermal energy into Lavrentiya's energy system is currently not a priority, as evident by the lack of effective geological exploration. Although it is possible to use small electric power plants with a 1–2 MW capacity (Vakin 2003), which could be sufficient to supply power to Lorino or Lavrentiya, Lavrentiya's remoteness and difficult hilly terrain makes geothermal an unlikely heating source for the settlement.

A more promising renewable energy option for Lavrentiya is the development of wind power. Although the Chukotka Autonomous

Table 5.3 | *Tariffs for utilities in different settlements of Russia*

Settlement	Monthly expenses for main utility bills (US$)*		The average wage of an employee after tax (US$)	Share of expenses for utility payments from average wages, percent	
	Population tariffs	Actual cost to produce		Population tariffs	Actual cost
Lavrentiya	61.7	441.1	644.5	9.6	68.4
Neshkan	54.6	675.3	511	10.7	132.1
Anadyr	92.6	220.3	954	9.7	23.1
Khabarovsk (mainland)	83.2	74.8	407.8	20.4	18.3

Source: Municipal Enterprise Iceberg and the Committee on Prices and Tariffs of the Khabarovsk Krai Government.

Note: *Main utility bills include hot water supply, heating, and electricity. The calculations were based on standard consumption rates: 3 cubic meters (m^3) of hot water, 300 (kWatt*hour) of electric energy for a 50-square-meter (m^2) apartment. The calculations were made according to tariffs in the first half of 2017.

Okrug and the territories of the Chukchi Peninsula in particular have significant wind potential, the history of wind energy in Chukotka has been brief and largely unsuccessful. The average annual wind speed on the Bering Sea coast is one of the highest in Russia at about 6 meters (m) per second or more, making it possible to generate wind power even at low altitude. The first attempts to develop wind energy in the region took place in the early 1980s; by the 2000s, however, the lack of experience using wind generators, the absence of local power engineers to maintain the turbines, and insufficient technical solutions to overcome the challenging Arctic climate had prevented this energy source from taking root. During the period when business magnate Roman Abramovich was governor, significant funds were directed to wind energy development, but this effort also proved ineffective for the reasons mentioned above and eventually did not lead to success.

There are many reasons why Lavrentiya lacks RES capacity. Primary among them is the fact that its municipal government does not have sufficient funds for any investment activity or modernization efforts related to the energy sector and existing mechanisms for return on investment make RES projects unprofitable for private investors. In terms of government funds for projects, the regional program "Energy Efficiency and Energy Development of the Chukotka Autonomous Okrug for 2016–2020" does not include RES development or related funds, signaling that the region has no short-term plans to invest in RES (Government of the Chukotka Autonomous Okrug 2016). Though investment mechanisms in Russia are complex, there are two key reasons why RES has not been profitable. First, the RES tariff calculated by the regional energy commission is not large and therefore requires a long payback period. Second, there is no guaranteed buyout for small-scale energy producers under the current RES production rates. Although there is a mechanism that obliges the local power grid organization to buy electricity from local producers or investors, RES production rates are approved by the regional energy commission, but in the amount of no more than 10 percent of network losses. Small energy districts have small losses, so the guaranteed volume of redemption at an attractive tariff is too small to garner investment. Additional challenges to driving RES projects forward include but are not limited to a lack of qualified staff or insufficient interest from public utilities.

There is a plan to integrate Chukotka's regional energy system with the Magadan region's power system to benefit from its excess capacity and lower energy costs by using energy from Kolyma's hydroelectric power stations. State energy companies are currently designing a high-voltage power line for this purpose in Western Chukotka, seeking to reduce the costs incurred by the high energy consumption of the many mining companies there. However, no such power lines will be constructed in Eastern Chukotka to reach Lavrentiya.

Current Governance Structures in Nome and Lavrentiya

Nome exercises a managerial form of government in which power is held by a council of elected officials who hire a professionally trained manager to ensure the delivery of public services ("Council/Manager" n.d.). Nome's city council is made up of six members who are elected by Nome city voters on an at-large basis. Each member serves a term of three years. Nome city voters also elect the mayor in whom the city's executive power is vested. The duties and powers of the mayor are described by Alaska law, and include implementing official documents approved by the city council and serving as the ceremonial head of the city government ("Mayor" 2018). A publicly elected utility board hires and advises the general manager who serves as the designated energy manager. The general manager is in charge of all day-to-day operations, planning, budgeting, and personnel management, though the city council has final approval of energy rates, budgets, and real property transactions (K. Morton, e-mail message to author, 9 February 2018).

Lavrentiya is the center of the six-settlement Chukotka Municipal District. The district administration is also located in the city and has more power than the local self-governing settlements. The elective head serves for four years, during which time he or she manages the district administration, determines its personnel policy, and effectively holds all power in the district. In each of the six district settlements, including Lavrentiya, there is a settlement mayor, but those mayors' financial resources and powers have significant limitations. Located in Lavrentiya, the Municipal Unitary Enterprise Iceberg is the only organization that manages the entire district's energy sector for its six settlements. Formally, it is an independent organization established and controlled by the municipal administration and is largely financed from the municipal and district budget. Although it is independent, all important decisions, including the purchase of fuel and equipment and choosing priorities for renovations are approved with the administration. The private Chukotka Trade Company and state enterprise Chukotsnab supply the region with coal and oil supplies.

The Role of External Financing

Recognizing how governance structures impact the willingness and capacity of external actors to invest in RES, external financing for such projects will be viewed through a governance—rather than private company—lens. Governance plays two major roles in advancing RES on the city level. First, governments can create financial incentives to spur commercial investment. Second, governments can provide direct financial support for RES projects. Private financing was used to jump-start Nome's wind industry before the turbines were acquired by NJUS. Here, government structures did not prevent community members from investing in a commercial project; after the initial installation of a wind farm, government funding through the Alaska Renewable Energy Fund was used to install more turbines.

In contrast, the pre-2017 energy tariff structure in Russia has created barriers for a commercial RES project to be implemented in Lavrentiya. Under this structure, private investment can realize profits in cases when the Russian state can promise a fixed tariff and adequate volume of electricity to guarantee payback in the long term. Given Lavrentiya's energy demand, Russia's private investment mechanism blocks profitable RES projects from being implemented. Another option may be for a commercial project to fall under a research and development framework to yield returns. At the Tenth Japan-Russia Energy and Environment Dialogue in 2017, installing a 3x300 kWt wind turbine in Lavrentiya was listed as a prospective Russian Energy Agency project (Ministry of Energy of the Russian Federation 2017). Though the project remains in the planning stages and the challenges to implementing RES in Lavrentiya still stand as barriers to this initiative, the project's proposal is evidence of the role commercial and outside government financing can have on RES development in Russian Arctic communities. In both cases, the role of external financing proved important to RES investment, but were hampered by governance structures. Moreover, Russian cities are limited in their access to government funding for RES projects.

Indicator Success in Measuring Energy Security

Two ISO energy indicators (7.1 and 7.2, according to their designation in the ISO document) were found to adequately measure energy security differences between Nome and Lavrentiya. None of the ISO governance indicators informed our understanding of these energy security differences and several of them seemed flawed in their ability to measure governance more generally.

Energy Indicators

ISO Energy Indicator 7.1—Total End-Use Energy Consumption per Capita (GJ/year, electricity only)

Arctic communities tend to rely heavily on energy imports. Consequently, the more energy they consume, the greater their vulnerability to energy import disruptions and the less energy secure they become. By measuring electricity consumption per capita, this indicator provides useful insights on how dependent an Arctic city may be on energy imports, accounting for differences in overall population size. In doing so, the indicator can be used to determine levels of energy security in Arctic cities and would be valuable to include in an Arctic city sustainability index. Based on the indicator results, Nome consumes more electricity per person than Lavrentiya, which indicates that Nome is slightly less energy secure for this indicator.

ISO Energy Indicator 7.2—Percentage of Total End-Use Energy Derived from Renewable Sources

The more renewable energy in a community's energy mix, the more capable it is to provide uninterrupted energy to its citizens. This capability is especially important in the Arctic where less dependence on high-cost, disruption-prone imports translates into greater energy security. Nome's modest inclusion of RES in its energy mix compared to Lavrentiya's lack of RES shows that Nome is slightly more energy secure than Lavrentiya. Efforts to deliver alternative energy provide meaningful insights into the level of energy security in each community.

ISO Energy Indicator 7.3—Percentage of City Population with Authorized Electrical Service (Residential)

The greater a city's ability to provide residents with authorized electrical service, the more energy secure residents will be. Access to electrical service is so critical to the survival of Arctic communities that it is unsurprising to find that 100 percent of both Nome and Lavrentiya residents have authorized electrical service. Though this indicator is an effective measure of energy security, more research is needed to determine if indicator results vary across Arctic cities. If 100 percent of all Arctic city residents have access to authorized electrical service, given how essential the service is to survive Arctic conditions, this indicator may be unable to yield valuable or unique conclusions in an Arctic context. Therefore, including this indicator in an Arctic city index is recommended only if further research shows meaningful variance in indicator results in other Arctic cities.

ISO Energy Indicator 7.4—Number of Gas Distribution Service Connections per One Hundred Thousand Population (Residential)

There is no natural gas distribution system in Nome or Lavrentiya. Connection to a natural gas distribution service stands to make a city more energy secure by further diversifying its energy sources. In this way the indicator succeeds in measuring energy security. However, as mentioned for Energy Indicator 7.3, if additional research finds that Arctic cities consistently lack gas distribution service connections, Energy Indicator 7.4 may not generate unique findings across the Arctic. If this is the case, this indicator may not be particularly useful to include in an Arctic city sustainability index.

ISO Energy Indicators 7.5–7.7

Neither Nome nor Lavrentiya were able to provide information for the following indicators:

- ISO Energy Indicator 7.5—Final Energy Consumption of Public Buildings per Year (GJ/m2)
- ISO Energy Indicator 7.6—Electricity Consumption of Public Street Lighting per Kilometer of Lighted Street (kWh/year)
- ISO Energy Indicator 7.7—Average Annual Hours of Electrical Service Interruptions per Household[2]

In particular, Nome stated that it does not collect information in a convenient manner to provide the requested information for these indicators. Though this data may exist for Lavrentiya, it was not available when we attempted to access it.

For Energy Indicator 7.5, the more energy that public buildings consume, the more a city relies on imported fuels to meet those higher energy needs. Therefore, the indicator is an effective measure of energy security. Since cities have more direct control over the electricity use of public buildings, determining a city's performance on this indicator can also prompt cities to take action to reduce building consumption and, in doing so, bolster their level of energy security.

For Energy Indicator 7.6, the more electricity consumed by public street lighting, the more a city relies on imported fuel to meet those higher energy needs. However, more research is needed to determine if the electricity consumption for public street lighting is substantial enough to pose a notable impact on energy security, especially compared to Energy Indicators 7.1 and 7.5, which present a more comprehensive measure of electricity consumption.

For Energy Indicator 7.7, the more electrical service interruptions per household, the less reliable a city's electrical service, which translates to a reduction in energy security. This indicator provides valuable insights into a city's energy security state.

All three of these indicators can provide useful information on a city's level of energy security. However, if gathering this data for other Arctic cities proves to be as difficult as it has in Nome and Lavrentiya, it may be challenging to produce meaningful results for these indicators. In this case, it may be worth considering the benefit of including the indicators in an Arctic city sustainability index.

ISO Energy Indicator 8.3—Greenhouse Gas Emissions Measured in Tonnes per Capita (Adapted for Electricity Sector Only)

Though this indicator was adapted to measure GHG emissions from the electricity sector only and as such did not directly measure energy security, it still provides useful information about the relationship between energy and sustainability. The results show that Lavrentiya's per capita emissions for the electricity sector were slightly less than they were for Nome, suggesting Lavrentiya's electricity sector is more sustainable. These results are somewhat surprising given that some of Nome's energy is being produced by RES, which generates fewer GHG emissions, while Lavrentiya relies in part on coal, which produces more GHG emissions than diesel. Nome's electricity sector also seems to be more energy efficient. Perhaps the fact that Nome's data is from 2018 and Lavrentiya's is from 2016 accounts for this difference in emissions. As demonstrated in Energy Indicator 7.1, Lavrentiya has lower per capita energy consumption, which may be significant enough to also account for this GHG disparity.

Governance Indicators

ISO Governance Indicator 10.1—Women as a Percentage of Total Elected to City-Level Office

At a fundamental level, this indicator seems to make two key assumptions that challenge its usefulness as a governance indicator. First, it assumes that whoever is elected to city-level office, whether they are men or women, will be capable of making decisions that promote sustainability. However, we have seen that Lavrentiya is dependent on decisions at the regional and federal levels, particularly for its budgets. Whether Lavrentiya's government was 100 percent female or 100 percent male does not change the fact that the government structure itself does not grant elected officials the ability to make decisions independent from the will of higher levels of government.

Second, though there is no explanation in the ISO for how this indicator measures sustainability, it seems at the very least to suggest that the more women elected in local office, the more sustainable a city will be. However, it stands unproven that women are more likely to make environmentally conscious decisions than men. Based on the results of this indicator, Lavrentiya should be more sustainable than Nome because 60 percent of its officials were women compared to 33 percent in Nome. It is challenging to find support for the idea that Lavrentiya's higher percentage of women in office equates to it being more sustainable, and therefore may play any role in enhancing the energy security of a city.

Though this indicator can serve as a measure of social inclusion, for example, it does not appear to hold much relevance for assessing how governance can impact the electricity sector specifically or environmental sustainability generally.

ISO Governance Indicator 10.2—Number of Convictions for Corruption and/or Bribery by City Officials per One Hundred Thousand Population

The ISO defines sustainable governance as upholding principles of objectivity, selflessness, openness, accountability, leadership, and honesty. Corruption erodes these principles. Although this chapter accepts the idea that corruption in local government reduces its level of sustainability, it is worth noting that a corrupt local government would not measure its own level of corruption, and thus any data gathered by government sources may not tell the whole story. By that same token, the absence of corruption data does not mean a city is free of corruption. Although data was unavailable for this indicator in Nome and Lavrentiya, if accurate data were accessible, the indicator seems to have some capacity to be a successful measure of city governance in relation to sustainability. In fact, if data were available on corruption in the energy sector specifically, such as rent-seeking activities, it could provide useful insights into the sustainability of the sector. However, finding these data is likely to be difficult.

Though this indicator has potential to be a useful governance indicator generally and for energy specifically should such data be available, challenges to finding city-level corruption data and ensuring its accuracy might weaken the power of indicator results or yield no results at all.

Consequently, more research is needed to see how successfully municipal corruption data can be found for other Arctic cities before assessing the usefulness of this indicator as a measure of governance.

ISO Governance Indicator 10.3—Number of Registered Voters as a Percentage of the Voting Age Population

This indicator fails to account for differences in voter registration policies across countries, which can significantly skew results, causing them to reflect an inaccurate picture of local governance. In Russia, anyone eighteen years of age or older is automatically registered to vote, which means all Russian cities, regardless of actual governance differences, would score 100 percent for this indicator. In contrast, the United States requires citizens eighteen years of age or older to register themselves in order to vote; because of this, US percentages for this indicator will be lower. Consequently, US cities will always underperform compared to Russian cities and, therefore, may fail to accurately highlight governance differences among cities in the two countries. For example, indicator results show Lavrentiya to have a more sustainable governance structure than Nome. However, this contradicts our findings that Lavrentiya's local government has little decision-making power whereas Nome has much greater flexibility and capacity to make its own decisions—energy-related or otherwise.

Although the ISO states that instances of automatic registration should be noted, the results can still be misleading upon first glance or lack the ability to be meaningfully compared to other cities with different voter registration policies. The shortcomings of this indicator reduce its usefulness unless all cities being compared require citizens to register. This limitation also lowers the indicator's ability to glean insights on energy governance more specifically. Given the fact that Russia and Scandinavian countries have automatic registration while the United States and others do not, this indicator may not yield as much telling information on Arctic governance as another indicator might. It is worth noting that this indicator does not take into consideration the extent to which elected officials actually represent the interests of their citizens. In this case, the fact that Russia is an authoritarian country while the United States is a democracy is not accounted for in indicator results.

ISO Governance Indicator 10.4—Voter Participation in Most-Recent Municipal Election (as a Percentage of Registered Voters)

Once again, measuring voter participation as a percentage of registered voters can skew results. Countries with automatic voter registration will have a higher denominator value when calculating this indicator and, consequently, may perform more poorly than those with voluntary registration if the registration values are close, despite true differences in voter participation. To illustrate, if voter participation rates were the same for Nome and Lavrentiya, the fact that Lavrentiya would have a denominator of 100 compared to Nome's 91.3 would skew results in favor of Nome. In practice, Nome's voter participation rate was so low that, in spite of Nome's calculation advantage, Nome still compared poorly to Lavrentiya. According to these results, Lavrentiya is more sustainable. Though this indicator can provide a better measure of governance than others examined here, it still shares some of the weaknesses of Governance Indicator 10.3 and should be used with caution in any Arctic city sustainability index.

Results and Suggested Improvements

Given the high importance of energy to Arctic communities, any set of indicators intended to assess the sustainability of Arctic cities should give considerable consideration to measuring energy security. Like Nome and Lavrentiya, many Arctic communities rely heavily on energy imports, lack connection to the larger national grid, have high energy costs, and are particularly vulnerable to energy disruptions given their geographical isolation and limited access to energy sources.

As demonstrated in this chapter, governance can play a significant role in community energy security; therefore, Arctic communities require an indicator that breaks the silo between energy and governance disciplines to more accurately assess energy security. Governance structures can help or hinder the ability of an Arctic community to be more energy secure. For example, in Lavrentiya, Russia's energy tariff structure disincentivizes commercial RES projects while the community's governance structure gives decision makers less authority over their budgets to fund such projects. In contrast, the State of Alaska has created financial structures to encourage projects that reduce the cost of electricity, in part by providing decision makers in cities like Nome with more access to RES funding.

Accounting for all indicator results, it appears that Lavrentiya is more energy secure and sustainable than Nome. However, this chapter's discussion has indicated several flaws in the ability of certain indicators to accurately measure sustainability in general as well as energy security in particular, which compromises the validity of this final finding. No combination of ISO energy and governance indicators could measure the important relationship between energy and governance in enhancing energy security. None of the governance indicators could be applied to understand a city's level of energy security, and many of them had limitations in measuring governance more generally. Only two ISO energy indicators—total end-use energy consumption per capita (GJ/year), and percentage of total end-use energy derived from renewable sources—provided some measurements of local energy security. According to the results from the two energy security indicators, Nome performed better on renewable energy use whereas Lavrentiya was superior in energy consumption per capita. However, differences in energy and governance indicator values between Nome and Lavrentiya were often marginal, indicating a potential lack of statistical significance to definitively say if one community was more energy secure or sustainable than the other. Better energy and governance indicators are needed to improve energy security assessments on the local level.

Delving into the energy and governance narratives surrounding both communities, however, it would seem that Nome should have performed better than Lavrentiya overall. In particular, Nome's governance structure is more conducive to RES and energy efficiency investments whereas such investments prove more challenging in Lavrentiya. It is these kinds of investments that ultimately stand to move a city toward greater levels of sustainability and energy security, yet there is no way to directly measure Nome's success in this area using the ISO index. Therefore, a major finding from the indicator results and other research is that omitting the role of governance structures in energy financing fails to capture a critical element of energy security.

Based on identified indicator needs, we propose an indicator measuring the total amount of funds made available by government sources for city-level RES projects. Doing so highlights how governance mechanisms can stifle or advance RES development, which in turn impacts the state of a city's energy security. Though commercial funding opportunities can promote RES deployment, the interest in better understanding the relationship between energy and governance structures—both at the city level and between the city and higher governance levels—merits limiting this indicator to government funding sources. The results of this indicator also provide additional context for why one community might do better than another in terms of energy security, namely because of how many financial resources different governance levels are making available to communities to invest in RES.

Nome benefits from multisource government financing mechanisms for RES projects, which has not only been instrumental in advancing greater urban energy security but also has contributed to creating a culture that encourages sustainable development. The Renewable Energy Fund was established in 2008 by the Alaska state legislature to generate heat and power through cost-effective renewable energy in order to retain money in local economies, reduce and steady energy costs, create jobs, and use local energy resources (Renewable Energy Fund 2019). In this case, state resources give Nome the ability to develop more sustainably while gaining other benefits for its citizens. The AEA is the state's energy office and is in charge of Alaskan energy program development and policy. To serve AEA's core mission to reduce Alaska's energy costs, the organization prioritizes diversifying Alaska's energy mix, investing in state infrastructure, improving energy planning and policy, and offering resources to rural communities. Through AEA grants and loans for energy infrastructure projects, Nome can access additional funding sources to invest in a greater number of sustainable energy options (AEA 2017). In principle, these government financing options for energy projects support Nome's long-term success in gaining greater energy security through sustainable development.

It is important to note that the State of Alaska is in the midst of a fiscal crisis that has severely reduced funding for AEA programs over the past few years. No new funding was awarded in 2016 and 2017 for the Renewable Energy Fund. Though $11 million was allocated for the 2018 fiscal year through the Fund (AEA 2019), it is unlikely to receive funding in 2019 due to Alaska governor Mike Dunleavy's proposed budget cut of $900 million if dividend spending is included (Brooks 2019). Slashing state spending is likely to reduce Nome's capacity to increase its energy security through greater RES deployment, at least in the short term.

In contrast, the limitations of Lavrentiya's governance structure to make RES investment indicates that its performance will remain at current levels for the foreseeable future unless regional or higher governments decide to invest in RES or conditions change to allow for external actors to profit from a RES project. Lavrentiya operates under a government structure that is dictated by regional and higher authorities. Financing and management of the energy sector is designed in such a way that Lavrentiya's local government cannot practically influence RES development as a larger effort to reform its energy system. Real changes are possible only with the support of regional and federal authorities, as well as large state energy companies. Better financial support mechanisms could also help Lavrentiya tackle the technical challenges it faces to develop RES. Despite promising potential for wind and geothermal energy in the Chukotka District and in Lavrentiya in particular, a lack of successful experience in operating wind turbines and the high costs of exploration studies, equipment, installations, maintenance, and recycling prevents RES development at this time. Though one renewable energy project may be realized in Lavrentiya, if it is not successful current government plans that suggest using coal and diesel as fuel for heat and electricity generation will likely remain uncontested.

If the suggested indicator had been applied to Nome and Alaska over the past few years, the results would have favored Nome for the years when Renewable Energy Fund financing was available. The indicator's ability to measure fluctuations in Alaska RES funding and Russia's lack of funding options would not only show the impact of government actions on energy security, but also, by extension, inform evaluations of each community's level of sustainability.

Conclusion

Examining how Nome and Lavrentiya performed on the selected indicators showed a difference in their levels of energy security and sustainable development, but government funding policies, combined with long-term demographic trends, can also impact future decision making on approaches to energy security and sustainable development.

Opposite population trends stand to affect sustainability approaches in Nome and Lavrentiya. Nome has a growing population; barring significant advances in energy efficiency, this increase will contribute to a higher demand for energy. As Nome plans for the future, there is a greater incentive to invest in RES and other measures to lower fossil fuel consumption and reduce the economic burden that added consumption would bring. Assuming continued population growth, it is easier to make the case that RES investment today will pay off in the long run to counteract projected costs from increased energy consumption. Conversely, Lavrentiya's population is decreasing. Though a smaller population may make it easier to justify investing in smaller RES projects for the population, a smaller population may also disincentivize the government to fund alternative fuel sources for Lavrentiya when it can continue to be served by diesel and coal. Divergent population trends may play a notable role in spurring more long-term RES in Nome and offer mixed incentives in Lavrentiya. As a result, differing population trends could, for example, bolster sustainable development in Nome while discouraging it in Lavrentiya. Examining energy security against relevant trends such as population growth can provide useful, additional context to how governance structures may promote or discourage RES investments in the future.

The different government policies shaping Nome and Lavrentiya's economic structures impact their approaches to energy security as well as overall sustainable development. Like most cities, Nome operates within a budget to provide services to its citizens and promotes economic development to support the population. Lowering energy costs through RES projects not only fuels the economy by providing more funding for citizens to spend locally, but also frees up more funding in the community's limited budget to offer other services to citizens. Nome's economic structure rewards actions that reduce expenses; in terms of energy costs, the pursuit of economic sustainability can align with environmental sustainability. Unlike Nome, Lavrentiya is not incentivized to reduce energy costs because it will not see the financial benefit of any energy savings. Instead, the value of their energy subsidy would decrease. Here it is clear how dissimilar governance approaches create differing incentive structures that influence each community's level of energy security. Stark differences in economic structuring create diverse incentives in Nome and Lavrentiya to pursue RES with consequences for the sustainable development of both.

Nome and Lavrentiya share many characteristics, but the differences in their governance structures and energy systems led to varied states of energy security. Two ISO energy indicators were found to adequately measure energy security differences between Nome and Lavrentiya while none of the ISO governance indicators informed our understanding of these energy security differences. Based on the two ISO energy security indicators, Lavrentiya and Nome reached similar levels of energy security. Recognizing the high importance of energy security to Arctic communities and the critical role that governance plays in energy decision making, Arctic communities require an indicator that simultaneously accounts for both energy and governance disciplines to more accurately assess energy security. Consequently, this chapter suggests that an indicator measuring total amount of funds made available by government sources for city-level RES projects be included in any future set of indicators for measuring the sustainability of Arctic communities. This new, multidisciplinary indicator highlights how governance mechanisms can stifle or advance RES development which, in turn, impacts the state of a community's energy security. Finally, other factors such as population growth and government policies impacting community economic structures need to be considered when attempting to project a community's long-term approach to energy security.

Katherine A. Weingartner graduated from George Washington University with a Master's in Security Policy Studies.

Evgenii Antonov is a research assistant in the Geography Department at the Lomonosov Moscow State University.

Alexey Maslakov is a faculty member in the Geography Department at Lomonosov Moscow State University.

Notes

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2. ISO Energy Indicator 7.8 was omitted from this analysis.

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Part III

Extending the International Standard for Measuring Urban Sustainability

CHAPTER 6

Fate Control and Sustainability in Arctic Cities

Recasting Fate Control Indicators for Arctic Urban Communities

Andrey N. Petrov

Introduction

This chapter argues that the ISO framework for sustainable cities, which is meant to apply to all cities on the planet, does not work for the specific conditions of the Arctic.[1] The ISO's main failure is that it is does not take into account the concept of fate control and, particularly, the contribution of the Indigenous communities, which make up a prominent part of Arctic cities and define the context in which these cities exist.

Fate control is the ability to guide one's own destiny. This concept is linked to the more common term of "empowerment," the process of achieving the capacity to "make choices and then to transform those choices into desired actions and outcomes" (Alsop, Bertelsen, and Holland 2006: 10). Fate control is the outcome of empowerment. To control its fate, a community must have the capacity to make its own decisions; it must also have the resources to implement these decisions (Dahl et al. 2010). Each of these aspects, in turn, has an internal and external component: A community needs both the internal capacity and resources and a lack of external barriers to make and implement decisions. The "concrete material, social, and institutional preconditions to exert agency" are critical to empowerment (Ibrahim and Alkire 2007: 11).

Lack of collective fate control has given rise to demands for self-determination and self-government throughout the Arctic, and at different scales. Over the past several decades self-government institutions developed in many areas of the Arctic, including in Greenland, Inuvialuit, and Nunavut. Peoples of the Arctic give prime importance to fate control: the *Arctic Human Development Report* (AHDR) listed it among the three main areas that determine well-being in the Arctic (Einarsson et al. 2004).

Fate control is a key component of sustainability. First, it is a future-oriented indicator; in other words, it describes the ability of a system to determine the trajectory of its own development. Second, fate control is an integrative concept that brings together elements from social, economic, political, and cultural domains to assess the levels of freedom, democracy, power, and equity in the governance system to which a region or city belong. Sustainability is thus contingent on attaining fate control, and fate control is an unequivocal measure of sustainability.

Fate control is a complex concept. As a result, it is naturally difficult to develop a comprehensive indicator that would adequately characterize its various aspects. Few sustainability indicator frameworks seem to be able to accomplish the task of fully incorporating this element, or even acknowledging it explicitly. For example, the ISO sustainable cities governance indicators focus on voter representation, participation, and gender equality. All three are key for understanding sustainable governance, but they do not reflect the complexity and uniqueness of the Arctic governance systems. First, they are exclusively political, although economic and cultural components of fate control are also very relevant. A community's ability to pay its own bills and provide consumer power are vital for its fate control and sustainable development. Cultural vitality and the preservation of local languages are also indicators of the internal societal capacities to drive development forward in a way that satisfies the needs of community members without jeopardizing future generations. Even in the political realm, ISO governance indicators omit Indigenous governance and Indigenous community capitals (language, culture, subsistence economy, etc.), all of which are crucial for Arctic sustainability. The Arctic Social Indicators report (Larsen, Schweitzer, and Fondahl 2010) suggested a few more comprehensively designed ways to conceptualize quantitatively and measure fate control including the rather simple, but powerful, approach of looking at fate control at a community level (Dahl et al. 2010). It recommended distinguishing between four forms (components) of fate control: political control, decision-making control, including land control, economic control (self-reliance), and control over knowledge construction (associated with overall cultural vitality, and specifically with the ability to speak a native language).

Based on these four domains, the ASI Report (Dahl et al. 2010) proposed to create a Fate Control Index (FCI) where a region (community) would be evaluated under each of the following four measures.

1. Political Control: The percentage of Indigenous members in governing bodies (municipal, community, regional) relative to the percentage of the Indigenous people in the total population. Seen in the perspective of human development, fate control should imply that none of these groups are discriminated against. This indicator measures relative political activity and power among different ethnic groups. It can be measured at the municipal, community, regional, or national level.
2. Decision-Making Control: The percentage of surface lands legally controlled by the inhabitants through public governments and native corporations. This indicator addresses political power, economic control, and decision-making power, and also has a cultural dimension. Moreover, since international conventions stipulate Indigenous rights to land, this indicator incorporates a dimension of human rights.
3. Economic Control: The percentage of public budget revenues within the region raised in the appropriate jurisdiction or the percent of self-generated income in the total local population's income. This indicator provides one measure of economic control. Without fiscal independence, a democratically elected and popular government may nevertheless have limited ability to operationalize its decisions.
4. Control over Knowledge Construction: The percentage of individuals who speak a mother tongue, whether or not that individual is native, in relation to the individuals reporting corresponding ethnicity. Language retention serves as a proxy for fate control, in terms of knowledge construction and human (and particularly Indigenous) rights.

Each component ranges from 0 (no control) to 1.0 (full control). To calculate the FCI, all four components are added together.

The concept of fate control and the FCI were applied in a number of studies and used to examine governance, human rights, and human development issues across the Arctic (e.g., Kimmel 2014; Petrov, King, and Cavin 2015). Some relationships were identified with other human development dimensions. For example, fate control has been found to be higher in Arctic communities that exhibited a strong attachment to land and/or sea, and that demonstrated a greater level of cultural vitality (Petrov et al. 2015).

The ASI Report also developed the notion of individual fate control (Dahl et al. 2010). The idea is that community and personal ability to determine current and future affairs are different, albeit related, concepts. Individual fate control includes the same basic elements: political control, decision-making control, economic control (self-reliance), and control over knowledge construction. Although no study in the Arctic ever measured individual fate control, potential variables may include voter participation, people's satisfaction with the level of local influence on resource management, their satisfaction with their standard of living, and indicators of cultural vitality (language, museums).

This chapter presents a first-cut analysis of fate control, both community and individual, in a sample of Arctic cities. We generally follow the ASI methodology in defining the elements of fate control, but introduce substantial modifications in respect to variables measured. The main difference is that the original community-level FCI methodology was designed to target largely rural, Indigenous communities in the Arctic, hence the emphasis on such variables as control over land/sea, Indigenous language retention, and Indigenous representation in governing bodies. While completely justified in the context of the ASI project and its follow-up studies, this approach may not be directly applicable to measuring fate control in Arctic cities. Although the presence of Indigenous populations in Arctic urban areas is substantial and important, and the control over land and resources is essential, there are other indicators that could be used to tackle fate control as applied to all population groups, both Indigenous and settler communities, and reflects the reality of the urban places, which is distinct from smaller rural communities. Below, we adjust the ASI methods to account for variables relevant in the urban context and also develop a measure of the individual fate control of urban residents.

Methodology

Following the definition and general understanding of the fate control components suggested in the ASI Report (Dahl et al. 2010), this chapter creates a modified set of indicators for a small but diverse sample of

Arctic cities. We consider a combination of standard ASI and ISO indicators, mostly giving preference to ASI as being more tailored to the realities of Arctic cities. We studied twelve urban communities from Russia, Canada, the United States, Greenland, Sweden, and Norway. The selection was based on size (> 12,000 population) and regional importance (county and regional capitals). In addition, an additional consideration was geographic and functional diversity. For example, the set of Russian Arctic cities included Archangelsk (a cultural center and the largest city in the Russian Arctic), Norilsk (an old mining city) and Salekhard (a booming capital of an oil/natural gas region). The Canadian sample consisted of Yellowknife and Whitehorse. The study also incorporated the two largest cities in Alaska: Anchorage and Fairbanks, and a number of Nordic communities: Tromsø, Kiruna, Luleå and Boden, alongside Greenland's capital of Nuuk.

The definitions of the variables used to characterize the four components of fate control (political, decision-making, economic, knowledge construction at both the community and individual levels) were heavily affected by data availability across the sample (table 6.1). This was a challenge given the high variability of data collection practices and differences in the underlying social and economic contexts. For some of the data, this study relied on the earlier work by Suter et al. (2017) and Petrov (2014), who compiled circumpolar datasets for urban Arctic communities.

In this chapter the community fate control elements are measured as follows. Political control is typically quantified based as a representation of a given community in a regional government. However,

Table 6.1 | *Fate control components and variables for Arctic cities*

Fate control components	Community fate control	Individual fate control
Political control	Fraction in total regional population (electoral weight)	National elections participation rate
Decision-making control	Democracy index (National)	Per capita income adjusted for purchasing power parity
Economic control	Per capita public expenditures per $100 of per capita income adjusted for purchasing power parity	Cost of travel to the mainland as a percentage of per capita income
Control over knowledge construction	Bachelor degree or equivalent education, location quotient (national base)	Access to Internet (percent of households)

Source: Adapted from Dahl et al. 2010.

it may be challenging to define which electoral districts are representing the community and in which governing body, especially when electoral systems are very diverse. To solve this problem, this study simply used the relative population size of the community in the region, which gives the electoral weight of a city. The underlying assumption here is that, to a certain degree, the representation in the governing bodies is proportionate to population size; this assumption holds in all governance systems across the Arctic.

The decision-making power of a community can be measured in various ways. One option is to develop localized indicators based on examining local electoral process and representation. However, these measures are qualitative in nature and may be difficult to compare among jurisdictions. For example, mayors or heads of municipalities are directly elected in Anchorage, Fairbanks, Nuuk, Whitehorse, and Yellowknife. In Russia, Sweden, and Norway they are appointed by city councils, which in turn are elected by popular vote (either by party lists or individually or both). Thus, the differences in the electoral systems across the Arctic make comparisons problematic.

Another option is to use a national indicator that describes the overall level of democracy. Such an indicator would measure the availability of the democratic process for communities to participate in. In this study, the decision-making power is represented by the Democracy Index (Kekic 2007). Designed by the Economist Intelligence Unit (2017), the Democracy Index is a weighted average based on the answers to sixty questions developed by experts and public opinion surveys. The Democracy Index evaluates five categories: electoral process and pluralism, civil liberties, the functioning of government, political participation, and political culture. Every country is rated for each of those categories, and an overall score is calculated (Campbell 2008). While not an ideal or strictly scientific measure, it gives an approximate, generalized, and comparable view of the state of democracy in all Arctic jurisdictions.

Economic control is quantified through per capita public expenditures per $100 of per capita income adjusted for purchasing power parity (PPP). In other words, this measure assesses the public expenditure as compared to overall community prosperity. Standard measures, like those used in the ISO (e.g., operating and capital budgets per capita), are not particularly informative. Given a large variety of economic conditions across the Arctic, using public finances without placing them in context appears to be problematic. Therefore, normalizing municipal expenditures by income provides a more realistic picture of true community budgetary affluence. Alternative or additional measures can be own-source revenue as a percentage of total revenues, as included in the ISO. However, this measure is heavily dependent on the national taxation system, and thus varies considerably among the Arctic countries.

Control over knowledge construction (i.e., the ability to produce, transmit and use information in a meaningful way that reflects the values and desires of a community) can be measured by the level of education of community members, assuming that higher education delivers more competencies to work with knowledge and information. In particular, this study uses the location quotient (relative share normalized by the national average) of population with a bachelor's degree or equivalent. It is a standard measure of human capital (Hirshberg and Petrov 2014; Petrov 2014). Admittedly, this measure focuses only on formal education, and undercounts informally educated human capital that is considerable in the Arctic (see also Hirshberg and Petrov 2014). Still, among the ISO measures of educational attainment, it is the most accessible in terms of data availability.

In respect to the individual fate control of urban dwellers in the Arctic, the four variables were defined as follows, taking into account indicators and available data suggested by ASI and ISO. Individual political control was expressed through participation in the latest national election (voter turnout). Presumably, the willingness to take part in an election reflects voters' perception about the importance of their vote. However, differences in political culture and systems may obscure direct comparisons between countries, and thus this parameter should be considered with caution. Its advantage is data availability and accessibility.

Decision-making power can be measured using surveys of people's satisfaction with their influence. However, since such data are not available, an alternative would be to gauge the ability to make decisions about personal affairs by looking at income. Personal control over one's life requires the presence of appropriate resources, such as money, to ensure the implementation of individual choices and decisions. This chapter uses per capita income in purchasing power parity-adjusted dollars with the assumption that higher income may lead to more control over personal affairs.

In terms of economic control, given the remote nature of most Arctic cities a key variable is the cost of travel to the mainland as a percentage of per capita income. If travel is relatively cheap, it not only leaves a considerable proportion of disposable income to be spent on other purposes, but also may indicate more-extensive opportunities for job searches, access to knowledge and financial hubs, migration, travel, and personal leisure. Again, cheaper travel increases available resources and opportunities to make decisions and implement them. The ISO framework does not measure remoteness or costs of travel. It captures the number of flights connecting the city, but this connectedness may remain superficial if local population lack the financial resources to travel (and when most travelers are fly-in/fly-out workers and other visitors).

Knowledge construction at the individual level may be quantified through access to knowledge-sharing platforms via the Internet. Availability of the Internet has been described as an important element of the freedom of expression (Lucchi 2011). This study uses access to the Internet as the percentage of all households to characterize the knowledge construction component of personal fate control in Arctic cities. The ISO uses a similar measure: the number of Internet connections per one hundred thousand residents.

Although the original ASI methodology called for creating an FCI, it did not provide guidance on weighting the components, especially when the original variables are modified or replaced as suggested above. To simplify this task, this study uses a straightforward approach by first ranking cities based on each parameter, and then deriving an average rank to compare the overall fate control in a given urban community with its circumpolar counterparts. The four fate control elements (political control, decision-making control, economic control, and control over knowledge construction) are weighted equally to determine the final ranking in respect to community fate control and individual fate control.

Results and Discussion

The community fate control ranking for the selected Arctic cities and towns is presented in table 6.2 (overleaf). The highest-ranked urban community in the Arctic is Tromsø followed by Luleå, Yellowknife, and Boden. Notably, two of the top three cities are Scandinavian. They are relatively large and less remote than some of their counterparts in the Arctic, represent well-established democratic governance systems, and boast healthy municipal budgets. Yellowknife, the capital of the Northwest Territories, benefits from its relatively large size, educated labor force and considerable local budget expenditures. These characteristics are undoubtedly related to its role as the capital of a resource-rich region. Whitehorse, another northern primate city, demonstrates a similar ranking (table 6.2). Nuuk is well-positioned in respect to most parameters with the exception of human capital: a relatively low proportion of labor force with higher education (compared to Denmark) drags that city down in the rankings.

On the bottom of the list are the US and Russian cities: Norilsk is the lowest ranked, followed by Fairbanks, Anchorage, and Arkhangelsk. The composition of this group is somewhat surprising given the differences between Alaskan and Russian northern urban communities. Accordingly, the reasons for being in the lowest tier differ: US cities suffer from poor budgets and a less-educated labor force, whereas Russian urban communities underperform in terms of democracy and municipal finances. The underinvestment in human and physical capital in the US Arctic cities appears to be a problem that needs to be investigated further.

The ranking for the individual fate control in Arctic urban communities follows a similar pattern (table 6.2). The highest ranks are earned by Swedish cities: Boden, Luleå, and Kiruna. Again, these are less-remote, better-connected places with broad Internet penetration and well-educated population. Voter turnout is also high (usually above 80 percent). Salekhard, the capital of the natural gas–rich Yamal-Nenets Autonomous Okrug, emerged in fourth place. This city is reasonably well connected with the mainland by air and railway, and demonstrates large per capita incomes. Salekhard, however, ranks low on Internet connectivity.

Two Russian cities, Norilsk and Arkhangelsk, are at the very bottom of the individual fate control ranking. Low voter turnout, limited Internet access, and relatively low per capita incomes are the main contributing factors. As a result, local residents face serious constraints in their ability to support their priorities and make decisions based on their best interests and desires. The low standing of Fairbanks and Yellowknife is surprising, but high travel costs compared to local income is the primary problem in these communities.

Taking both community and individual fate control rankings into consideration, it is clear that cities in northern Scandinavia perform the best, while urban settlements in the Russia Arctic lack fate control. However, this pattern is not without exceptions. The city of Salekhard is unexpectedly well positioned in the overall ranking, ahead of US cities, Canadian territorial capitals, Nuuk, and all other Russian communities. Being the capital of a booming fossil fuel region propels Salekhard to the top, but this position may change should the resource cycle enter a declining phase. In other words, the long-term fate of Salekhard (and other resource-dependent settlements) is really outside its control.

It is also notable that the large Alaskan cities, Anchorage and Fairbanks, exhibit less community fate control than other Western

Table 6.2 | *Fate control rankings for selected urban communities in the Arctic*

City	1 Fraction in total regional population	2 Bachelor degree or equivalent education, LQ	3 National democracy index	4 Per capita public expenditures per 100 dollars of per capita incomePPP	5 Cost of travel to the mainland as a percentage of per capita income	6 Per capita income (PPP)
Anchorage	0.405732	0.95	7.98	1,574.75	0.127004	36,733
Arkhangelsk	0.310872	1.38	3.17	945.59	0.105754	20,174.46
Boden	0.075195	0.96	9.39	11,535.46	0.008669	37,802.69
Fairbanks	0.130746	0.87	7.98	1,067.6	0.281004	33,553
Kiruna	0.073078	0.65	9.39	9,411.79	0.026562	37,533.63
Luleå	0.183024	1.11	9.39	11,548.68	0.008659	37,264.57
Norilsk	0.06099	0.96	3.17	3,953.66	0.126465	36,459.09
Nuuk	0.315073	0.83	9.22	10,183	0.098203	39,568.97
Salekhard	0.079366	1.5	3.17	5,223.71	0.076574	41,541.71
Tromsø	0.559197	1.25	9.87	5,144.82	0.029156	35,850.03
Whitehorse	0.686668	1.09	9.15	2,447.707	0.285982	42,510.57
Yellowknife	0.463895	1.29	9.15	3,925.756	0.152837	57,765.04

Sources: Economist Intelligence Unit 2017; Petrov 2014; Suter et al. 2017.
Note: Voter turnout is taken from miscellaneous media reports

urban settlements. The same applies to their residents who are set to exercise less control over their lives. It appears that structural problems, such as tight local budgets, high travel costs, the relatively small share of college-educated labor force, and lower voter participation, are at the core of their lack of fate control.

Fate control is not only a key social indicator related to well-being, human rights, and political empowerment (Dahl et al. 2010), but also an important characterization of governance as it relates to the ability of communities and individuals to make informed and self-beneficial choices. Sustainable development is one such choice that requires resources, freedoms, and capacities to develop in a way that serves the current generation of residents while supporting the community's future. Therefore, governance based on robust fate control is both a prerequisite for and an element of sustainability. Conversely,

7 Access to Internet	8 National elections voter turnout	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Mean Rank *Community FC*	Mean Rank *Individual FC*
95	60.7	4	9	8.5	10	8	1	8.5	9	7.875	6.625
66	58.2	6	2	11	12	12	11	11	7	7.750	10.250
93	85.3	10	7.5	3	2	5	4	1.5	2	5.625	3.125
94	60.7	8	10	8.5	11	11	2	8.5	11	9.375	8.125
93	82.5	11	12	3	4	6	4	4	3	7.500	4.250
93	85.3	7	5	3	1	7	4	1.5	1	4.000	3.375
67	60	12	7.5	11	7	9	10	10	8	9.375	9.250
65	74.2	5	11	5	3	4	12	6	6	6.000	7.000
70	84.2	9	1	11	5	3	9	3	5	6.500	5.000
78	74	2	4	1	6	10	8	7	4	3.250	7.250
78	76	1	6	6.5	9	2	7	5	12	5.625	6.500
91	55.2	3	3	6.5	8	1	6	12	10	5.125	7.250

a community cannot move toward sustainability if it cannot define its own future, whether in the short or the long term. Sustainable governance must incorporate conditions for strong fate control or there will be no progress toward sustainability. This applies to all levels of governance: local, regional, national, and global. External barriers represented, for example, by national political systems, could impede the ability to make and implement decisions, even if there are internal community capacities and resources.

Conclusion

This chapter applied the notion of fate control as one of the key Arctic social indicators to selected urban communities in the Arctic.

A set of variables was used to characterize both community and individual fate control using the four elements approach (political control, decision-making control, economic control, and control over knowledge construction). The indicators were applied to twelve cities located in Russia (three), Sweden (three), the United States (two), Canada (two), Norway (one), and Greenland (one). Results demonstrate that, generally, cities in northern Scandinavia perform the best, whereas urban settlements in the Russian Arctic lack fate control, with Canadian and US cities positioned in between. Structural or systemic problems, such as remoteness (and high travel costs), poor local finances, low voter turnout, and lower levels of educational attainment, heavily contribute to depressing both community and individual fate control.

Although this first-cut study of fate control in Arctic urban communities is indicative of considerable difference across the circumpolar region, more-detailed work is needed to develop indicators appropriate for remote urban communities and to link levels of fate control with other social, political, and economic factors and processes that determine the density of the cities. In particular, the association between fate control and sustainable development could be an important area of inquiry. Relating sustainability and governance via the notion of fate control is a promising approach that should be explored.

From our analysis, measuring fate control as a component of urban sustainability is attainable even given data limitations. Here we mostly used the ASI-suggested indicators, although some of them closely match the ISO framework. Still, urban fate control measures need further development, since neither the ASI nor the ISO was designed to describe the unique socioeconomic, geographic, and governance characteristics of Arctic urban communities.

Andrey N. Petrov is associate professor of geography at the University of Northern Iowa and president of the International Arctic Social Sciences Association.

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CHAPTER 7

What Do ISO Indicators Tell Us about Corporate Social Responsibility and Sustainability in Cities of the Yamal-Nenets Autonomous Okrug, Russia?

Stephanie Hitztaler and Veli-Pekka Tynkkynen

Introduction

Corporate social responsibility (CSR), broadly defined as a set of governance initiatives ensuring the betterment of workers and communities alongside a corporation's economic development (see Henry et al. 2016), holds clear potential in promoting social, economic and environmental sustainability.[1] How do current CSR programs in cities and towns in the Russian Arctic affect key ISO indicators of sustainability? How useful are these indicators in measuring the contribution of CSR to an Arctic city's overall level of sustainability? These guiding questions are addressed through an analysis of change over time in selected ISO indicators and an exploration of how they do (or do not) reflect the impact of prominent CSR programs in Arctic cities of the Yamalo-Nenets Autonomous Okrug (YNAO) in northwestern Siberia.

In this Arctic region, a palpable tension exists between the social sphere and environmental status, suggesting that CSR perspectives here may be slanted toward upholding the existing social order and not necessarily toward sustainable development. This chapter seeks to fill the knowledge gap on the actual impact of CSR initiatives in YNAO's towns and cities. It also offers a critique of the ISO index, inquiring into whether it is a sufficient tool in measuring the sustainability outcomes of CSR programs. These insights are crucial today as large-scale, international projects aimed at hydrocarbon production are launched in the area (Gritsenko et al. 2018).

The assessment of how CSR programs are connected to the ISO index and the implications for sustainability in YNAO proceeds as follows. We first detail CSR, especially the aspects of it that are unique to Russia, and then give a background of the Russian companies that are responsible for authoring the CSR policies and programs discussed here and the specific Arctic conditions of YNAO in which these companies operate. We then look at how CSR projects influence selected ISO indicators over time, focusing on the core indicator of number of sports facilities per one hundred thousand population in the YNAO cities of Labytnangi, Nadym, and Noyabrsk. Finally, we end with a discussion of whether CSR translates into sustainability and a critique of the ISO index.

Oil, Gas, and CSR in YNAO

A Closer Look at CSR in the Russian Context

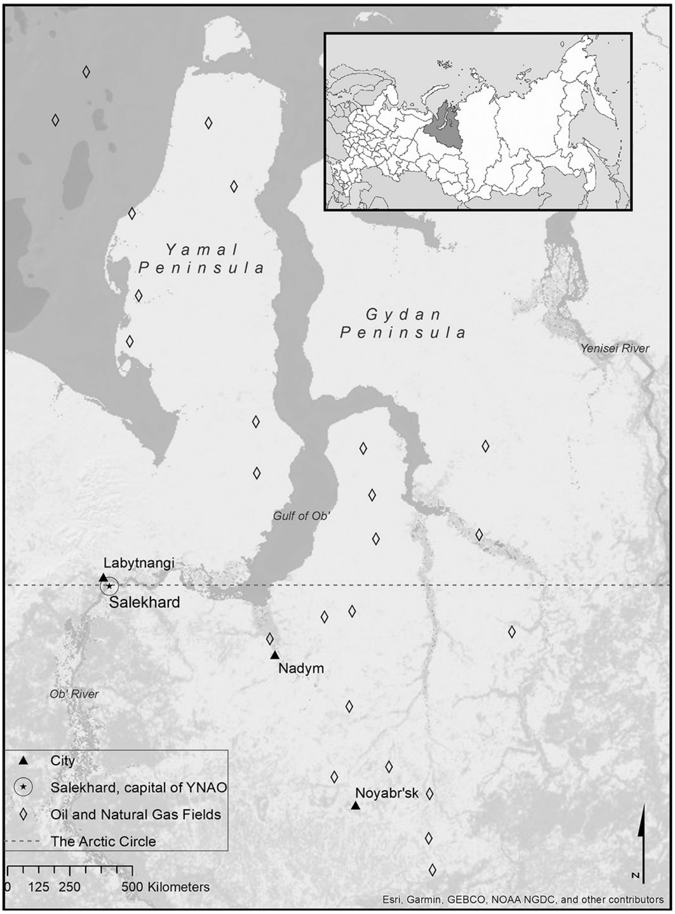
CSR is commonly defined as "a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis" (European Commission 2001). A wider view of CSR includes the recognition that companies bear a responsibility for (1) their impact on society and the natural world, (2) the actions of others with whom they do business, and (3) their relationship to both their stakeholders and the wider society in which they operate (Blowfield and Frynas 2005; Nekhodka, Kolbysheva, and V. Makoveeva 2015; Prieto-Carrón et al. 2006; Tysiachniouk et al. 2018). In sum, CSR embraces transparency, stakeholder interests, labor rights, safety, and a pledge to protect the environment (Henry et al. 2016).

While overall descriptions of CSR generally converge on a global level, there is a distinct variation in how CSR is understood and implemented in local contexts (Henry et al. 2016). In the Russian context, CSR is relatively new and is readily distinguished by the firm role of the state in its development (Khayrullina 2017). As described by Marina Khayrullina (2017), CSR policies in Russia tend to fall in the middle of the CSR continuum, bounded at one end by a purely business-initiated model and at the other by a solely state-initiated model. More specifically, CSR in Russia involves a limited group of stakeholders consisting of the state and company owners and employees; local communities typically have not been fully included. In terms of the CSR social-environmental continuum, focused solely on social/socio-economic issues at one end and environmental actions at the other, Russian CSR initiatives lean heavily toward the social end, tending to fall into patterns resembling the Soviet legacy of paternalist welfare provision (e.g., providing social services and building infrastructure in the local communities of operation; see Henry et al. 2016). This trend of paternalism is a hallmark of CSR policies within Russia's oil and gas sector, even as these policies have become more prominent due in part to increased competition in export markets, the necessity of attracting foreign investment, and the chance to take part in multinational consortiums on hydrocarbon development (Henry et al. 2016).

Yamal-Nenets Autonomous Okrug: A Land of Tundra, Water, and . . . the Hydrocarbon Industry

We examine the CSR policies and initiatives specific to YNAO, a region that is literally awash in hydrocarbons. To illustrate, three of the major deposits (Bovanenkovskoye, Kharasaveyskoe, and Novoportovskoye) alone hold an estimated 5.8 trillion cubic meters of natural gas, 100.2 million metric tons of gas condensate, and 227 million metric tons of oil (Gubarkov 2008, qtd. in Walker et al. 2011). Consequently, YNAO has become a pivotal region for the growth and expansion of Russia's oil and gas giants, including Gazprom, Gazprom Neft (a subsidiary of Gazprom, specializing in oil extraction), Rosneft, and Novatek (Gazprom Neft 2019a). In a country where oil and gas form the economic cornerstone (Kumpula, Forbes, and Stammler 2010; Shvarts, Pakhalov, and Knizhnikov 2016), the current surge in fossil fuel production in YNAO has elevated this region to a highly strategic position on the national and global stages, especially in terms of natural gas.

Gazprom, for instance, has established and is actively developing a center of gas extraction in YNAO from which it procures more than 90 percent of its gas, a resource critical to Russia's energy security (Gazprom 2013). Similarly, Gazprom Neft derives nearly half (47.6 percent) of its total production from its oil and gas condensate fields in YNAO (Gazprom Neft 2019a). These include the Novoportovskoye



Map 7.1 | *Cities of the Yamal-Nenets Autonomous Okrug. Map created by Claire Franco, base map source: ESRI. Published with permission.*

Field on the Yamal Peninsula, which is the northernmost onshore oilfield in Russia, and the Vostochno-Messoyakhskoye Field in northeast YNAO. Today Gazprom Neft's upswing in production is attributed in large part to these unique fields (map 7.1) (Gazprom Neft 2019a).

Overall, total hydrocarbon extraction in YNAO has risen more than threefold in terms of gross value between 2005 and 2015 (Gritsenko and Efimova 2018). Massive investments have facilitated this surge in production. In fact, 72 percent of all investments in the Russian Arctic are put into hydrocarbon projects in YNAO (Burov 2017). Moreover, major advances have been made in the technical infrastructure required to export hydrocarbons out of the frigid and unpredictable terrains of YNAO. These advances include the Arctic Gates terminal where oil is transferred from subsea pipelines into large oil tankers, and nuclear icebreakers that cut paths in the sea ice for these tankers.

The Rise and Nature of CSR in YNAO

Massive industrialization by the oil and gas industry has brought substantial amounts of revenue into the operating budget for YNAO; it has also enabled this industry to allocate generous funding for the development and implementation of their CSR policies and projects. In the words of one Gazprom Neft executive, "Yamal is one of the most important regions for us. Therefore, we are directing considerable funding toward the building of important facilities [e.g., athletic, educational, medical] for YNAO's cities, towns and villages" (Gazprom 2013). CSR initiatives in YNAO are not one-sided; instead, they are closely interwoven into corporate-governmental partnerships. Such coordinated teamwork enables joint decision making concerning the pressing issues facing YNAO residents (Gazprom 2013).

While this phenomenon of close ties between company and government officials is pronounced in YNAO, it is, nonetheless in line with the parastatal status of Gazprom and Gazprom Neft, meaning that these companies operate under the authority of the Russian state and President Putin's rule. At the same time, they retain their status as commercial enterprises (i.e., open joint-stock companies; Tynkkynen 2016a). Below, we summarize key CSR initiatives of both Gazprom and Gazprom Neft, with an emphasis on the programs of the latter, because these have been especially instrumental in the expansion of sports infrastructure throughout YNAO, especially in urban centers.

Gazprom—For the Children

This key program demonstrates Gazprom's special devotion to the development of children and young people, and the company's acknowledgement that this new generation has great meaning for the future of Russia. The main goal of this initiative is to facilitate the balanced intellectual, spiritual, and physical development of the country's youth, primarily through sports and creative activities (Gazprom 2019). In YNAO, for example, a hockey rink in the city of Labytnangi was built through the support of this program.

Rodnye Goroda: Gazprom Neft's Flagship CSR Program

In 2012 Gazprom Neft united all of its CSR-based initiatives into one broad-scale program named Rodnye Goroda (Poznakhareva 2017). Envisioned as a departure from philanthropic-based (or more paternalistic) CSR policies, Rodnye Goroda represented a new, conceptual movement in CSR grounded in the positive transformation of the regions where Gazprom Neft operates through the development of human potential. Rodnye Goroda was also packaged as a people-driven initiative, with an emphasis on inclusivity and on the creativity of all who unite to make it a reality (Gazprom Neft 2017, 2019b).

Gazprom Neft claims that an underlying goal of Rodnye Goroda is improving the quality of people's lives, both through the support of diverse projects, and the building of modern infrastructure. Another important emphasis of Rodnye Goroda is on granting people living in Russia's peripheral regions access to some of the same kinds of opportunities (e.g., cultural, recreational) that those living in large metropolises enjoy. Thus, the program spans a wide range of interests, as evident in the main divisions of Rodnye Goroda. Those divisions are named Sports, Culture and Arts, Science and Education, Transformation of Urban Environments, Support of People with Disabilities, and Support of Indigenous Peoples of the North. In its development of Rodnye Goroda, Gazprom Neft is thought to have achieved a level of sophistication in CSR programs that is unprecedented among Russian companies (Frynas 2005; S. Orlov 2018). In YNAO the Rodnye Goroda program is actively being implemented in small, remote villages on the Yamal Peninsula (Mys Kamennyi and Novy Port) as well as in the region's larger urban areas.

Assessing the Connections between ISO Indicators and CSR Initiatives

Our approach in this assessment involved the following steps. First, we chose the following ISO indicators on the basis of their potential to gauge the effects of CSR initiatives (primarily the Rodnye Goroda program):

- Number of sports facilities per one hundred thousand population (17.1—core indicator)[2]
- Percentage of municipal budget allocated to cultural and sports facilities (17.2—supporting indicator)

- Percentage of city population living in inadequate housing (12.1—core indicator)
- Living space (square meters per person) (12.5.4—profile indicator)
- Number of personnel working in sports facilities per one hundred thousand population (Russian data).[3]

Note that these indicators represent the following divisions in the Rodnye Goroda initiative: Sports, Culture and the Arts, and Transformation of Urban Environments (namely, building of new, modern housing units). To determine change over time, we gathered data (where available) on the aforementioned indicators for the years 2012 (the inception of Rodnye Goroda), 2015, and 2018. In this analysis we focused on the YNAO cities of Labytnangi, Nadym, and Noyabrsk (table 7.1). (Note that Salekhard was left out because there were no major Rodnye Goroda projects completed during this timeframe.)

We also drew on an extensive dataset consisting of 217 news articles that spanned a three-year period (1 January 2016 to 31 December 2018).[4] These articles originated from diverse sources, ranging from regional and local newspapers to online news sites to more specialized outlets.[5] Several articles also came from the official government website of YNAO. These articles provided critical context in which to interpret the ISO data. For instance, they were instrumental in understanding the scope of specific CSR initiatives in a particular city or, more specifically, the likelihood that changes over time in an indicator could be attributed to CSR. Below, we consider each indicator individually; however, the core of our analysis centers on the ISO indicator of number of sports facilities per one hundred thousand population in each city (Labytnangi, Nadym, Noyabrsk) since we had the most conclusive data for this indicator.

17.1: Core Indicator of Number of Sports Facilities per One Hundred Thousand Population

Labytnangi: A New "Start"

"Labytnangi: The Train Does Not Go Farther," wrote Viktor Sevte in the title of his story on this small city of approximately twenty-six thousand residents (Sevte 2018). Situated across the Ob River from Salekhard, the capital city of YNAO, Labytnangi has acquired the reputation of being a dead end because it hosts the very last station on Russia's Northern Railroad. In the beginning of the 2000s,

Table 7.1 | *Selected ISO indicators for the cities of Labytnangi, Nadym, and Noyabrsk*

City	17.1 Number of sports facilities per 100,00 population (core indicator)	17.2 Percentage of municipal budget allocated to cultural and sports facilities (supporting indicator)	12.1 Percentage of city population living in inadequate housing (core indicator)	12.5.4 Living space (m^2 per person) (profile indicator)	Number of personnel in sports facilities per 100,000 population (Russian data)
2012					
Labytnangi	120.43	4.68	0.48	20.94	1,072.56
Nadym	116.13	no data	0.20	no data	1,138.10
Noyabrsk	171.19	5.99	0.61	18.30	956.64
2015					
Labytnangi	124.30	6.14	0.51	21.50	1,069.70
Nadym	no data	9.31	1.36	no data	no data
Noyabrsk	189.49	8.58	0.50	20.00	984.80
2018					
Labytnangi	183.75	6.61	0.71	21.60	no data
Nadym	163.70	6.13	0.69	no data	no data
Noyabrsk	221.64	9.89	0.31	19.20	no data

Source: Russian Federal State Statistic Service Database of Municipality Indicators.

the Obskaya-Bovanenko railroad line was built, turning the Obskaya station just outside Labytnangi into a transshipment facility through which cargo and shift workers are transported year-round to the gas and oil fields in the Yamal Peninsula. Thus, while Labytnangi itself is not a site of oil and gas extraction, or the base of hydrocarbon companies, it nonetheless serves as an important transportation hub for the industry. Thanks to the flourishing of this industry throughout YNAO (particularly on the Yamal Peninsula), the city has seen substantial improvements in its infrastructure since 2013. These include new daycare and other centers for children, road repairs, reconstruction of the waste-water treatment facility, along with a general clean-up of littered areas ("V Labytnangi v 2018 godu planiruyut postroit' neskol'ko znachimikh ob'ektov" 2018; Zainullina 2017).

No doubt, however, the most prominent additions in the city have been the new outdoor and indoor sports facilities. The number of sports facilities per one hundred thousand population (ISO indicator 17.1) increased slightly from 2012 to 2015 (table 7.1). This occurrence was most likely explained by the completion of a new outdoor soccer stadium in the center of Labytnangi in September 2013, which was financed in part by the Gazprom subsidiary, Gazpromtrans (specializing in the movement of freight) ("Novyi stadion poyavitsya v tsentre Labytnangi" 2013). Although at that time there was a youth sports school (*sportivnaya shkola "Yunost"*) in the city dedicated to developing a culture of physical fitness and sports for all, this new sports field was the only one of its kind in Labytnangi and stood to become the focal point of athletic activity for people of all ages ("Novyi stadion poyavitsya v tsentre Labytnangi" 2013).

This project proved to be just the beginning of what looks like an athletic revival in Labytnangi. Through citizen initiative and funding from Gazpromtrans, a multipurpose outdoor recreational center was envisioned and built in the city center ("Po pros'bam trudyashchikhsya: Labytnangi golosuet za sport" 2017; Zainullina 2017). Opened in Fall 2017, this large, new addition to the city's sports infrastructure appears to be reflected well in the ISO indicator 17.1, which grew by 32 percent in just three years, from 2015 to 2018. By popular vote the center was named Start ("Na 'Start,' vnimanie, marsh! V Labytnangi otkryli novyi sportivnyi tsentr" 2017), which is symbolic since the high-caliber center, complete with an all-weather regulation track, various sports courts, a skate and bike park, and playgrounds, to name just a few of the amenities, provides an opportunity for all in the city—small children, teenagers, and adults alike—to take new steps toward becoming more physically active. This center also represents a start in promoting familial and community cohesion.

Besides all the amenities listed above, this recreational center also has a training area specifically designed for the Russia-wide program entitled Ready for Labor and Defense (Gotov k Trudu i Oborone [GTO]), which specifies norms for physical training with the overall intent of developing popular sports and improving the nation's health. The focus on this program highlights the Russian state's tangible presence in this remote northern corner of the country. Moreover, the recreational center as a whole was part of a country-wide initiative, Formation of Comfortable and Modern Urban Environments, which the Russian state has declared a top national priority. ("Na 'Start,' vnimanie, marsh! V Labytnangi otkryli novyi sportivnyi tsentr" 2017). The funding for this complex, however, has been largely corporate. Gazpromtrans, through its CSR program, provided the additional financial support to make the many parts of this multipurpose center a reality (Labytnangi City Administration 2017, "V Labytnangakh stroyat srazu dva sportivnykh kompleksa i ledovyi kort" 2017). But both the state and the corporations take credit for its popularity. The success of this center is hard to exaggerate: Professional athletes and trainers, as well as city residents all give it high acclaim. Additionally, in 2017 this center was included in a highly selective list in the federal register of best practices in the implementation of the program Formation of Comfortable and Modern Urban Environments (Labytnangi City Administration 2018a).

Rather than the end aim, the Start complex is, in fact, a stepping-stone toward a more physically fit and engaged public, and toward urban renewal. Even before this complex was fully completed, construction on two other major athletic facilities alongside Start was already underway. This latest stage in development complements the outdoor center by providing vast indoor spaces for athletics and fitness. For instance, the immense, three-story sports and fitness complex with an area of 7,400 square meters (m^2) (79,653 square feet [ft^2]) features a multipurpose athletic hall for basketball, volleyball, and tennis; and a six-lane swimming pool. Additionally, a spacious indoor ice arena with an area of 5,482 square meters (m^2) (59,008 square feet) accommodates hockey, figure skating and open skating with bleacher seating for up to 400 spectators ("V Labytnangakh postroyat sportivno-ozdorovitel'nyi kompleks" 2016; "V Labytnangakh stroyat zhil'e i sotsial'nye ob'ekty" 2016; YNAO Administration 2017a). The sports and fitness center also includes bleachers for up to 345 spectators; both places also house weight and workout rooms and smaller gym space (e.g., for rhythmic gymnastics). Accordingly, each facility is furnished with the latest equipment and, notably, each was designed to accommodate less-mobile segments of the city's population ("V Labytnangakh postroyat sportivno-ozdorovitel'nyi kompleks" 2016).

These impressive facilities, especially given the relatively small population size of Labytnangi, were built by Gazprom Neft through its Rodnye Goroda program. This program has also provided support to create in Labytnangi a local chapter of the national youth hockey league, Avangard (YNAO Administration 2016a). Although the Rodnye Goroda program is technically meant to help raise the quality of life in the cities and towns where Gazprom Neft operates, this program was nonetheless extended to Labytnangi, where the company is not based, on the initiative of the former governor of YNAO, Dmitry Kobylkin, who sought support for the integrated development of social infrastructure in Labytnangi ("V Labytnangakh stroyat zhil'e i sotsial'nye ob'ekty" 2016; YNAO Administration 2016b). Such arrangements are viewed as mutually beneficial partnerships between the state and corporations (Burov 2017).

Still, the process of constructing these facilities in Labytnangi has been much more protracted than initially expected, perhaps due to the sheer size of the project. Initially, both buildings were expected to be fully ready by the end of 2017 ("V Labytnangakh stroyat srazu dva sportivnykh kompleksa i ledovyi kort" 2017). When this timeframe was exceeded, the pace of construction was stepped up with a new projected end date set for early September (ice arena) and December 2018 (sport-fitness complex) (A. Orlov 2018; Labytnangi City Administration 2018b). This month, however, came and went without any grand opening of either facility. No specific reason was cited; perhaps, the initial frameworks for completion were simply not compatible with the scope of these projects. While the official opening of the sports-fitness complex is still forthcoming as of this writing, the ice arena, named Avangard, was completed in early Fall 2019, becoming the fourth such ice arena built by Gazprom Neft in YNAO. Its grand opening was held on 6 September 2019, on the eve of the annual day commemorating the city.

This remarkable facility of Olympic quality was presented to the residents of Labytnangi as an "excellent gift" made possible by Gazpromneft through its Rodnye Goroda program ("V Labytnangi otkrylsya novyi ledovyi kort 'Avangard'"2019), which seems to run entirely counter to the novel people-driven approach supposedly distinguishing this program from other CSR initiatives. Dmitry Artyukhov, the new governor of YNAO who was appointed in September 2018, reinforces this top-down CSR approach:

> "Labytnangi is actively developing. There are an increasing number of sports facilities in the city and this infrastructure is due in large part to our strategic partnerships. The new ice arena is an excellent example of such partnerships. Labytnangi now has world-class facilities where young hockey players and figure skaters can train year-round, and where families here can enjoy active leisure time. I want to thank *Gazprom Neft* for their CSR program and policies." (Artyukhov quoted in "V Labytnangi otkrylsya novyi ledovyi kort 'Avangard' " 2019)

Due to the approximately two-year delay of the opening of the ice arena and sports-fitness complex, it is difficult to ascertain whether these facilities were included in the data used to determine the core ISO indicator 17.1 (i.e., number of sports facilities per hundred thousand population) in 2018, or if that rise was due primarily to the construction of the outdoor Start complex. The important point to underscore here is that this specific indicator captures the major CSR contributions in Labytnangi well.

Nadym: Site of a Broadening Sports Culture

Roughly twice the size of Labytnangi, with a population of approximately forty-five thousand, Nadym is home to the Gazprom subsidiary, Gazprom Dobycha Nadym (Gazprom Extraction Nadym) as well as to a branch of the hydrocarbon company, Novatek. Thus, unlike Labytnangi, Nadym, which is situated about 300 kilometers (km) southeast of Salekhard on the shore of the Yantarnoe Lake near the Nadym River, is recognized as an oil and gas city. At the same time, these two cities shared a similar trajectory of growth in the ISO core indicator 17.1 from 2012 to 2018. In Nadym this indicator increased by 29 percent during this period. We examine the rise of sports infrastructure in this city that has materialized as the direct result of CSR initiatives, primarily the Rodnye Goroda program. Besides infrastructure development, these initiatives have also facilitated the spread of a sports and fitness culture in the city ("V Nadyme otkryli novyi futbol'nyi stadion i khokkeinyi kort" 2016).

Through the Rodnye Goroda program, Gazprom Neft Muravlenko (a subsidiary of Gazprom Neft) through a long-term agreement with the administration of the Nadym District, has built two prominent sports facilities in Nadym. Officially opened on 9 September 2016, one of these places is a modern soccer stadium equipped with artificial turf, an electronic scoreboard, outdoor lighting, and handicap-accessible stands accommodating up to 460 spectators. Due to the innovative drainage system, this stadium may also serve as an outdoor hockey rink in the winter ("V Nadyme otkryli novyi futbol'nyi stadion i khokkeinyi kort" 2016). The second facility in another area of Nadym, which opened on the same day, is a multipurpose sports venue that serves as an outdoor hockey rink in the winter, and as an area for soccer and volleyball in the summer, thanks to its covering of energy-absorbent and wear-resistant artificial turf ("Pri podderzhke 'Gazprom nefti' v Nadyme vozvedeno dva sportivnykh ob'ekta" 2016). Heated changing rooms adjoin the rink.

Because both of these major athletic additions to the city were opened in 2016, we assume that the bulk of the increase observed in the ISO indicator 17.1 occurred between 2015 and 2018; there were no available data for 2015. As in the case of Labytnangi, this indicator appears to express well the contribution of CSR initiatives to the city of Nadym. This message of corporate support in urban YNAO is further and consistently supported in the media and online. For instance, on the official site of the regional government in Salekhard, there are clear statements of how corporate support—in this case, of Gazprom Neft Muravlenko—acts as an outstanding addition to Nadym's athletic infrastructure ("V Nadyme otkryli novyi futbol'nyi stadion i khokkeinyi kort 2016). Interestingly, just as in Labytnangi, the appearance of new sports facilities was viewed as a valuable gift that also happened to be given on the day commemorating the city of Nadym ("Dlya futbola i khokkeya" 2016).

Noyabrsk: Home of the First Major Sports and Fitness Center Built by Gazprom Neft

Like Nadym, Noyabrsk is also an oil and gas city, founded alongside hydrocarbon development in the southernmost part of YNAO and the northern part of the Khanty-Mansi Autonomous Okrug. Today, it is home to branches of both Gazprom (Gazprom Dobycha Noyabrsk) and Gazprom Neft (Gazprom Neft-Noyabrskneftegaz). With an official population of approximately one hundred and five thousand people, Noyabrsk is the second-most-populous city in YNAO, behind Novy Urengoy. The story of sports development here mirrors that in both Labytnangi and Nadym: namely, there was a steady rise in the indicator 17.1 over time, specifically from 2012 to 2015. It is interesting to note that already in 2012 the data for this indicator were much higher than in the other two cities. This finding is most probably attributed to the opening at the end of 2012 of the first large sports center of its kind in YNAO, which was completed under the Rodnye Goroda initiative. This sports center, visited by up to fifteen hundred people per day, offers a wide variety of sports for all ages and abilities; it also has features for adaptive sports ("Noyabr'skii 'Zenit' stal bol'she chem sportkompleksom" 2017). At the five-year commemoration of this facility named Zenith (Zenit), it was recognized that this focal point of city life has become much more than a sports complex, serving as a valuable cultural center within the city that can accommodate concerts, meetings, and conferences ("Noyabr'skii 'Zenit' stal bol'she chem sportkompleksom" 2017).

From 2012 to 2015 there was a fairly modest increase in indicator 17.1 of 10 percent, probably owing to the completion of the ice arena Avangard in December 2015. This arena with an area of 7,500 square meters (m^2) (80,729 square feet [ft^2]) features a hall for choreography, a weight-training room, and space for conferences, in addition to the ice rink. It was also funded through the Rodnye Goroda program; similar to the fanfare of arena grand openings to follow, this arena was presented as a valuable gift to the residents of Noyabrsk ("Dobro pozhalovat' v 'Avangard!'" 2015). Furthermore, from 2015 to 2018 there was a somewhat larger increase of 15 percent in this indicator due to the completion of two more projects sponsored through Rodnye Goroda.

The first project was a new sports complex completed in 2016 and situated in the farther suburbs of Noyabrsk. As in Labytnangi and Nadym, the grand opening of this facility coincided with a holiday, the Day of Workers in the Oil and Gas Industry, and was presented as a "real" gift for the people of Noyabrsk (YNAO Administration 2016a). This new facility of more than 3,500 square meters (m^2) (37,674 square feet [ft^2]) included sports halls, weight rooms, a swimming pool, and a medical unit. It was also designed to adapt to the fitness needs of people with handicaps.

Besides these immediate amenities, this center more broadly empowered people by providing access to a resource that they did not have previously. Consider this statement by former governor Kobylkin: "This new sports center allows for radical improvement in opportunities to pursue sports in a more remote section of the city where there were no modern sports facilities up to the building of this new facility" (YNAO Administration 2016a). Furthermore, this center, like the others before and after it, was built on joint corporate-state agreements, and served the larger purpose of popularizing a healthy lifestyle and a striving for victory in competitive sports in YNAO (YNAO Administration 2016a). Finally, another CSR project in Noyabrsk that could have helped nudge indicator 17.1 higher was the addition of two outdoor fitness squares with equipment. One adjoined the Avangard ice arena, while the other was next to a youth center ("V Noyabr'ske poyavitsya eshche odna ploshchka s ulichnymi trenazherami" 2016).

17.2: Supporting Indicator: Percentage of Municipal Budget Allocated to Cultural and Sports Facilities

With the exception of the city of Nadym, this indicator rose modestly over the period 2012 to 2018 for the other two cities, with the greatest increase observed in the city of Noyabrsk. This greater funding may be explained by general budget increases, especially as hydrocarbon revenue surged in YNAO. Increased municipal budgeting in this category was also likely due to the costs associated with supplying massive athletic complexes with electricity, heat, water, and wastewater disposal systems. In Labytnangi, for instance, the responsibility to connect new facilities to existing city infrastructure was included in the agreement with Gazprom Neft ("V Labytnangakh postroyat sportivno-ozdorovitel'nyi kompleks" 2016). Moreover, the city bore responsibility for the building of new infrastructure (e.g., roads) necessary to accommodate the new buildings financed by Gazprom Neft. Officials of the administration of Labytnangi have taken this obligation seriously because they want to continue to attract investment in their city ("V Labytnangakh postroyat sportivno-ozdorovitel'nyi kompleks" 2016). In this respect, a larger increase in the municipal budget would be expected. It is possible that these additional services provided by the city are reflected in another indicator, or that they simply are left out of the ISO index.

12.1: Core Indicator: Percentage of City Population Living in Inadequate Housing and 12.5.4: Profile Indicator: Living Space (square meters [m^2]) per Person

The linearity between new CSR-sponsored athletic facilities and an increase in indicator 17.1, and to a lesser degree in 17.2, was not observed in the housing indicators 12.1 and 12.5.4. The direct association between CSR initiatives and change over time in housing indicators was more difficult to identify in the ISO index. Gazprom Neft does construct new housing for residents through its Rodnye Goroda program, literally giving people the keys to new apartments in some cases so that they can move out of substandard housing ("V Sele Novyi Port dvadtsat' odna sem'ya poluchila klyuchi ot novykh kvartir"

2016). Such programs, however, have typically taken place in smaller and more economically depressed villages with large Indigenous populations (e.g., Mys Kamennyi and Novy Port) on the Yamal Peninsula where Gazprom Neft's presence is especially prominent (Gazprom Neft 2016a; "V Novom Portu neftyaniki pomogli postroit' chetvertyi mnogokvartirnyi dom" 2017). In the case of the three cities that this chapter discusses, CSR initiatives have not typically been directed toward new housing projects (YNAO Administration 2016c). Data for the housing indicators listed above over the period 2012–18 for each city simply are not conclusive (table 7.1), thus precluding any firm assertions.

Indicator of Number of Personnel Working in Sports Facilities Per One Hundred Thousand Population

There were simply not enough data to make a conclusive statement regarding the utility of this indicator in capturing the effect of CSR initiatives on sustainability within an urban area in YNAO. Also, it should be noted that even if we would have been able to obtain better data, including those for the number of personnel working in cultural institutions, it is unlikely that this indicator would have been helpful in measuring the impact of CSR programs. While these programs, particularly Rodnye Goroda, allocate considerable funding for support of the arts and culture, many events in this category are annual and do not necessitate a permanent staff. One example is the widely acclaimed street art festival Steinograffia, which features professional graffiti artists who transform the sides of apartment buildings and garages into striking and colorful murals. In addition to Steinograffia, the Rodnye Goroda program has supported other festivals, such as Where Art Is Born (Gde Rozhdaetsya Iskusstvo) and, most recently, Breath of the Arctic (Dykhanie Arktiki). These programs represent a recent and growing effort to shift attention somewhat from the dominant sports sphere to the arts ("V Noyabr'ske i Muravlenko pri podderzhke 'Gazprom nefti' vpervye proshel Vserossiiskii festival 'Gde rozhdaetsya iskusstvo'" 2017).

Does CSR Translate into Sustainability?

At the beginning of this chapter we asked how CSR initiatives influence core and profile indicators in the ISO index. Our assessment revealed that the ISO core indicator of the number of sports facilities per one hundred thousand population was the best measure of CSR programs, particularly that of Rodnye Goroda, in YNAO. Because the urban areas we examined in this chapter were small, especially Labytnangi and Nadym, and because in YNAO the CSR programs are essentially the sole means of support for major sports projects, it was straightforward to connect jumps in this core indicator to an increased impact of CSR. The other ISO indicators we considered were not as effective in showing the outcomes of CSR programs, which in this case was explained in part by the nature of the CSR initiatives themselves, specifically where their investments were focused. Also, a variety of issues may factor into these indicators, making it difficult to determine the extent of the CSR influence. Some ISO indicators were suitable for our assessment (e.g., square meters of public outdoor and indoor recreation space per capita), yet there were simply no data available at the city level. Nonetheless, at least one core indicator was successful in capturing the considerable impact of CSR-sponsored sports facilities in YNAO. Yet, what do these indicators that are part of an index that is meant to assess sustainability actually tell us about sustainability in YNAO's urban areas? Can we extend the connection from CSR to ISO indicators to an outcome of sustainability? In other words, does the rise we observed in an ISO core indicator also mean an increased level of sustainability in a city, particularly social sustainability in this case?

At least in theory, the idea of social sustainability appears to drive the vision of Rodnye Goroda as a forward-looking program dedicated to the development of human capital (S. Orlov 2018). Moreover, the spread of athleticism and popularization of physical fitness in YNAO through the Rodnye Goroda initiative would indeed appear to be an impressive stride in people's well-being and their potential for further development. Yet here we must take a careful and more nuanced look at the highly dynamic and paradoxical political, cultural, and ecological contexts of YNAO (see Tynkkynen 2018) to grasp more fully what the ISO indicators are, or are not, telling us. To begin, we contemplate YNAO through the lens of the Russian state whose status as a great power is bolstered by high levels of oil and gas output; thus, the abundance of hydrocarbons and a steadily rising output of gas and oil from this region are equated with increasing power (Tynkkynen 2018).

What is seen as empowering, however, also has the real potential to be impoverishing. In this sense we encounter a local Arctic paradox where a huge influx of funds has noticeably raised living standards today, yet strategies for the eventual post-fossil-fuel-production period are nonexistent. Although predominantly based in the political economy, this Russian Arctic paradox is also shaped through cultural practices and identity, especially those related to what has become a firmly entrenched dependence on hydrocarbons. Reflecting the state's priorities, fossil fuel giants, such as Gazprom, have helped embed a deep national sense of hydrocarbon attachment, emphasizing it as a clear reinforcement of Russia's status as a Great Power (Tynkkynen 2016a, 2016b).

Aligning national identity so closely to the hydrocarbon state has effectively precluded any real vision of society in a post production scenario. Thus, cultural practices and identity, similar to Arctic economies, are propped up by the oil and gas industry for now, even as long-term socioeconomic prognoses remain wholly uncertain. The question of the natural environment also fits into this equation of short-term benefit at the expense of a sustainable future, further strengthening the Russian Arctic paradox that has emerged at the hand of the political economy, and the cultural practices and identity linked to this economy.

This broad overview of the larger contexts in which major fossil fuel players, like Gazprom and Gazprom Neft, operate exposes the considerable power that these companies wield in YNAO. Such status undoubtedly dictates how CSR initiatives like Rodnye Goroda are authored and put into practice, which is namely in ways that maximize gains for the company, and for those who back CSR programs in the state (Tynkkynen 2016a). This corporate-state interplay is evidenced in the numerous socioeconomic agreements drawn up between the two sides. In this light, the immense state support of and corporate investment in athletic infrastructure throughout YNAO, where there are currently eighteen major sports facilities under construction ("V Labytnangi otkrylsya novyi ledovyi kort 'Avangard'" 2019), begins to make sense in a new way as articulated below.

Ready for Labor and Defense: Fostering a Culture of Physical Fitness and Strength

"Physical fitness and sports—they are among the most important spheres of public activity. The main aim is the comprehensive and balanced development of an individual, who is then able to make a contribution to society thanks to many years of effective professional and personal activity" ("O Yunosti" n.d.). These words introduce a school entirely dedicated to the athletic development and physical fitness of young people in the city of Labytnangi. They encapsulate a sentiment that is becoming widespread throughout urban and rural

YNAO alike. For instance, at one grand opening celebrating a new athletic facility one corporate official began his remarks with the following: “Healthy people are so essential for us. They are needed to build our beautiful city, and to develop our homeland of Russia” (“Novyi stadion poyavitsya v tsentre Labytnangi” 2013).

This ideal of a healthy, fit person as elemental in nation-building, as well as nation-defending, lies at the core of the previously mentioned Russia-wide program, Ready for Labor and Defense (Gotov k Trudu i Oborone [GTO]). The specially designated training sites for this program within some of the corporate-funded athletic facilities in YNAO are a clear demonstration of how the state relies on, and ultimately benefits from, the CSR programs that are funding the sportification of YNAO. This tight link between the state and CSR policies is elaborated on by former governor Kobylkin: “Today YNAO is one of the youngest and most athletic regions in Russia. It is heartening that more than a third of our region’s population is regularly involved in sports and other forms of physical fitness, and that the Ready for Labor and Defense program is being implemented within our municipalities. Our future includes the development of modern athletic infrastructure, and the advancement of the value in leading a healthy lifestyle in the Arctic” (Kobylkin quoted in YNAO Administration 2017b).

(More) Power to the Companies

Considering the rapid expansion of large sports facilities, swimming pools, and ice arenas throughout YNAO today, it appears that Gazprom Neft has remained loyal to the “highly visible and spatially extensive social responsibility projects in the sphere of sports” (Tynkkynen 2016b: 81). At the same time, it has honored a primary intent of Rodnye Goroda, which is to provide people who live in small, remote cities and towns, with the same opportunities as those living in large metro areas. The latest Avangard ice arena built by Gazprom Neft in Labytnangi epitomizes this main aim of the company’s CSR policies: the people in this tiny and (sometimes almost inaccessible) city of twenty-seven thousand now have access to vast, Olympic-quality facilities. Nonetheless, this type of investment serves the vitally important purpose of greatly elevating Gazprom Neft’s image and status in YNAO, which ultimately serves to consolidate the company’s power in this region.

Corporate power is further strengthened by pitching grandiose sports facilities as valuable gifts for the people. In this sense, CSR resembles a tribute that the company grants to the people (see Frynas

2005; Tysiachniouk et al. 2018). Such tributes or gifts from the outside do not instill a sense of ownership among the local people. According to Jedrzej George Frynas (2005), projects introduced in this way cannot continue to function without steady support from the outside, which contradicts a basic principle of sustainable development. Here we return to the questions posed at the beginning of this section on the links among the ISO indicators, CSR policies and social sustainability. While a core ISO indicator shows positive growth, our analysis of the context in which these CSR policies are made and implemented reveals a situation that is inherently unsustainable for the people, as well as for the economy and ecology of this place.

Conclusion

Our analysis of the relationship among the ISO indicators, CSR initiatives and sustainability underscored key points that are also helpful in understanding the overall utility of the ISO index in measuring economic, social, and environmental sustainability in the Arctic urban areas, especially those in the Russian Arctic. Most importantly, when addressing sustainability in a systematic way, it is vital to understand the bigger issues surrounding sustainability before we start measuring the details. Specifically, case studies in which empirical data are gathered, or at the very least a thorough contextualization of an Arctic city, are a must. By not taking into account social, political, cultural, and environmental realities, the ISO index can give a highly misleading picture of a city's sustainability outcomes. This chapter, for instance, revealed that while some ISO indicators did reflect the impact of CSR programs in a city, these programs did not in fact translate into a higher level of social sustainability in the city due to a host of political, cultural, and economic features unique to the region. Another clear drawback of the index is that some key aspects of sustainability (e.g., people's attitudes) are difficult to capture quantitatively. And, finally, in the Russian context the quantitative, statistical data that could be helpful in an index can be challenging to collect at the city level. Even when these data are accessible, their accuracy is often an issue.

Stephanie Hitztaler is a postdoctoral researcher at the University of Helsinki.

Veli-Pekka Tynkkynen is associate professor of Russian environmental studies at the University of Helsinki.

Notes

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2. This indicator number is technically the number of sporting facilities and cultural institutions per one hundred thousand population; however, we are working with the data for just the number of sporting facilities.
3. This indicator is not included in ISO 37120, but we are using it as a proxy since Russia's state statistical agency provides data for it. It should be noted that we had to exclude other highly relevant indicators because there simply were no data available for the Russian cities. These indicators included annual number of cultural events (e.g., exhibitions, festivals, concerts) per one hundred thousand population (17.3 supporting indicator); and public indoor and outdoor recreation space (m^2) per capita (14.1 and 14.2 supporting indicators).
4. We gathered most of these articles through the Integrum Profi database, which offers the world's largest archive of mass media pertaining to Russia and the Former Soviet Union (FSU). We searched for sources using the following query: "Rodnye goroda," "Gazprom Neft," and "Yamal."
5. Examples of regional newspapers included: *Vremya Yamala* (Yamal Time), *Argumenty i Fakty—Yamal* (Arguments and Facts—Yamal) and *Sever Press—Novosti Yamala* (Northern Press Informational Agency—News of the Yamal Region). Examples of local newspapers included: *Krasnyi Sever—Salekhard* (Red North—Salekhard), *Rabochii Nadym* (Working Nadym), and *Nash gorod Muravlenko* (Our city Muravlenko). Online news sites included nakanune.ru, vslukh.ru, and ura.ru; and more specialized information outlets included EnergyLand.info and Neftegaz.ru.

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CHAPTER 8

Planning for Sustainability

The Russian Case

Alexander Sergunin

Introduction

In its current format, the ISO 37120 (all references to ISO 37120 are to the 2018 version) as described in this book's Introduction does not include a component that measures how well a city engages in the process of planning for sustainability.[1] The lack of a planning component is a major oversight of the international standard. This chapter lays out a description of what a sustainability process might look like and examines how it works in several Russian Arctic cities.

The public administration and management sciences instruct us that planning is the process of thinking about the activities required to achieve a desired goal. It involves the creation and maintenance of a plan as well as of implementation procedures and feedback mechanisms. Planning has a specific process and requires special skills from people and institutions involved in these kinds of managerial activities. In each field, there are different types of plans that help economic, social, and political actors to achieve efficiency and effectiveness.

An important, albeit often ignored, aspect of planning is its relationship with forecasting. Forecasting can be described as predicting what the future will look like, whereas planning predicts what the future should look like for multiple scenarios. Planning combines forecasting with preparation of scenarios and how to react to them.

Planning is one of the most important project management and time management techniques. Planning sets up concrete priorities for specific policies as well as strategic and tactical goals for a policymaker. Establishing a system of indicators to measure the progress and outcomes of policies and projects is an important function of planning as well. Planning is also preparing a sequence of action steps to achieve some specific goal. A person or institution that plans effectively can reduce considerably the necessary time and effort for achieving the goal.

In other words, a plan is like a map. When following a plan, planners can see how far they have progressed toward their project goal and how far they are from their destination.

Planning is an integral part of any urban development strategy, including for Russian Arctic cities and towns. City administrators understand that planning gives more power over the future. Planning is deciding in advance what to do, how to do it, when to do it, and who should do it. This bridges the gap between where the city is to where it wants to be. The planning function involves establishing goals and arranging them in logical order. Well-planned cities achieve goals faster than cities that do not plan before implementing their development strategies.

Planning is especially important for designing a proper urban sustainable development (SD) strategy because the latter requires an integrated approach to the developmental policies where all aspects of such a strategy—economic, social, and environmental—should be harmonized and coordinated. Planning is also important because all potential stakeholders—municipal, regional, and federal authorities; companies; universities; and civil society institutions and NGOs—should be involved in the SD strategy formulation and implementation in order to make such strategies efficient and feasible.

The main research objective of this chapter is to examine how SD strategy planning is organized in the industrialized centers of the Arctic Zone of the Russian Federation (AZRF). There are four specific purposes for this analysis: The first purpose is to find out whether the SD concept is incorporated into the municipal developmental plans and whether it is a real priority for the local government and communities. The second purpose is to examine which governmental and societal institutions are involved in the policy-planning process and whether this process is transparent and open to public discussions. The third purpose is to understand which dimensions of the SD strategies—economic, social, or ecological—are prioritized in the AZRF urban development plans. Finally, the fourth purpose is to explore whether these policies are of a short-term or single-issue character or whether they represent forward-looking strategies that are conducive to the sustainable socioeconomic and environmental development of the northern urban areas and really can improve the situation with human and societal security in the AZRF towns. The content of the study draws on several AZRF cities and towns: Arkhangelsk, Murmansk, Monchegorsk, Nickel, Norilsk, Salekhard, Severodvinsk, and Vorkuta.

Theoretical Framework

Urban planning is part of any urban development strategy. It is considered an interdisciplinary field that includes social, engineering, and design sciences. Urban planning guides orderly development in urban and suburban areas. Although predominantly concerned with the planning of settlements and communities, urban planning is also responsible for the planning and development of water use, resources, and parks; and the conservation of areas of natural environmental significance (van Assche et al. 2013). Experts in urban planning are concerned with research and analysis, strategic thinking, architecture, urban design, public consultation, policy recommendations, implementation, and management. Urban planners work with the related fields of architecture, landscape architecture, civil engineering, the public, and business administration to achieve strategic, policy, and sustainability goals. Today urban planning is a separate, independent professional discipline. This discipline is a rather broad field that includes different subfields such as land-use planning, zoning, economic development, transportation planning, environmental planning, societal and human security, and ethnographic and cultural studies, among others (Taylor 2007).

Planning theory is the body of scientific concepts, definitions, behavioral relationships, and assumptions on urban development. According to Whittemore (2015: 77–78), there are eight procedural theories of planning: the rational-comprehensive approach, the incremental approach, the transactive approach, the communicative approach, the advocacy approach, the equity approach, the radical approach, and the humanist or phenomenological approach. Of these eight approaches, three of them—the rational-comprehensive, advocacy, and humanist or phenomenological approaches—are best suited for explaining the AZRF situation.

The proponents of the rational-comprehensive model argue that problem definition is the territory of expert planners who judge the alternatives and actions required to meet desired ends. Qualities of the rational-comprehensive planner, known as the technician, include neutrality to politics, and a dependence on problem solving via technical information (Forester 1982). The substantive complement to this theory of planning procedure is the systems approach. The view of cities as systems entails manipulating mechanistic movements of people, goods, services, and capital between function-defined locations to achieve greater choice (Clavel 1986; Faludi 1973). Such a technocratic approach dominates AZRF urban planning because all levels of the Russian government—local, regional, and federal—operate on the assumption that only experts/specialists have the relevant knowledge and skills to produce a proper urban SD strategy.

An advocacy theory of planning expects planners to use their knowledge and power to advance the cause of a specific actor or actors (Davidoff 1965; Kurtz 1970). Decision makers take up planning from the perspectives of many governments, community groups, and other entities. This perspective could make for a more pluralistic discussion than in the case of the rational-comprehensive model. Given a variety of actors in the AZRF cities—governments, companies, military, Indigenous peoples, trade unions, NGOs—the municipal planners try to take into account those actors' interests by integrating their needs into urban development plans and involving them in both the policy-planning and implementation processes.

A humanist or phenomenological theory of planning stresses the unique ways that different groups come to possess knowledge (including, for example, the traditional knowledge of the Indigenous peoples of the North), while acknowledging the difficulty with which one group's knowledge can be translated for others, given the diversity of human experiences and perspectives (Reich 1975; Schön 1983). This theory challenges the merits of the rational-comprehensive model, pointing out that different ways of understanding problems and actions imperil what one group might consider rational. Planners erred, the proponents of the humanist approach argue, in assuming that their professional knowledge could simply be transferred from context to context as universal justification for intervention. According to this theory, attention to the diverse ways of conceptualizing the city in a pluralistic society means accepting a degree of irrationality as inherent to the task of planning. The humanists note that the realities and rationalities of the various actors can be almost mutually exclusive. For example, various stakeholders, such as the municipal government, extractive industries, environmentalists, and Indigenous peoples, can radically differ in their visions of a sustainable Arctic city. This variety of views creates a puzzle for urban planners who are often unable to reconcile these conflicting interests in local SD strategy documents. As some humanists stress, formal planning seen in this larger context becomes only one component of the whole planning process and a broader, more-evolutionary notion of the planning process is needed to account for different realities (Reich 1975: 11).

It should be noted that, despite the obvious collisions between these theoretical approaches, all three can be found in the AZRF city development plans and practical policies. Among the AZRF urban planners, we do not see one theory replacing another. Though many planning specialists believe that the existing dominant paradigm of rational-comprehensiveness is inadequate, other theories also failed to fully explain either urban developmental problems or planning procedures.

Data and Method

The data for this study are drawn from the following sources:

- regional and municipal development and action plans;
- regional and local government reports;
- government position and background papers;
- analytical reports produced by research centers and NGOs; and
- media reports.

As with any study of contested political issues, it is difficult to compile a set of reliable data. Information is often contradictory, misleading, or not fully reported. Research is also complicated by differences of opinion between scholars as regards methods of assessment and interpretation of sources. Moreover, research techniques and terminology vary. Therefore, exercising judgment and comparing sources are important elements in compiling my database.

Since the study does not only entail data collection but also data assessment, three main principles are implemented with regard to selecting and interpreting sources:

- *Validity.* Data should represent the most important and typical trends rather than occasional or irregular developments in the AZRF cities' human security and SD policies.
- *Informativeness.* Sources that provide valuable and timely information are given priority.
- *Innovativeness.* Sources that offer original data, fresh ideas and nontraditional approaches are preferable.

These research techniques help to overcome the limitations of the sources and compile substantial and sufficient data for this study.

What Would an Ideal Urban Planning Process Look Like?

According to public administration postulates, planning is "an anticipatory decision-making process" that helps in coping with complexities (Ackoff 1970: 1–2). It requires deciding a future course of action from different alternatives. Planning is a process that involves making and evaluating each set of interrelated decisions. It entails the selection of missions, objectives, and "translation of knowledge into action. (Ackoff 1970: 2)" Within the planning process, it is important to achieve the optimum balance of needs or demands with the available resources.

ISO 37120 is based on the so-called PDCA (plan–do–check–act or plan–do–check–adjust) model (Deming 1986: 88) that is an iterative four-step management method used in business for the control and continuous improvement of processes and products. It is also known as the Deming cycle. It should be noted, however, that PDCA represents a rather general management model rather than a specific planning approach.

Planning experts suggest a more detailed, five-step result-oriented, process for planning:

1. Identify the goals or objectives to be achieved.
2. Evaluate alternative routes to achieve them.
3. Formulate strategies to achieve them.
4. Arrange or create the means required.
5. Implement, direct, and monitor all steps in their proper sequence. (Goodin 2006: 17–20; Montana and Charnov 2000: 118)

There are two planning components—strategic and tactical (see figure 8.1). Strategic planning decisions are those that are broad in scope, have long-term effects, formulate long-term goals, and are difficult to reverse. Tactical planning decisions are concerned with selecting the most efficient means of pursuing the goals set out in the strategic plan. Tactical/operational planning addresses specific timetables and measurable targets (Schermerhorn 1999: 141). Both types of planning can overlap, but each provides a different level of detail and time frame. Plans are reviewed periodically to ensure a fit with the environment. Tactical plans are usually reviewed and/or revised

Figure 8.1 | *How strategic and tactical plans support each other. Designed on the basis of Schermerhorn 1999: 141.*

frequently, while strategic plans may be reviewed and/or revised only every several years.

Ideally, planning should be every city manager's job as well as an organizational (city administration) function. A municipal planning department may gather data, analyze it, and make it available to top administrators and all local government officials who do the day-to-day planning to phase a project from idea to implementation. Many tools and techniques exist to assist in planning. Among them are scheduling techniques, such as Gantt charts; the critical path method of analyzing the events and time frames that are potential bottlenecks to achieving the desired result; the project evaluation and review technique, which displays all tasks and time frames from start to finish; project management, which allows a manager to phase a project from idea to implementation; and simulation models, which depict various options or what-ifs (Montana and Charnov 2000: 125).

Planning should be tailored for each city or town. Although the basic concepts are the same, each municipality's culture and philosophy will result in a slightly different set of priorities. Levels of involvement and a consistent method of communication are critical to success, as is heavy use of the administrative staff in the planning process.

There are two major responsibilities in the strategic management process (see figure 8.2). The first is strategy formulation. This responsibility involves assessing existing strategies, city administration potential, and the overall environment to develop new strategies and strategic plans capable of delivering future SD strategy. The second strategic management responsibility is strategy implementation.

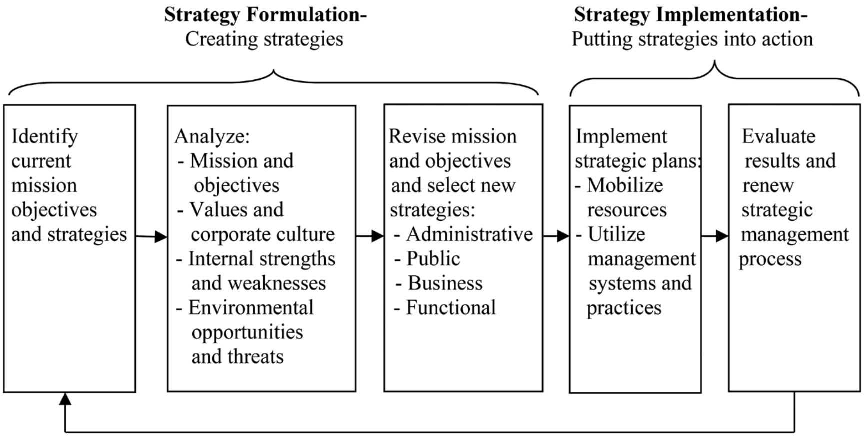

Figure 8.2 | *The strategic management process strategy formulation and implementation. Designed on the basis of Schermerhorn 1999: 159–60.*

Once strategies are created, they must be acted upon successfully to achieve the desired results.

Five major components of planning strategy can be identified: determining opportunity, capabilities, values, and obligations and then matching these factors in a final statement of purpose (Drucker 2011). Objectives, strategies, and policies are not mutually exclusive components of the managerial process but are highly interdependent and inseparable.

Several analytical techniques are helpful in the strategy formulation process:

1. Gap analysis is a planning approach for determining where we are, where we want to go, and how we are going to get there. The ways to close the planning gap are to improve current operations, to develop new policies, or to diversify the city economy, among other options.
2. SWOT analysis is another interesting approach to filling the planning gap(s). In this approach, the strengths (S), weaknesses (W), opportunities (O), and threats (T) for a city are analyzed. Practical recommendations on how to fill the gap(s) and improve the situation in a city are developed on the basis of the SWOT analysis.
3. The McKinsey 7-S Framework can be also used for examining the fits with managerial strategy. These fits fall into seven broad areas: (1) strategy; (2) structure; (3) shared values, attitudes,

and philosophy; (4) approach to staffing the organization (city administration in our case) and its overall people orientation; (5) administrative systems, practices, and procedures used to run the organization on a day-to-day basis, including the reward structure, formal and informal policies, budgeting and programs, training, and financial controls; (6) the organization's skills, capabilities, and core competencies; and (7) style of management (how they allocate their time and attention), symbolic actions, their leadership skills, and the way the top management team comes across to the rest of the organization.

As far as strategy implementation is concerned, management/public administration experts suggest the following algorithm (Drucker 2011; Goodin 2006: 17–20; Montana and Charnov 2000: 151–74; Schermerhorn 1999):

1. The process starts with defining objectives, assigning responsibilities, and developing standards of performance and ends with redefining objectives for the next policy cycle or budget period.
2. As for the management system's objectives, there are three basic types: routine, innovative, and improvement. Routine objectives aim to ensure that they maintain the current level of service while the two other types of objectives are oriented toward making positive changes going forward.
3. The objective should be focused on a result, and not on an activity; and should be consistent, specific, measurable, related to time, and attainable.
4. In some cases an objective cannot be stated in terms of the true result desired because, potentially, it would be impossible to measure the result in any sound way.
5. Responsibilities of specific town administrative units and individual managers/municipal officials should be clearly assigned and put in written form. In the Russian administrative practice, such responsibilities are called job responsibilities or official duties.
6. It is preferable that such responsibilities be formalized in a performance contract where the managers and subordinates put in writing their expectations and commitments for a certain period. Such contracts should not leave any chance for assumptions based on different perspectives and interpretations. There are two parts to the performance contract: (1) statements of key responsibilities and (2) standards of performance for each of those responsibilities.

7. A performance standard should apply to a single responsibility, be specific and attainable, and include a target date for achievement. To the extent possible, a standard of performance should be stated in terms of the result expected rather than in terms of an activity to be carried out.

One more important question is about the nature of planning. In the Soviet era the centralized planning and control system prevailed both in Russia's Arctic and in the country at large. In the post-Soviet period, new modes of more-decentralized planning and control that are more sensitive to the dynamic AZRF realities have emerged. For example, indicative planning loosens up the planning process: Instead of setting taut and unchanging targets, it merely points in certain desired directions and recalibrates future targets in light of what past practice has shown to be realistic aspirations. More generally, present-day Russian policymakers can rely more heavily on loose/soft laws and regulations. Instead of tightly specifying exact performance requirements, the laws and regulations can be written in more general and vaguely aspirational terms (Goodin 2006: 18). It should be noted that most of the AZRF urban development strategies are written in the spirit of indicative planning rather than in a centralized, Soviet-type way.

It should be noted that ISO 37120 has a rather specific interpretation of urban planning and its indicators. Particularly, the system of indicators includes the following:

- Green area (hectares) per hundred thousand population (core indicator)
- Areal size of informal settlements as a percentage of city area (supporting indicator)
- Jobs–housing ratio (supporting indicator)
- Basic service proximity (supporting indicator)
- Urban planning profile indicators:
  - Population density (per square kilometer)
  - Number of trees per hundred thousand population
  - Built-up density

It is obvious that these indicators are of little help for evaluating the AZRF urban SD planning. First, the ISO 37120 indicators reflect urban development rather than the planning process itself. Second, some of these indicators (e.g., green area per one hundred thousand population or number of trees per one hundred thousand population) are simply irrelevant for the Arctic.

For the purposes of the Arctic PIRE project, a special system of indicators for Arctic urban SD planning was developed. The indicators include the following:

1. Ability to Acknowledge the Need to Plan for Sustainability

- Is there a planning office in the city? Or a group of offices that address the 3E's of sustainability (environment, economy, equity)?
- Is planning centralized or decentralized?
- Are there one or more job descriptions that have a sustainability component?
- Does the city have sufficient organizational unity to provide plans for sustainability?
- Are there NGOs and other organizations present that are working on sustainability issues and collaborating with the city?

2. Ability to Provide Holistic and Integrated Views of Sustainability

- Do cities cooperate with regional and federal levels? Have they addressed regional priorities in their sustainability plans?
- Do they base their studies on scientific and cultural assessments?

3. Ability to Engage Community Input

- Do cities have the capacity to engage communities and community inputs?
- Are the plans publicly available, for example on a website?
- How do local communities define sustainability? How important is this issue to the local community?
- Are there opinion polls? What is the amount and transparency of communication?
- Are there attempts to achieve and measure equity?
- How diverse of a community group did the planning process engage? Does it include ethnic or linguistic minorities if they are present?
- Are Russia's public chambers used? These bodies are not made up of elected officials but are a place where anyone can go to arrange public hearings.

4. Ability to Implement Plans for Sustainability

- Are there indicators measuring the implementation of the sustainability plans? How do they follow up?
- Does the city publish a progress report? What are the benchmarks? How often is the progress report published?

- What is the turnover rate among the personnel who develop and implement sustainability plans? Does the organizational and political structure provide a sense of continuity to implement the sustainability plan?
- Are there indexes to measure economic and environmental benefits, and how they are distributed among population?

Although not every indicator is applicable to the existing planning process in the AZRF cities and towns, this index was taken as an organizing principle for this study.

The Russian Urban Development Planning: Conceptual and Legal Aspects

Given the highly centralized nature of Russian political and administrative systems, the AZRF municipal SD strategies are dependent on and interlinked to federal policies in this area. Municipal strategies are based on numerous conceptual and normative documents issued by Moscow, although the federal center encourages subnational units to take into account local peculiarities and to suggest solutions to the specific problems of the AZRF. That is why it is important to understand what kind of conceptual and legal basis for SD strategies exists on the federal level.

It should be noted that the Russian SD concepts and national strategies (in their environmental form) date back to Mikhail Gorbachev's 1987 Murmansk speech, which included a section on the ecological problems of the Arctic. That speech was well received by the Nordic countries and led to various environmental initiatives, such as Finland's 1989 initiative on Arctic environmental protection cooperation, which resulted in a number of technical and scientific reports between 1989 and 1991. This ultimately led to the development of the Arctic Environment Protection Strategy in 1991 and the establishment of the Arctic Council in 1996 (Heininen 2004: 208–9).

Russia signed and ratified the most important international agreements on environment protection and SD: UN Convention on the Law of the Sea (1982); Convention on Biological Diversity (1992); International Convention for the Regulation of Whaling (1946); Fish Stocks Agreement (1995); United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention Concerning the Protection of the World Cultural and Natural Heritage (1972); Convention on the Conservation of Migratory Species of Wild Animals

(1979); Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973); Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matters (1972); International Convention on Oil Pollution Preparedness, Response, and Cooperation (1990); Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic (2013); and the International Maritime Organization's Polar Code (November 2014 and May 2015). To date, Russia has a reputation as a responsible regional player that duly implemented the above international agreements.

Moscow made great strides internalizing these international documents and making them an integral part of its national legislation. The Russian national legislation on environmental protection includes the following legal acts: Federal Law No. 7-FZ On Environmental Protection (2002), Water Code of the Russian Federation No. 74-FZ (2006), Federal Law No. 155-FZ On Internal Marine Waters, Territorial Sea and the Contiguous Zone of the Russian Federation (1998), Federal Law No. 187-FZ On the Continental Shelf of the Russian Federation (1995), Federal Law No. 52-FZ On Fauna (1995), Russian Federal Law No. 16-FZ On the Ratification of the Convention on Biodiversity (1995), Federal Law No. 132-FZ On the Northern Sea Route (2012) and its new version No. 525-FZ of 2018. This legislation constitutes an integral part of the international governance system in the Arctic region.

In the social sphere, Moscow's policies aim to foster favorable conditions for the SD of the Indigenous peoples. For example, in 2009 the Russian government approved the concept of SD for the Indigenous small-numbered peoples of the North, Siberia, and the Far East (Putin 2009). Among other things, the concept set forth the general task of raising the quality of life in these regions to the Russian average and the specific task of halving the 2007 infant mortality rate by 2025. However, these policies have still not come close to their targets and the failure to implement them is harshly criticized by Russia's Indigenous peoples and by national and international human rights organizations (Rohr 2014).

In June 2014 President Putin (2014) signed a federal law No. 172-FZ "On strategic planning in the Russian Federation" that prescribed for all levels of government—national, regional, and municipal—having three types of strategic documents: (1) a strategy for socioeconomic development, (2) forecast of socioeconomic development, and (3) specific programs to implement the two former documents. According to this law the municipalities should define strategic objectives for socioeconomic development and organize monitoring and control over strategic plan implementation. The law also established major principles of strategic planning, such as coherence and integrity, delimitation of powers between various levels of government, sustainability and continuity, balanced nature of the planning system, result-oriented approach and efficiency, clear responsibilities for managers, transparency of the planning process, feasibility and realistic approach, resource-based approach, measurability, relevance of indicators to objectives and, finally, program-targeted principles.

The law on strategic planning has become a legal basis for the development of various normative documents regulating the planning process at the regional and municipal levels. For example, in 2012 the Russian Agency for Strategic Initiatives (2012) launched an Investment Standard (Standard 1.0) to improve the business climate in the Russian regions and increase their investment attractiveness. Having started as a pilot project in eleven Russian regions, Standard 1.0 became a mandatory instrument for assessing a region's investment conditions starting in 2013.

A similar investment standard (Standard 2.0) was developed for municipalities as well. It emphasized the creation of planning and managerial structures in urban administrations, including so-called investment boards; identification of proper objects for investment; building infrastructure for investment projects; and training municipal officials.

Initially, it was planned to launch Standard 2.0 implementation in 2014. However, only a limited number of Russian cities and towns were able to do it. As of this writing in 2019 this standard is being introduced only on a voluntary basis and mainly in the regions that successfully implemented Standard 1.0 (Emelyanova 2014). Although both standards were heavily criticized for their technocratic character and ignorance of local realities, especially in Russia's remote regions, the process of discussing and implementing them was a rather useful exercise in strategic planning that likely will bear fruit in the foreseeable future.

Sustainable Development Planning in Russia's Arctic Industrial Centers: From Theory to Practice

My research shows that, first and foremost, the AZRF industrial cities aim to create and develop an efficient strategy planning system. To make judgments on the administrative/management mechanism's efficiency, it is necessary to examine whether the city leadership is able to acknowledge the need for SD strategy planning. As municipal documents show, the AZRF local governments understand the importance of having some sort of SD strategy. None of the AZRF industrial cities has a specific SD strategy, but there are sections in the city development strategies and plans that are relevant to this issue. These sections are titled differently, such as, for example, Human/Social Capital Development, Sustainable Socioeconomic Development, and Sustainable Ecological Development.

It should be noted that until recently only cities that are large, by Arctic standards, had development strategies of their own. Relatively small urban settlements usually relied on the so-called target programs. For example, Nickel (in the Murmansk region) had a municipal program on providing urban amenities and urban development, but lacked an integrated development plan (Administration of the Urban Settlement Nikel of the Pechenga District 2017). Interestingly, Severodvinsk, which is a rather large city with a population of some one hundred and eighty-five thousand, stopped adopting comprehensive and long-term plans for socioeconomic development after 2012 and replaced them with three-year forecasts, indicative plans, and targeted programs (Severodvinsk City Government 2010 and 2016). The local government believed that less-ambitious but more-specific plans were more effective in terms of implementation. However, with the adoption of the 2014 federal law on strategic planning, all levels of Russian government, including the municipal governments were obliged to develop socioeconomic development strategies of their own. In May 2018 the Severodvinsk mayor organized a meeting with the local legislators, business community, experts, and NGOs to discuss the prospects for the development of an integrated municipal socioeconomic strategy up to 2030 instead of a set of target programs (Severodvinsk City Administration's Press-Service 2018).

It is also important to know whether a special strategy planning office exists in an Arctic city. Most AZRF municipalities prefer to charge their economic departments with planning functions rather than involve units responsible for environmental or social policies. This tendency brings a certain economic bias to their development programs at the expense of the social/humanitarian and environmental dimensions of their SD strategies. This economic preference also may challenge the integrated nature of planning and give the local development plans a single-issue character. For example, the Murmansk (Murmansk City Government 2013) and Severodvinsk (Severodvinsk

City Government 2010) development plans include almost all aspects of the SD strategy, with the exception of food security. However, the Arkhangelsk development strategy (Arkhangelsk City Government 2008) prioritizes only sectors such as transport infrastructure, health care, education, and cultural heritage preservation, while almost completely ignoring the issues of food, environment, community, personal security, and politics.

Planning units are small and normally consist of several managers even in the largest AZRF cities, such as Arkhangelsk, Murmansk, and Norilsk. For this reason, these units are often unable to fully comply with all classical requirements of the planning management process, including strategy formulation and implementation. It is also difficult for them to properly coordinate their activities with other city administration units that are also involved in the planning and implementation process. For the same reason, it is not easy to mainstream urban sustainability plans in the sense that all parts of the government have some stake in achieving the goals.

Most city development programs have clearly defined outcome goals and implementation strategies, including indicators and benchmarks. However, they may differ in terms of the specific details. For example, while the Murmansk (Murmansk City Government 2013), Norilsk (Norilsk City Government 2012), Severodvinsk (Severodvinsk City Government 2010), and Vorkuta (Vorkuta City Government 2014) strategies have a detailed description of the implementation mechanisms and indicator systems, the Arkhangelsk (Arkhangelsk City Government 2008) and Salekhard (Salekhard City Administration 2007) documents limit themselves to depicting specific project management procedures and setting some general indicators.

The AZRF municipalities aim to develop a proper legal basis for SD strategies, including power-sharing with the federal and regional governments. As mentioned above, by federal law the Russian municipalities must coordinate their development plans and programs with the regional and federal SD strategies. However, this coordination is done by the AZRF cities in different ways. For example, in the Murmansk development plan each strategic priority is linked to the specific regional and federal programs (Murmansk City Government 2013: 108–69). In contrast, the Arkhangelsk, Norilsk, Salekhard, and Vorkuta development strategies mention the need to coordinate with the higher levels of governments only here and there (Arkhangelsk City Government 2008: 51–52; Norilsk City Government 2012: 105–7, 170; Salekhard City Government 2007: 32–33; Vorkuta City Government 2014: 84).

The AZRF municipalities are rather cautious about any federal initiatives in the field of strategic planning. For example, Moscow's efforts to introduce the Standard 2.0 got a cold shoulder in the northern cities. In 2014 about eighty municipalities across the country were selected to implement the project. However, in the AZRF only several municipalities in the Murmansk region, where Standard 1.0 on the regional investment climate was successfully implemented, currently participate in the experiment with Standard 2.0 designed for providing a favorable investment climate at the municipal level. Four municipalities are considered pilots (the Pechenga and Kola Districts, Monchegorsk and Murmansk), other municipalities (Polyarnye Zori, Apatity, Kirovsk, Olenegorsk, and Kovdorsky, Lovozersky, Tersky and Kandalaksha Districts) implement only certain elements of Standard 2.0. The only municipality that has fully implemented all elements of Standard 2.0 is Murmansk itself. This success can be explained by the fact that it is the capital of the region and therefore has larger financial and human resources than other municipalities (Emelyanova 2014).

To provide SD strategies with a proper societal setting, they should support transparency in the planning process and encourage public input and community engagement. Theoretically, the Russian Arctic municipalities have several instruments to organize the planning and implementation process in an open and democratic manner: regular opinion polls, public discussions in the media, regular hearings in the public chambers, and dialogue with NGOs. However, only Severodvinsk has a special municipal program to facilitate the local NGOs' development (Severodvinsk City Government 2016). The Murmansk and Vorkuta development plans hardly mention the need for a dialogue with civil society institutions (Murmansk City Government 2013; Vorkuta City Government 2014). Other AZRF cities simply ignore this issue, assigning the SD strategy planning process entirely to governmental structures.

As far as the environmental aspect of the SD strategies is concerned, the AZRF municipalities have the following priorities:

- Prevention and reduction of pollution rather than cleaning up existing contaminants as was the case before
- Rehabilitation of damaged natural environmental systems (damage assessment, targeting the priority areas, clean-up programs in some cities, monitoring)
- Solid and liquid waste treatment
- Targeted programs to protect endangered species

- Development of public-private partnerships in the environmental protection sphere
- Encouraging environmental research (support for local universities and research centers)
- Developing environmental education and culture
- Cooperation with the local environmental NGOs and mass media to promote green projects and culture
- Development of monitoring systems in various areas (prevention of natural and man-made disasters; air and water pollution; endangered species, etc.)

AZRF cities differ with regard to their views on the significance of environmental problems in the SD strategies. While for some municipalities, such as Arkhangelsk, Murmansk, and Salekhard, environmental issues are one of several policy priorities, for Monchegorsk, Nickel, Norilsk, and Severodvinsk, where the ecological situation is rather grave, the need to solve the environmental problems is critical. These cities are traditional centers of metallurgical production, and of machine- and ship-building industries, and for this reason are heavily polluted and pose serious health hazards. Russian scientists identified twenty-seven so-called impact zones where pollution has led to environmental degradation and increased morbidity among the local population. The main impact zones include the Murmansk region (10 percent of total pollutants in the twenty-seven impact zones), Norilsk urban agglomeration (more than 30 percent), West Siberian oil and gas fields (more than 30 percent) and the Arkhangelsk region (around 5 percent) (Dushkova and Evseev 2011; Ekologicheskoe Sostoyanie Impactnykh Raionov 2012). In sum, about 15 percent of the AZRF territory is polluted or contaminated (Kochemasov, Morgunov, and Solomatin 2009).

As mentioned above, the AZRF cities pay little attention to the purely human security dimension, preferring to focus on economic and environmental issues. The human dimension of the SD strategies is mostly represented by the municipal programs on civil defense (Murmansk City Government 2013; Severodvinsk City Government 2010; Vorkuta City Government 2014) to protect the local population from natural and human-created catastrophes. Some development plans (Murmansk City Government 2013; Severodvinsk City Government 2010) also have sections on personal security, including the need to deter street violence.

Almost all city development plans mention the need for international cooperation, including in venues such as the Arctic Council, Barents

Euro-Arctic Council, International Polar Year, Intergovernmental Panel on Climate Change, United Nations Environment Program (UNEP), United Nations Development Program (UNDP) and UNESCO programs, and country-to-country, region-to-region, and town-to-town collaborations.

Conclusion

As this chapter shows, the Russian Arctic municipalities have familiarized themselves with the concept of SD. To some extent, this concept was embedded in municipal development plans and strategies, although the AZRF cities lack special SD strategic documents; in addition, quite often economic, ecological, and social dimensions are not properly harmonized with one another. The Arctic municipalities view the development of sound urban planning strategies as an important policy priority. They have tried to create proper legal and institutional settings for the development and implementation of such strategies. They also have tried to cooperate with regional and federal authorities in the field of strategic planning and solving concrete socioeconomic and ecological problems.

They have made great strides in implementing some SD-related projects over the past ten to fifteen years; most of these projects addressed economic and environmental issues. There was a clear shift from survival-based approaches that were simply reactive to various crises to more-proactive capacity-building SD strategies. These efforts resulted in some success stories, albeit rather modest ones.

However, there is still a long way to go, in terms of both the development of adequate policies and their effective implementation. The main problem is how to solve the words and deeds problem because many of the SD projects still remain on paper and have never been implemented. In other words, the gap between strategy formulation and implementation still exists.

The weak points of the AZRF urban development strategies include a lack of transparency in the policy-planning process and a lack of cooperation with and involvement of civil society institutions. To a large extent, the policy planning and implementation process is still of the top-down rather than bottom-up nature. Moreover, not all SD-related issue areas are addressed, and different strategic approaches are not properly synchronized with one another. Finally, quite often municipal SD programs and projects are understaffed, underfunded, and not supported by regional and federal authorities.

Hence, larger staff and funding as well as better coordination of SD strategies between different levels of government are badly needed.

To conclude, despite the above problems and shortcomings, the total balance sheet of the Arctic cities' SD strategies and general dynamics is rather positive. The AZRF municipalities are serious about solving numerous socioeconomic and environmental problems and making these urban areas better and more comfortable places to live.

Alexander Sergunin is professor at the Moscow State Institute of International Relations and Saint Petersburg State University, Russia.

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CHAPTER 9

Transport Connectivity and Adapting to Climate Change in the Russian Arctic

The Case of Sakha Republic (Yakutia)

Aleksandra Durova

Introduction

Sustainability has been recognized as a pressing issue for the past three decades, and climate change has been an important stressor and threat to sustainability in the Arctic. Current sustainability challenges in Arctic settlements relate to their urbanization trajectories, inherited vulnerabilities, and development uncertainties. Arctic cities today, despite their diversity, are nodes of unevenly developed and poorly connected territories with low population densities (Bashmakova et al. 2013; Pilyasov 2013). They have been historically susceptible to adversities and the variability of climate conditions, and are increasingly exposed to new risks posed by climate change. Ensuring the sustainability of these cities is not possible without taking into account the impact of climate change in all of its implications.

Northern settlements have relied on a few core transport corridors, typically seasonal water transport and ice-roads, for supplies of food, energy, and essential materials (Selin, Skufina, and Bashmakova 2016). Eight Russian Arctic regions rely on specialized delivery, called the Northern Supply, to areas with limited transport access, to ensure that they receive the necessary provisions (Zvorykina 2017).[1] The

Northern Sea Route (NSR), which is navigable on average for 3.5 to 5.5 months a year (Vasiliev, Gritsevich, and Selin 2009), has remained the exclusive delivery option for dozens of remote Russian Arctic settlements along the Arctic Ocean coast (Shpak and Serova 2011). The NSR, combined with river transport, provides a twelve-month provision of supplies (Bashmakova et al. 2013). However, in the context of climate change, Arctic communities face increasing vulnerabilities related to disruptions of the very transport connectivity that is vital for sustaining life, economic prosperity, and security (Arctic Council 2013).

Currently, connectivity disruptions are related to changing hydrology and shallow waters in rivers (Bashmakova et al. 2013; Koetse and Rietveld 2009), shorter operational periods for critical ice-roads and ice-crossings (Stephenson 2013), and risks of infrastructure failures due to thawing permafrost (Streletskiy, Anisimov, and Vasiliev 2015). The reduction of sea ice in combination with rapid permafrost degradation creates risks of coastal erosion and the need to relocate communities (Jones et al. 2009; Paglia 2018). In this context, the sustainability of settlements and the livelihoods of communities depend on their adaptive capacity, which in turn is greatly affected by external conditions, such as government policies in the Arctic and adaptation actions across various scales and sectors (Carson and Peterson 2016).

Transport performance, as a tenet of sustainability, is reflected in the framework of ISO indicators described in the book's Introduction. The transport indicators included in the ISO primarily focus on measuring elements of an urban transport system, urban mobility, and road safety within municipal boundaries. The only indicator that measures transport connectivity between cities and other parts of the region, country, and world is the Commercial Air Connectivity indicator, which measures the number of non-stop commercial airline destinations served from the city's airports. Flights are indicative of one connectivity dimension, but a sole focus on this indicator overlooks other dimensions pertinent to freight transport. For example, Yakutsk, the capital of Russia's Sakha Republic and a key northern hub in eastern Siberia, performs relatively well with respect to commercial air connectivity compared to the largest Russian Arctic cities. However, relying on this particular indicator alone to measure transport connectivity can be misleading, because it does not reflect the reliability of transport networks and physical infrastructure, quality of service, and access to regional trade partners.

A World Bank (2018) effort to measure the domestic freight connectivity between Russian regions shows great disparities among regions regarding freight connectivity to their top five trade-partner regions. The weighted travel time for Yakutia exceeded eleven days, while for Moscow it was less than five days. Constructing a single indicator for comparative purposes on a large scale is challenging due to methodological limitations and a lack of data. The World Bank calculated freight connectivity as weighted travel time between regional capitals accounting for respective trade volumes by mode (road, rail, and river). Similar to the ISO air connectivity indicator, such a measure of freight connectivity would not be suitable for a granular analysis of regional connectivity, considering the distribution of freight flows and possible delivery disruptions, which are becoming more frequent due to changing climate conditions and other factors.

All in all, the current ISO indicators overlook multiple dimensions of connectivity and should be complemented by a more detailed examination of connectivity issues to better reflect Arctic circumstances. To more effectively measure sustainability, a key indicator that is needed is one that gauges the ability of the system to adapt to climate changes that threaten the connectivity of cities. In the Arctic, where cities are often remote and isolated, the ability to ensure connectivity is crucial.

Given the need to understand how climate change affects connectivity between Arctic cities, this chapter draws attention to climate change impacts on the Sakha Republic's transport system, and examines the efforts to mitigate these impacts. The discussion focuses on what adaptation measures are planned and implemented if at all, why they are implemented, and what potential sustainability implications they have. The discussion explores triggers of adaptation actions and risks that are expected to be addressed. With regard to the sustainability implications of these adaptation actions, the discussion in the chapter considers whether the adaptations (1) address causes of vulnerabilities, (2) promote more-sustainable development trajectories, and (3) deal with all foreseeable risks. Adaptation in this chapter is understood as policies, projects, strategies, or other tools "seek[ing] to moderate or avoid harm or exploit beneficial opportunities" (Intergovernmental Panel on Climate Change [IPCC] 2014: 118), which can directly respond to climate change or be triggered by nonclimatic motivations (Smith et al. 2000). The central thesis is that measuring the sustainability of Arctic cities requires a strong understanding of how these cities will be able to respond to climate changes that threaten to sever vital transportation links.

Data and Methodology

This case study analysis of connectivity issues in Sakha Republic relied on two main sources of data. First, the study used analyses of online media sources, including official press-releases from government websites, local news, and online video interviews. The online search was conducted using key words identified from the literature review of potential climate change impacts on transport in the Arctic, in particular including the latest report of Roshydromet (2017) that summarizes climate risks in Russia.[2] Second, the study included qualitative analysis of official government documents. Given that regional transport policy and investments are closely interwoven with federal Arctic and transport policies and funding, documents were selected at the level of strategies and programs both at the national and regional scales, which were effective or planned at the time of the study.[3] The study explores river, sea, road, and railway transportation modes within the region, with a focus on freight. Air transport is not examined, because climate change impacts on air transport are much less obvious compared to other modes, and air plays a relatively less significant role with regards to freight movements in the Russian Arctic.[4]

There are a few limitations of the chosen methodological approach. First, it is worth noting that there are still no national and regional adaptation strategies and plans,[5] and actions covered in this study may not be definitive of all adaption actions, or could not capture their latest status of planning and implementation. Second, as the adaptation literature demonstrates, adaptation actions are not necessarily purposeful and driven by climate change risks alone, but might be incidental and triggered by a combination of factors (Berrang-Ford, Ford, and Paterson 2011; Smith et al. 2000). This study lacks details on the implementation of adaptation actions, as well as factors, beyond those that were identified in available data sources, that might challenge or stimulate implementation. For next steps, these findings will need to be triangulated through interviews with stakeholders involved in planning and implementation at different levels of government and the private sector to provide a more nuanced understanding of an adaptation landscape, barriers and opportunities, and impacts on settlements and communities.

Yakutia under Climate Change Uncertainty

The Republic of Sakha (Yakutia) is home to 967,000 people (Rosstat 2019a), more than 120 ethnicities (*Labour, Transport and Energy Development Concept 2020* 2006), and around 40,000 Indigenous people (Rosstat 2010). The region is unevenly populated, with almost 50 percent of the total population concentrated in the Central Administrative District and the least populated northern and eastern areas of the region (*Labour, Transport and Energy Development Concept 2020* 2006). Almost sixty-six percent of the region's population is urban,[6] of which almost 50 percent lives in the city of Yakutsk (Rosstat 2019b). Yakutia has extreme climate conditions, with more than a 100°C difference between winter and summer extreme temperatures. With the overall warming of the Arctic, evidence from literature on Yakutia demonstrates uneven changes in climate throughout the region (Kirillina 2017; Shiklomanov et al. 2017), and projections suggest warming in the future (Kirillina, Lobanov, and Serditova 2015).

The region has an unevenly developed inland transport system that is sensitive to seasonal variations and changes in climate and provides poor connectivity (*Yakutia Transport Program 2022* 2017). The existing transport system in Yakutia inherits vulnerability to climate from the network developed during Soviet times. The development of the transport network was driven by aspirations of exploring for natural resources, but at the same time had to face large distances, high construction costs, extreme climate conditions, and low population density. As a result, the region relied on a few core transport arteries for intra- and interregional connectivity. It is a seasonal network (rivers, ice-roads, ice crossings, and the NSR) with gaps along the main road corridors that were always vulnerable to climate conditions and risks. Economic decline during the post-Soviet transition in the 1990s led to deterioration of the transport system, including declining quality of roads and decay of port infrastructure and navigation systems (Stepanova 2013). Since the 2000s the regional government has focused on addressing gaps and completing missing transport links like the Berkakit-Tommot-Yakutsk Railway[7] (Stepanova 2013; *Territorial Planning Concept* 2011) that is vital for the Sakha Republic's economy and the livelihoods of communities. Addressing these gaps can be expected to reduce existing vulnerabilities and provide more-reliable connectivity to the people in the region. New circumstances brought by climate change, however, are likely to require additional measures beyond those just outlined.

Yakutia historically has relied on water transport for shipping freight for economic development and sustaining communities, and shipping is unlikely to be replaced by other modes in the foreseeable future (*Yakutia Transport Strategy 2025* 2004). The river system is expansive and is represented by large rivers like the Lena, Aldan, Vilyui, Yana, Indigirka, and Kolyma Rivers, as well as small feeder rivers, that all serve communities within the region. River transport, reportedly, annually carries 40 percent of annual freight turnover during the navigation season (*Yakutia Water Transport Program 2036* 2017), which lasts up to four months on big rivers and about a month or less on small feeder rivers (Vasiliev, Gritsevich, and Selin 2009). Supplies into the northern areas adjacent to the Laptev and East-Siberian Seas are limited to around three months of ice-free navigation, while for the remainder of the year delivery is challenging and expensive (Vasiliev, Gritsevich, and Selin 2009). The NSR currently supplies up to one hundred thousand tons of oil products into the region (Press-Center 2016).

Between river navigation seasons, transportation and delivery throughout the region rely to a large extent on ice-roads. Around 90 percent of Yakutia's territory, where 84 percent of the population resides, lacks a year-round road network (*Draft Socio-Economic Strategy 2030* 2016; *Yakutia Safety Program 2022* 2017), and 73 percent of existing roads in the region are either seasonal or depend on ice crossings[8] (Draft Law on Advanced Delivery 2017). Both rural communities and cities depend on seasonal ice-roads. For example, the city of Yakutsk with its population of almost 308,000 people (2017) relies on an ice crossing to connect to the road and railway network across the Lena River. Delivering into the city, except for expensive air transport, is done by a ferry in summer or via an ice crossing in winter (*Yakutsk Strategy 2032* 2015). Currently, 248 out of 641 settlements lack year-round connections with the main road network (*Yakutia Transport Program 2022* 2017). Settlements in the North often rely on air transport and off-road vehicles, which makes travel and shipments unreliable and expensive (*Yakutia Transport Strategy 2025* 2004).

The State of Adaptation in Yakutia's Transport

Adaptation in transportation is increasingly important at regional and municipal levels in Yakutia and involves a variety of actors, but the state of adaptation planning remains in its infancy. Adaptation measures are ad hoc and generally driven not by climate change alone but a combination of factors. Adaptations relate to vulnerabilities that have their roots in spatial development, governance, economic constraints, and organizational failures, and are based on a limited understanding of future social, economic, and environmental risks. Existing adaptation measures in Yakutia's transport sector respond to emergency and safety risks or are driven by motives to exploit opportunities associated with climate change. Similarly, in other contexts adaptation better resonates with governments when it is contextualized within development issues and relates to public safety (Measham et al. 2011), security (Hodson and Marvin 2009), or if it offers development benefits and reduces vulnerabilities in the longer term (Klein et al. 2007).

Degradation of permafrost, navigation problems, delivery failures, and connectivity disruptions within the region occur in the context of extreme climate conditions, decaying infrastructure, and budget constraints that add a sense of urgency to adaptation responses. The lack of adaptation threatens economic losses, environmental degradation, and infrastructure failures. On the other hand, adaptations driven by motivations to tap into potential opportunities brought by climate change are associated with improvements of transport infrastructure and connectivity, expansion of exports, and economic gains. The following discussion provides several examples of risks posed by climate change, adaptations, and their sustainability implications in the context of the Sakha Republic.

Responses to Experienced Safety and Emergency Risks

Rather than being planned as part of a comprehensive process, many of the adaptation responses in Sakha Republic are in fact just reactions to emergency situations. This reactive approach can be seen in the responses to permafrost degradation and past connectivity disruptions.

Permafrost degradation and thawing have been of growing concern in the region with respect to risks of infrastructure failure and connectivity disruptions (Romanova 2017). Changes in the bearing capacity of permafrost, cryogenically destructive processes, and uneven settlement of the ground under buildings and pipelines threaten the safety and stability of infrastructure (Osipov 2016; Roshydromet 2017; Yakovlenko et al. 2017). Permafrost impacts, however, are location specific and unevenly distributed within the region (e.g., see studies by Nelson, Anisimov, and Shiklomanov 2002; Vorontsova 2017). Together with melting sea ice, thawing permafrost is expected to profoundly affect the coast along the Laptev and East Siberian Seas (Yakutia). Records already show a retreat of the coastline varying from a few to a hundred meters per year (Alekseeva 2016; Maslakov and Kraev 2016), and coastal erosion can create risks for communities and transport infrastructure. There are known engineering solutions to address thawing-induced risks. However, it remains unclear to what degree they are being used with regard to the existing and new infrastructure. Planning for adaptation requires understanding location-specific cryogenic processes and future risks, mapping the vulnerability of transport networks, and understanding location-specific adaptation needs (Osipov 2016).

In 2018 the Sakha Parliament passed a law on Preservation of Permafrost (N 2006-3 N 1571-V). In 2017 the Sakha legislatures initiated a discussion on adopting a federal law on Preservation and Rational Use of Permafrost with a committee of the Federation Council, the upper chamber of the national parliament. The law spells out the need to monitor permafrost conditions, supervise land use, track factors (including anthropogenic ones) that may lead to permafrost degradation, and identify actions to protect people from possible negative consequences (Vasilieva 2018). This law is a clear step toward planned adaptation in the region and addressing cryogenic risks to infrastructure and communities.

On the other hand, regions are limited in promoting anticipatory or planned adaptation actions with regard to sea coastal protection, since it falls under federal jurisdiction, specifically that of the federal Ministry of Construction. Reportedly, regional authorities currently cannot initiate preparation of engineering designs to include coastal protective measures because this would be considered a misuse of funds (Kudrin 2017). Authorities and scientists noted that it would be important to delegate some planning responsibilities to the regions. The Ministry of Economic Development is considering legal amendments[9] that would provide flexibility allowing regions to act on climate change—for example, to plan for coastal protection (Kudrin 2017).

In essence, these proposed legislative changes, together with research and systematically applied engineering solutions, can potentially increase resilience of transport networks to climate change. Causes of vulnerabilities, however, span various issues, from engineering design standards that have, reportedly, not accounted for climatic variability (Kirillina 2017; Kudrin 2017), to budgetary limitations in the region to maintain and upgrade transport infrastructure (Regnum 2017a), to spatial policy aligned with construction of infrastructure on permafrost under conditions of low population densities and large distances between settlements (Stepanova 2013).

Timing and duration of river navigation have become less predictable due to declining water levels, resulting in connectivity disruptions (*Yakutia Water Transport Program 2036* 2017). For example, during the 2015 river navigation season, water levels were low for as long as forty-five days in some locations (Poleshkina 2017). Even though, as noted by the chairman of the Sakha Parliament's Committee for Land, Natural Resources and Environment, little research has been done on how climate change has affected river systems in Yakutia during the past twenty years (Romanova 2017), scientists and authorities have offered explanations for this problem. Degradation of permafrost changes hydrological regimes and negatively affects freshwater navigation (Bashmakova et al. 2013). Officials also refer to frequent forest fires in the neighboring region, droughts, as well as insufficient dredging,[10] affecting water levels on the upstream portion of the Lena River (Regnum 2017b; Yakovlev 2017). Navigation problems have made delivery challenging, unpredictable, and costly. Shallow waters and forest fires can paralyze delivery during short navigation seasons, as happened on the Aldan and Indigirka Rivers in 2012 (Vinokurov 2012). They can also limit loading of ships, resulting in slow and risky delivery. For example, in August 2016, ships could only load up to one third of their capacity, and transportation costs surged resulting in higher prices for delivered fuels (Tuktarova 2017).

Navigation disruptions and failures of the Northern Supply have led to emergency situations when communities faced the possibility of not having essential goods or heating fuels (*Yakutia Water Transport Program 2036* 2017). For example, in 2013 shallow waters on the Indigirka River and the shorter navigation period resulted in only half of planned supplies (coal, oil, liquid natural gas, food, construction materials, and agricultural produce) reaching communities on time. The Ministry for Emergency Situations had to declare emergencies in three administrative districts and send supplies, including coal, by air ("Timely Comments" 2013).

Climate change also poses risks of a shorter season for ice-roads, jeopardizing their safety and, as a result, disrupting connectivity within the region (A. Vasiliev 2017). According to local media coverage, there are already evident risks of late openings of ice-roads and disruptions in delivery by road transport. For example, in the winter of 2016–17, snowfalls and warmer weather delayed opening of winter roads in some remote settlements, putting communities at risk of depleting supplies before the arrival of trucks (Taurskiy 2017), which reached some villages in April instead of the planned January (Yakovlev 2017).

Risks related to disruptions in connectivity trigger adaptation responses by regional authorities aiming to prevent emergency situations that leave communities without subsistence and heating. For example, emergency risks related to navigation conditions on rivers made the regional government reconsider how the Northern Supply is organized. The recent completion, after many years of construction, of the Berkakit-Tommot-Nizhny Bestyah railway line finally opened up an opportunity to bypass the Lena River's shallow upstream and consider shifting freight from river transport to the railway, as far as Nizhny Bestyah, where cargo can be transferred back to river transport and trucks. However, these organizational changes had not been feasible until the train line opened. Until then the Lena's shallow water made navigation unreliable (Taurskiy 2017). Furthermore, given the shift in navigation seasons, the government is also considering creating an earlier delivery schedule. However, as noted by the former head of the Sakha government, early delivery requires longer storage and improvements in storage facilities, and therefore the republic is seeking support from the federal budget to build storage facilities in rural areas (Yakovlev 2017). These examples demonstrate that adaptation actions depend on the state of infrastructure development, and their feasibility is closely related to the availability of infrastructure, as in the case of the railway line and sufficient storage facilities.

Unfortunately, Sakha adaptation responses are reactive and do not address causes of vulnerabilities. As in the case of the Northern Supply, vulnerability to climate change relates to a combination of infrastructure, organizational, and structural factors. As noted by academics and authorities, transition of the Northern Supply to market principles during 1990–2004 and the lack of national regulation have left the Northern Supply system decentralized and uncoordinated (Vasiliev, Gritsevich, and Selin 2009). There are multiple participating actors, including those in the private sector looking for profit, and regional and municipal governments bearing the ultimate social responsibility to provision remote cities ("Il Tymen" 2014; *Yakutia Safety Program 2016* 2013; "YKTIMES.RU" 2017). In the case of rapidly changing climate conditions and under financial constraints, the private sector is unable to adapt quickly, while the government has to either react to find more sustainable ways to address problems or bear costs in case of emergencies. The Northern Supply system under the conditions of extreme climate and limited transport accessibility was initially founded on the principles of centralized organization and funding (Vasiliev, Gritsevich, and Selin 2009). However, the current decentralized organization and planning for the delivery of necessary supplies under conditions of limited transport connectivity and a lack of funding grows even more complicated due to uncertainties brought by climate change.

Adaptation Driven by Motives to Exploit Opportunities

In Sakha, adaptations also take the form of investments in infrastructure that are driven by developmental intentions rather than climate change threats. They are designed to fuel economic development in the region, revive and expand transport links, and serve increasing transport demands including exports. Nevertheless, they are also meant to address existing challenges related to transport connectivity that have legacies in the political economy transition in combination with changes in climate. Outcomes and implications of such adaptations are closely interwoven with the state of infrastructure development and development trajectories. Investments in infrastructure (for example, road and railway networks, inland water transport and the NSR) are limited to strategic links serving economic and spatial development. They are expected to increase the resilience of the transport system and, therefore, reduce negative impacts of transport and delivery disruptions on connected settlements. However, the implications of such investments for communities can be mixed with regard to their subsistence economies, food security and cultures, environmental consequences of industrial development and increased transportation flows, and other impacts that are not yet fully anticipated.

The warming of the Arctic Ocean is expected to open up potential opportunities for longer ice-free navigation, exploration of natural resources and exports, and commercial shipping. Transportation investments reflected in national and regional strategic plans and programs related to the revival of water transport (for example, *State Arctic Development Program 2015–25* 2017; *Yakutia Water Transport Program 2036* 2017) serve aspirations of economic interests in the Arctic and respectively anticipated increasing transport demand. At the same time, given that rivers are becoming shallow and navigation more unpredictable, while navigation in the Arctic Ocean is becoming longer, the growing use of the NSR promises transport alternatives for regional supplies and economic development (Arctic Strategy 2020 2013; *State Arctic Development Program 2015–25* 2017; *Yakutia Transport Program 2022* 2017). Yakutia is projecting almost a five-fold increase of freight delivery by the NSR by 2030 (*Yakutia Water Transport Program 2036* 2017).

Inland water transport, together with the NSR, is increasingly important in light of the anticipated future expansion of supplies, including those serving investment projects[11] in the North-Yakutian Core Arctic zone that are considered important for the spatial and economic development of the region (*State Arctic Development Program 2015–25* 2017). Currently, annual river transport carries on average around 2.8 million tons of cargo per year, half of which is life-sustaining goods, and around a third is for projects related to exploration of the Arctic. Furthermore, water transport is an integral part of the future international transport corridor China-Yakutia-NSR, the vision for which is spelled out in the *Yakutia Water Transport Program 2036* (2017). To support these aspirations and address current navigation problems, the State Arctic Development Program 2015–25 (2017) is funding construction of a dock yard in Zhatai to upgrade the river and river-sea fleets for socially important freight supplies. The regional government in its turn is providing financial support to transport enterprises for upgrading their outdated fleet. Sakha is also expecting to receive an additional dredging ship constructed with federal funds[12] to ensure navigation on the Lena, Yana, and Indigirka Rivers (*Yakutia Water Transport Program 2036* 2017).

Ambitions with regard to the revival of shipping in the Arctic Ocean, however, require investments in ice-breakers, modernization of decayed port infrastructure, provision of search and rescue services, hydrometeorological monitoring and forecasting, and emergency and disaster planning (*State Arctic Development Program 2015–25* 2017; *Yakutia Transport Strategy 2025* 2004) that all fall under federal jurisdiction, and to some degree are covered by the current federal program.[13] The current state of their development, as well as expectations of increased shipping in the Arctic, is a growing concern because of implications it may have in case of oil spills and environmental disasters (World Wildlife Fund [WWF] Russia 2008) and negative impacts on local communities (Heininen, Sergunin, and Yarovoy 2014; Stephenson, Brigham, and Smith 2014).

Overall, vulnerabilities to climate change in the transport sector largely depend on spatial and economic development trajectories. According to strategic documents, core investments in transport continue to serve exploration of natural resources, exports, and markets (*Draft Socio-Economic Strategy 2030* 2016; *Labour, Transport and Energy Development Concept 2020* 2006), and shape axes, around which connectivity gaps are likely to be addressed. At the same time, according to the spatial planning documents, spatial development of the region would follow a fly-in/fly-out principle, which means that it is infeasible to expand or build new settlements around industries in addition to those core towns that have existed since Soviet and earlier times. Settlements that lack permanent populations and economic activity are planned to be closed. Strategic plans also prioritize year-round connections between core towns as part of main transport corridors, as well as road-river connections in the on/off areas. At the same time, areas in the North, within the Arctic Circle, with a total population of around 30,000, are expected to remain without year-round connections and continue to rely on seasonal and air transport (Territorial Planning Concept 2011). To a large extent these areas will depend on how the transport system will be adapted to changing climate conditions. Even though some current and planned adaptation actions may reduce some vulnerabilities through investments in year-round networks and other infrastructure, they, being driven by economic and geopolitical motivations in the Arctic, perpetuate the region's dependency on the exploitation of natural resources and can yield unsustainable outcomes.

Conclusion

This chapter argues that ISO 37120 does not do enough to measure the level of connectivity between cities that is important for their sustainability. The current focus on air connections should be supplemented with indicators measuring connectivity and reliability of multiple transport modes as well.

Beyond those simple indicators, measuring sustainability requires understanding how climate change will affect the level of connectivity between cities in the future. This case study provides a critical examination of how Sakha Republic is addressing the climate change challenges to connectivity. The central conclusion is that rather than addressing the core problem of climate change challenges, Sakha's adaptions are focused on other priorities, such as responding to emergencies and developing the ability of the republic to engage in resource exploitation.

In terms of sustainability implications, adaptation actions that aim to respond to or prevent emergencies do increase the resilience and reliability of transport networks or supplies, but do not address causes of vulnerabilities. These causes cut across multiple scales, from design standards and poor connectivity, to budgetary limitations and spatial policies. For example, preexisting conditions in the case of the Northern Supply, such as limited connectivity, poor infrastructure, transition to decentralized planning, and shortage of funding, make adaptation more difficult. This aligns with the current understanding of limitations of sectoral, infrastructural and spatial adaptations in addressing root causes of vulnerabilities. More transformative approaches may include institutional reforms, behavioral shifts, cultural changes, questioning of values, and reorientation of development (O'Brien 2012; Pelling 2011).

Furthermore, current and planned investments in infrastructure associated with the revival of water transport and year-round road networks to some degree are expected to reduce vulnerability, exposure, and sensitivity of communities to climate change risks that cause delivery disruptions. However, what impacts they may have on other dimensions of community resilience, for example food security, traditional subsistence economies and cultures, remains understudied. For example, infrastructure development driven by objectives not aligned with interests and lifestyles of local communities can have detrimental effects and reduce their adaptive capacity, and interrupt ecological systems that can be an important livelihood source (Carson and Peterson 2016; Forbes et al. 2009). Also, such adaptations, being driven by economic and geopolitical interests in the Arctic, are inherently built on the growth imperative, perpetuate the region's dependence on exploiting natural resources, and can result in unsustainable outcomes. For example, the current state of the NSR infrastructure, as well as an expected increase in shipping in the Arctic, may lead to negative and even disastrous outcomes, such as oil spills, environmental destruction, and further contributions to climate change. Although Arctic policy has been at the front line of the Russian Federation government agenda, the absence of a national adaptation policy and supporting regulatory environment and funding impede planning and implementation of adaptation actions. Indeed, findings demonstrate that the role of the federal government is important with respect to various issues, from infrastructure design standards and funding to policy-making. Coordination with the federal government and between regions is essential for pushing adaptation initiatives forward, for example with respect to legal changes and funding for large projects. While adaptation actions need to account for regional differences, a national policy would be essential for establishing a legal foundation, responsibilities, and preparing the ground for collaboration between government agencies and between regions.

Most identified adaptation actions are not stand alone in terms of planning and implementation. They cannot be separated from existing challenges and tasks. For example, inefficiencies of the Northern Supply combined with impacts and uncertainties brought by climate change require searching for solutions either at the federal or regional levels since investments into connectivity and infrastructure are inseparable from spatial and economic policies. In such cases, adaptation measures would be incorporated into sectoral reforms and investments. Accordingly, transfer of responsibilities for adaptation planning from the federal to the regional level needs to be accompanied with clear funding arrangements to ensure successful outcomes.

Aleksandra Durova is pursuing a doctoral degree in the Department of Urban Studies and Planning at the Massachusetts Institute of Technology.

Notes

1. The Northern Supply (Government Decree 402 2016) in practice means a set of measures undertaken by the authorities to ensure delivery of life-sustaining goods to the remote settlements with transport access of fewer than 180 days a year (Zvorykina 2017).
2. The key words included "permafrost," "shallow rivers," "navigation," "flooding," "winter roads," "advanced delivery," "Northern Supply," "infrastructure," and "Northern Sea Route" in combination with "transport" and "climate change," "global warming," and "Yakutia." The search of online sources was done in Russian.
3. Arctic Strategy 2020 (2013); Draft Law on Advanced Delivery (2017); Draft Socio-Economic Strategy 2030 (2016); Yakutia Transport Strategy 2025 (2004); Labour, Transport and Energy Development Concept 2020 (2006); State Arctic Development Program 2015–2025 (2017); Territorial Planning Concept (2011); Yakutia Safety Program 2022 (2017); Yakutia Transport Program 2022 (2017); Yakutia Transport Strategy 2025 (2004); Yakutia Water Transport Program 2036 (2017); Yakutsk Strategy 2032 (2015).
4. On average during 2005–10 river transport's share of freight turnover was around 60 percent, auto transport was 30 percent, railway was around 6 percent, sea was almost 5 percent, and air was less than 2 percent (in million ton-km). In tons on average during 2005–10, auto transport took over 86 percent of freight, river transport took 8 percent, and railway took 5 percent; sea and air transport's shares were less than 1 percent, according to statistics from the Yakutia Transport Program 2019 (2011).

5. Russia has not yet developed a national adaptation strategy and only a few regions (the Murmansk region (in 2009), Saint-Petersburg (in 2009), and the Arkhangelsk region (in 2014) have designed pilot regional adaptation strategies (Kirillina 2017).
6. Living in towns or urban settlements: in 2018, nine urban settlements with population over ten thousand people and forty-six urban settlements with population less than ten thousand people (Rosstat 2019b).
7. The Berkakit-Tommot-Yakutsk Railway (around 800 kilometers [km]) connects central Yakutia with the Trans-Siberian and Baikal-Amur Railways. The construction of the railway lasted from 1985 to 2014 when the last section, Tommot-Nizhny Bestyah (on the river bank across from Yakutsk), was completed and launched. Now the regional government is looking into the development of Yakutsk as a multi-modal regional transport hub, once it is connected by all modes of transportation (Yakutsk Strategy 2032 2015).
8. A third of roads in the region are seasonal (Yakutia Safety Program 2022 2017). However, paved roads also depend on ice crossings. For example, federal roads network with hard surface have seven ice crossings over large rivers Lena, Vilyui, and Aldan (Draft Law on Advanced Delivery 2017).
9. On amendments to the federal law, "On Rules of Organization of Legislative and Executive Authorities in Regions of the Russian Federation."
10. Dredging was regularly carried out in the Lena River during 1970–1990 to ensure navigable depths (Anisimov and Kokorev 2016), but in the last 25 years was reduced to less than a fifth of previous efforts (Yakutia Water Transport Program 2036 2017).
11. Exploration of hydrocarbons, diamonds, gold, and other precious metals (State Arctic Development Program 2015–2025 2017).
12. Federal Target Program "Development of Transport System in Russia (2010–2020)," sub-program "Inland water transport."
13. Funding for modernization of the Tiksi port is yet undetermined; it has not been included into any of the current programs ("Ysia.ru" 2017).

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CHAPTER 10

Sustaining Sustainability in Whitehorse, Yukon, Canada

James Powell

Introduction

One major deficiency with the ISO approach is that it does not include specific indicators to track city-level planning; in addition, the ISO does not include specific measures of the implementation of sustainability plans. With its collection of 148 indicators, the ISO does measure a city's progress in improving its performance on the various indicators included in the international standard, but it does not provide any way to measure how much a city tries to achieve sustainability. This chapter shows how a city can use self-selected indicators to drive progress toward greater sustainability. Although the indicators that Whitehorse selected differ from those included in the international standard, there is considerable overlap.

Whitehorse, the capital of Canada's Yukon, demonstrates how a northern city can successfully plan and monitor sustainability when city leaders and the general public benefit from strong guidance, a comprehensive process, and access to funding. Few examples of successfully implemented sustainability plans can be found in the world today, and only a small fraction of those are in North America (Powell 2012). In this context, Whitehorse's sustainability planning history provides a rare instructive example of how a community's sustainability ambitions can become reality.

Four factors explain the success of Whitehorse in defining and implementing a sustainability plan. First, beginning in 2006, national gas tax revenue funds were passed through the Yukon territorial government for use by communities that agreed to develop sustainability plans (Yukon Government 2005), laying the foundation for Whitehorse to begin preparing its first sustainability plan in 2007.

The second factor is a shared commitment to learning. The high level of community engagement in Whitehorse illustrates how the community has learned together; at the same time that professionals have learned about public values and everyday life in Whitehorse, citizens have learned about overarching frameworks for achieving progress toward sustainability (Sapountzaki and Wassenhoven 2005). Public meetings, charrettes, well-designed websites, dashboards that consolidate information for decision makers and the general public—all these contribute to consensus building and a two-way learning process.

The third contributing factor is that the sustainability plan must align with broader city planning. In Whitehorse, the plans and dashboards (with focused, results-oriented strategies, including milestones and targets for improvements) are aligned with city priorities. The fourth and final critical contributing factor involves the community's culture of acceptance of government participation in sustainability planning as a legitimate and useful state function. As a result of its attention to fostering shared learning, aligned planning, and civic buy-in, Whitehorse stands out among Arctic cities as a leader in implementing and actualizing sustainable development at the municipal level.

This chapter examines Whitehorse's process for robust sustainability planning and implementation, based on in-depth interviews, participant observations, and a review of government reports and scientific literature. We interviewed twelve experts and decision makers involved in the process, including a mayor, members of the municipal and territorial governments, and representatives from First Nations.

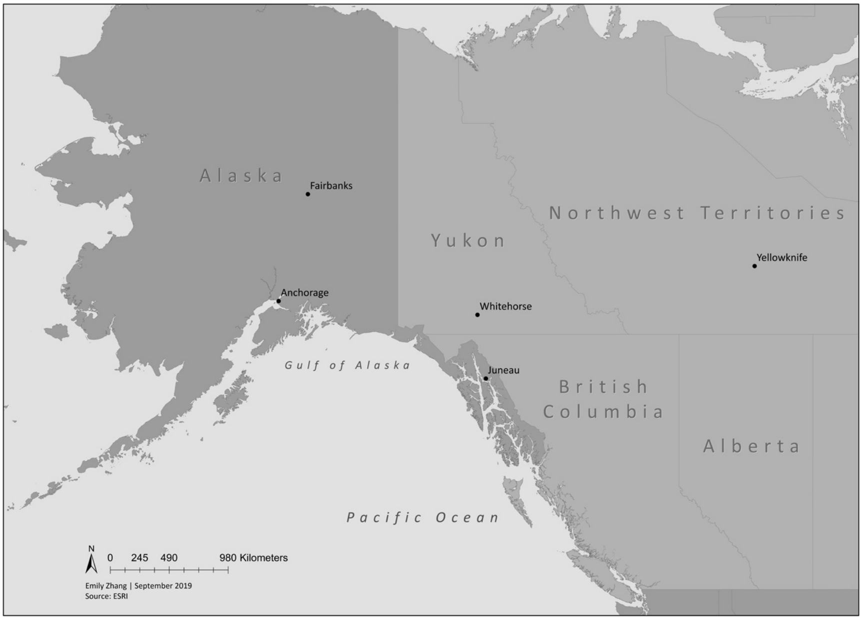
Underlying the four factors listed above, Whitehorse's success has relied on breaking down sustainability, a sometimes-nebulous concept, into smaller executable tasks without losing a systemic approach. The Whitehorse Sustainability Plan includes a vision, a list of values, and guiding principles, while the core focuses on twelve goals, each with specific targets and strategies to achieve those targets. The goals and targets are easily found on the city's website with highly readable dashboards for each of the twelve goals, and targets showing alignment with the sustainability goals. Each goal features a specific implementation approach, along with a brief synopsis of Whitehorse's jurisdiction regarding that particular goal.

Whitehorse's goals and targets are more focused than the ISO sustainability indicators laid out in the introductory chapter. As with many remote northern municipalities in Canada, the federal government provides Whitehorse with funding for services, facilities, and activities that boost its residents' quality of life in an effort to stimulate private sector activities associated with resource extraction. In contrast to many of its peers, however, Whitehorse stands out as a community that embraces sustainability and has found a way to integrate it into government policy with the support of its residents. Considering the lack of successful community sustainability indicator projects in the North and elsewhere, lessons learned from Whitehorse's success may be transferable to other cities.

The chapter starts with a short description of Whitehorse's social-ecological setting and the objectives of the study. We then review the progress that Whitehorse made between its first plan in 2002 (City of Whitehorse 2002) and its landmark Whitehorse Sustainability Plan (City of Whitehorse 2015b) in 2015. We compare those years to the three phases of sustainability planning, tracking Whitehorse's progress through each phase. We then study the Whitehorse Sustainability Plan and investigate how it has worked to build on Whitehorse's previous achievements. Finally, we will conduct an analysis using a tool in the American Planning Association's Planning Advisory Service Report 578 (PAS 578; Godschalk and Rouse 2015) and offer some discussion and recommendations for next steps.

Whitehorse's Social-Ecological Setting

In the northwestern corner of Canada lies Yukon, a territory that borders Alaska to the west, British Columbia to the south, and Northwest Territories to the east. The community of Whitehorse is situated in the wide valley of the Yukon River and the Yukon Southern Lakes Ecoregion. It is surrounded by three nearby mountains: Grey Mountain to the east, Haeckel Hill to the northwest and Golden Horn Mountain to the south (Yukon Government 2014). Whitehorse has a northern continental climate with cold, dry winters and mild, temperate summers; it is the driest city in Canada based on annual precipitation (City of Whitehorse 2010a). More than five thousand years before Whitehorse was established as a central settlement, aboriginal tribes, including the Tagish Kwan, Tlingit, Kasha, Han Gwich'in, and Tutchone Nations, used the area for food gathering, trade, and as a meeting place (City of Whitehorse 2013). The aboriginal tribes of the



Map 10.1 | *Map of Yukon and Whitehorse. Map created by Emily Zhang; published with permission.*

area moved around during different times of the year; archaeological findings confirm continual use of seasonal hunting and fishing camps. Descendants of these people are the Kwanlin Dün First Nation and the Ta'an Kwäch'än Council. Located at the head of the navigable waters of the Yukon River, and an important stop on the journey to the Klondike during the 1898 Gold Rush, Whitehorse became a settlement and transportation hub for a growing population of nonnatives (map 10.1). Once the White Pass and Yukon Railway linked Whitehorse with the Alaskan port of Skagway, Whitehorse became the center of transportation into and out of Yukon (City of Whitehorse 2013).

The City of Whitehorse was incorporated in 1950 as the capital of what was then called the Yukon Territory. In 2018 the population was 31,527; approximately 75 percent of the population are non-Indigenous peoples sharing the traditional territory of seventeen aboriginal, or First Nations, tribes (Statistics Canada 2011). The municipality of Whitehorse covers a large area of approximately 41,900 hectares, extending approximately 30 kilometers (km) from north to south and 14 km from east to west (City of Whitehorse 2013). The Kwanlin Dün First Nation and the Ta'an Kwäch'än Council are the largest landowners within the municipality.

As the largest community in Yukon, Whitehorse serves as a regional hub. Although remotely situated, the city is well connected in comparison to other northern communities, because the Alaska Highway connects Whitehorse to both Alaska and northern British Columbia. Whitehorse provides many government services and supports economic activity associated with Arctic and sub-Arctic natural resource extraction, such as mining and timber, in addition to tourism.

The city's slogan, "The Wilderness City," reflects the value its inhabitants place on Whitehorse's wilderness characteristics. Cultural and athletic events are common, and Whitehorse is well known in northern Canada and Alaska for its indoor and outdoor recreational and sports facilities. One example is the more than 700 km of maintained trails within the city limits alone (City of Whitehorse 2010a). With new facilities, including two ice rinks, a state-of-the-art fitness center, an aquatic center, and 75 km of groomed trails for cross country skiing, the community stays active and frequently hosts national and international events.

Demographics

Table 10.1 provides an overview of Whitehorse's demographics. Approximately 75 percent of the Yukon population lives in Whitehorse. The city outpaced the nation with a 7.8 percent increase in population compared with the national growth rate of 5 percent, according to the Yukon Bureau of Statistics July 2018 report and census data (Yukon Bureau of Statistics 2018a). In Yukon as well as in Whitehorse, between 2008 and 2018 the population, labor force, and employment trended upward (Yukon Bureau of Statistics 2018a). The territory's unemployment rate dropped from 7.2 percent in 2012 to 3.6 percent in 2017 (Yukon Bureau of Statistics 2018b). In 2018 the population of the territory hit a new record high of 40,483. The City of Whitehorse's population grew from 25,300 in 2008 to 31,527 in 2018, an increase of 24.6 percent. Housing has not kept pace with the growing number of residents (a problem shared with other northern urban centers), and housing costs have continued to increase dramatically in recent years ("Real Estate Market Report for Whitehorse, YT" 2016). During the third quarter of 2018 the average price of a single detached house was reported to be $475,000, an increase of $25,100 or 5.6 percent from the prior year. In 2016 the median price per home was approximately $402,000 (Yukon Bureau of Statistics 2018c).

All of our key informants indicated that the Yukon territorial and Canadian government both provide substantial funding to further

Table 10.1 | *Whitehorse by the numbers*

Category	2008 (except where indicated)	2018 (except where indicated
Total population*	25,300	31,527
Indigenous population**	3,770 (2011)	3,993 (2016)
Median age of population*	38.1	37.1
Average house price*	$322,800[4]	$475,000 (3rd quarter)
Unemployment rate*	7.6%	4.1%
Graduation rate*** (urban area—mostly Whitehorse)	68% (2013–14)	75% (2015–16)
Cost of living****		Cost of living (2019): $19.07/hr. Minimum wage: $12.71/hr.

Note: * Yukon Bureau of Statistics 2017; ** Yukon Bureau of Statistics 2017; *** Statistics Canada 2016; **** Hammond 2019.

develop and maintain Whitehorse's infrastructure. We included the six-year completion as an indicator of education. The graduation rate for urban Yukon, which includes all Whitehorse areas, has increased from 68 percent in 2013–14 to 75 percent in 2015–16 (Yukon Government 2017).

Sustainability Leadership

Canada has a long tradition of leadership in sustainability at the international and local levels. Recent trends are moving toward better integration in Canadian federal government departments with sustainability development defined in legislation and written into its mandate (Natural Resources Canada 2017).

Jurisdiction

The City of Whitehorse has responsibility for basic governmental services, including water, sewerage, garbage, recreational facilities, land development, roads, and fire control. Canada's federal and territorial/provincial governments are generally responsible for health, education, and libraries. However, the governments work together on several programs to support and fund different activities, such as sustainability planning. Unlike most other Canadian communities, Whitehorse lacks a municipal and territorial police force. The Royal Canadian Mounted Police is the only law enforcement agency.

Though the municipal and territorial governments do not fund a local police force and no such entity exists, there are some staff employed to respond to complaints.

Case Study Objectives and Methodology

The purpose of this study is to investigate how sustainability indicators and planning in Whitehorse have been and are being implemented. The research combined participant-observation, document analysis, and in-person interviews gathered in the Fall of 2017 and the Spring and Fall of 2018 (Kawulich 2005; Yin 2009). The interviews built on the author's twenty years of participation in numerous structured and unstructured meetings with members and leaders of the Whitehorse City Council. The author's access and established rapport garnered insight into local organizational culture and political processes and provided valuable context for government reports about sustainability plans and monitoring. In-person interviews were conducted with local officials and experts in an effort to provide additional context and to augment and confirm local data and reports.

The author interviewed twelve individuals—the mayor and two members of the Whitehorse City Council, two representatives from First Nations, and seven government officials from the City of Whitehorse and the Yukon government who worked on sustainability issues—in person in September 2017 and September 2018. The interviewees were selected based on their expertise and availability and their match with one of the following criteria:

- Current city or territorial employee with a role in city planning or sustainability issues such as recycling, energy, conservation, or climate change
- Current employee in a First Nations organization with a role in natural resources or sustainability planning

In order to learn about the major local issues in Whitehorse and to learn about how sustainability indicators were implemented in the municipality, the author asked each interviewee six open-ended questions (table 10.2). The interviews lasted approximately one hour, and all interviewees answered all of the questions. The answers were recorded.

As part of our analysis, we drew from the American Planning Association Planning Advisory Service Report No. 578 (PAS 578) titled *Sustaining Places: Best Practices for Comprehensive Plans* (Godschalk

Table 10.2 | *List of interview questions*

1. What do you think are the top five issues for Whitehorse?
2. Who has the most power over the key decisions in the city (e.g., local government, companies, federal government, First Nations, citizens, others)?
3. Is the city making sustainability plans for the future? Who is leading this process?
4. Does the local education system give students the knowledge and skills they need to continue living in the city?
5. How successfully is the city integrating renewable energy into its overall energy supply?
6. Are there indicators for measuring sustainability goals?

and Rouse 2015). In 2016 the American Planning Association published one of the few available standards for evaluating sustainability planning as part of local planning processes. The standards include six principles, two processes, and two attributes. Collectively, the American Planning Association considers these ten components as guidance for how sustainability should be integrated into comprehensive planning. The two required processes are authentic participation and accountable implementation. The best practices in these categories are used as measures to evaluate the development and implementation of sustainability plans.

Origins of Whitehorse's Sustainability Planning and Indicators

Sustainability planning and indicators (goals and targets) in Whitehorse can be traced back nearly fifty years to the city's first general plan, which was a land use plan adopted in 1976. In 1986 the general plan was replaced with the first Official Community Plan (OCP; City of Whitehorse 1987), as directed under the Yukon Municipal Act (Yukon Government 1986). The OCP was adopted under City of Whitehorse Bylaw 86-50, that states, "Future development and redevelopment within the municipality may be carried out, having regard to public input to consideration of orderliness, economy, convenience and physical, social and environmental consequences . . . on the basis of public input and of survey and studies" (City of Whitehorse 1987: 3).

The OCP is a policy document that provides an overall vision for the City of Whitehorse. The OCP also serves as a tool to guide decisions related to land development as it relates to residential and commercial projects, industrial activity, transportation infrastructure, and the environment (City of Whitehorse 2013).

Three Phases of Sustainability Planning and Indicators

Since 1986 major advances toward sustainability implementation have taken place in Whitehorse in three phases: (1) vision and principles, (2) issues and measures, and (3) measures and monitoring. Table 10.3 traces the evolution of the city's sustainability plans, beginning in 2002, when city leaders articulated a general vision and goals for sustainability. This vision laid the groundwork for the measurable sustainability goals and targets (indicators) detailed in the 2015 Whitehorse Sustainability Plan. The seven plans developed since 2002, along with the 2016 monitoring report (listed in table 10.3), all focused on sustainability. These plans required substantial commitment and leadership from the city, funding from the Yukon government, and public interest and pressure.

In 2007 the city hosted a four-day sustainability charrette to engage the public in developing the Strategic Sustainability Plan. The planning documents show that the visions, values, themes, and goals had not changed significantly over time but had gradually become more focused. The visions included in the 2002 OCP led to strategic planning, with measurable goals and action items set out in the 2015 Whitehorse Sustainability Plan, and, most recently, the 2016 Whitehorse Sustainability Plan Monitoring Report.

Phase 1: Vision and Principles

Although the OCP had been amended several times over the years, the first time a vision statement for sustainability was included was in the 2002 plan, which listed seven core principles of sustainability. These were broad and aspirational, without measurements or targets, and laid the groundwork for future sustainability goals and measures. The seven principles are listed in table 10.4.

When these principles were drafted in 2002, Whitehorse lacked blueprints or systematic guidance for developing and implementing holistic objectives such as quality of life. Because these goals reached beyond the scope of extant formal institutions, they had the unintended consequence of facilitating the appearance of informal drivers promoting sustainability, such as cultures of collaboration, local leadership, and partnerships—all considered necessary for successful

Table 10.3 | *Phases of Whitehorse's sustainability planning*

Phases of sustainability planning and implementation	Planning and sustainability policy documents	Major contents
Phase 1 Vision and Principles	2002 Official Community Plan (OCP)	The first time a sustainability vision with seven principles was included in a city planning document. The OCP, which is periodically updated, is largely a land use document reflecting community aspirations.
Phase 2 Integrated Framework: New Deal for Cities and Communities	2007 Integrated Community Sustainability Plan (ICSP)—a guide to infrastructure investment.	Funded under the federal Gas Tax Agreement 2005–15, the plan continued to focus on areas of emphasis. Ten priority areas were targeted for action. Based on community consultation, the plan proposed 87 actions, with a goal to complete 75 actions by 2014.
	2008 Strategic Sustainability Plan—Engaged the public on values and issues beyond infrastructure.	Building on the ICSP, the city adopted its Strategic Sustainability Plan and hosted a four-day sustainability charrette.
Phase 3 Measures and Monitoring	2010 Official Community Plan (OCP)—Amended	"Aims to integrate sustainability into City operations and decision-making." (OCP 2010: 7) Wilderness highly valued, with nearly 60% of the land within the city boundary reserved for greenspace.
	2010 Sustainability Achievements, Sustainability Trends	Seven sustainability goals with an analysis of trends.
	2011 and 2012 Strategic Sustainability Plan Highlights Summary	Progress report on seven key principles.
	2015 Whitehorse Sustainability Plan 2015–50	Transformed the 2008 Strategic Sustainability Plan into a city-wide plan reflecting aspirations of the entire community.
	2016 Whitehorse Sustainability Plan Monitoring Report	Report on 2014–15 progress toward targets.

Note: Three phases categorize the development of sustainability planning and indicator development using the City of Whitehorse's planning documents. The table lists each phase with relevant documents and dates and a short description.

Table 10.4 | *Seven principles of sustainability*

1. Management of growth for the long term	Consider the long-term impacts of all land-use decisions. Ensure short-term decisions do not compromise long-term intent. Make sure services and amenities are available close to home.
2. Environmental stewardship	Grow in harmony with the natural surroundings and ecosystems. Preserve all important and unique natural features, including watercourses, landforms, and habitats.
3. Social responsibility	Ensure that all residents live in a safe community and have access to affordable housing, educational opportunities, and recreational facilities.
4. Maintain and enhance the quality of life	Focus on creating a high quality of life for residents. Consider the visual, social, environmental, and community impacts of development.
5. Provision of trails and recreational opportunities	Recognize the importance of trails for both motorized and nonmotorized modes of travel. Provide for the expansion and enhancement of trails and ensure that trails and park spaces are safe and accessible by all.
6. Economic diversity and vitality	Create a diverse, flexible, and vibrant local economy that provides sustainable employment.
7. Involve the community	Provide a process for involving residents in land use and community development decisions. Build consensus on actions affecting the city's future.

Note: Modified from Whitehorse's 2002 OCP (City of Whitehorse 2002).

sustainability planning (Gattinger, Saint-Pierre, and Couture Gagnon 2008). Since sustainability is not mentioned in the Yukon Municipal Act, jurisdiction over the cultural domain of sustainability was shared; this jurisdictional ambiguity and a lack of formal planning guidelines opened the door for sustainability policy and planning innovations.

Phase 2: Integrated Framework

The next major phase of sustainability planning occurred as part of a national effort to address infrastructure funding needs. Canadian federal policy has recognized the growing need to respond to global, environmental, and demographic challenges through actions that are "local and shaped by a strong sense of place" (External Advisory Committee on Cities and Communities 2006: 10). Like most rural communities across Canada, Whitehorse's infrastructure is aging, and limited means are available to raise the money necessary to respond to the infrastructure deficit. In response, in 2007, with the Government of Yukon providing substantial impetus and funding, the City of Whitehorse adopted the Integrated Community Sustainability Plan (ICSP). The ICSP was shaped according to the process set out by Canada's Gas Tax Revenue Fund, which provided revenue from gas taxes through a Gas Tax Agreement between Whitehorse and Yukon (Yukon Government 2005). That agreement was part of a national effort referred to as a "New Deal for Cities and Communities," designed to respond to the increasing infrastructure deficit and the inability of municipalities alone to raise the necessary funds to respond (City of Whitehorse 2009).

The New Deal for Cities and Communities grew out of the Canadian federal government's External Advisory Committee on Cities and Communities, which, in 2006, put forward a vision and approach for sustainable development for cities and communities that was based on a four-pillar framework (External Advisory Committee on Cities and Communities 2006), on which ICSPs were to be built.

Yukon First Nations, specifically the Kwanlin Dün First Nation and the Ta'an Kwäch'än Council, as well as the City of Whitehorse, were funded for planning and infrastructure. The Gas Tax Agreement directed the city to develop a long-term plan, to be prepared in consultation with community members, that would set out means for the community to realize sustainability objectives for the environmental, cultural, social, and economic dimensions of its identity (Yukon Government 2005).

In a background paper intended to furnish both provinces and municipalities with information on ICSPs, the federal government clearly stated its intentions with regard to this process: the requirement for municipalities to develop ICSPs was designed to accelerate the shift in local planning and decision making toward a longer-term, more-quantifiable, and more-participatory approach to achieving sustainable communities. ICSPs have been identified as a means to help cities, communities, and First Nations effectively plan and manage their resources to achieve identified outcomes, deliver services, and address priorities within an integrated framework encompassing the economic, environmental, social, and cultural dimensions of community sustainability (Yukon Government 2005: 4–5).

The Whitehorse ICSP included a list of seven values (sense of community, quality of life, nature and beauty, contributions of the First Nations, leadership, vibrant arts and local business); these values were aligned with goals and measures of success. The measures of success represented the first such list spanning sustainability areas, or domains. The measurements ranged from activities and general objectives, such as “Increase cultural awareness” and “Build a new fire hall” to Leadership in Energy and Environmental Design (LEED) standards. Several of the measures suggested increasing or decreasing activities, such as “Increase transit service” or “Implement a water metering program.” However, there were no targets or quantitative measures set in the plan.

In 2008 the City of Whitehorse decided to develop a Strategic Sustainability Plan that would build on the work done for the ICSP. As part of this effort, the city hosted several visioning and charrette exercises to develop a vision and principles beyond basic infrastructure, which had served as the focus of the ICSP. The city, with input from the general public, developed and included in the 2008 Strategic Sustainability Plan the following vision statement: “Whitehorse will be a well-planned self-sustaining community that is a leader in energy conservation and innovation that maintains and conserves wilderness spaces for future generations. Whitehorse will continue to strive for a better quality of life that is reflected in its vibrant economy and social life” (City of Whitehorse 2008: 8).

This plan advanced the original sustainability principles in the 2002 OCP (see table 10.4) by modifying them into seven core principles—thriving environment, community development, leadership, diverse local economy, equity, cultural identity, and education—each with related goals (see table 10.5; City of Whitehorse 2010b).

Phase 3: Measures and Monitoring

In 2010 the Strategic Sustainability Plan was integrated into the 2010 Official City Plan; at the same time, the city published the Sustainability Achievements and Trends report (City of Whitehorse 2010b). This report was the first major sustainability report on progress in Whitehorse. After more than a decade of sustainability planning, there were many clear and measurable indicators of success; progress toward meeting the goals established in the sustainability planning documents was clearly being made. Many benchmarks that had been established in the course of sustainability planning (see table 10.5), and significant progress toward those goals, had been accomplished. Impressively, the sustainability achievements in Whitehorse occurred in several areas, going well beyond energy conservation and recycling. Consistent with the integrative nature of successful sustainability planning, the city’s program spanned departments and organizations while examining the entire system.

Table 10.5 | *Seven core principles and achievements*

Seven core principles	Goals	Achievements
Thriving environment	Achieve community waste targets	A goal is set to achieve zero total waste by 2040, with 32% diversion in 2013. Total landfill diversion increased from 1,200 metric tons in 2000 to 3,500 tons in 2014; curbside diversion rates reached 42% in 2009.
Community development	Prepare local climate change adaptation plan	Responding to climate change is one of the City of Whitehorse's twelve sustainability goals. Greenhouse gas (GHG) emissions reduced to 2014 level and holding steady. The Yukon government released its Climate Change Action Plan in 2009 and updated it for 2016–18. A goal is set to increase renewable energy use, with new solar on all city buildings in 2019.
Leadership	Reorganize city admin structure to deliver sustainable services	The 2010 OCP addresses restructuring to include sustainability in all operations, to be facilitated by a sustainability project manager hired to work with all departments to integrate sustainability into city operations.
Diverse local economy	Develop an economic strategy	The 2010–11 Economic Development Action Plan is completed. The city begins to develop an integrated branding initiative to be completed in 2011.
Equity	Ensure universal accessibility	All public service areas of city facilities are now universally accessible. Barrier Free Access construction is now implemented in all new city buildings.
Cultural identity	Increase use of trail network	Eleven new trailheads are established in 2010. Trail signage and features are completed on hiking and mountain bike trails; 10 km of new trails are constructed and 15 km of existing trails enhanced.
Education	Sustainability education	Community consultations, such as charrettes, provide opportunities for public education and exchange. City environmental grants continue to support community environmental initiatives.

Source: Based on City of Whitehorse 2010b.

Whitehorse Sustainability Plan

The City of Whitehorse Sustainability Plan 2015–50 replaced the city ICSP and moved sustainability planning forward by updating and refining the sustainability documents published by the city over the preceding thirteen years. The Whitehorse Sustainability Plan is a comprehensive and highly readable strategic planning document that includes a vision, values, themes, and principles (see table 10.6). This plan also describes the four-part process that was used to develop it. First, gaps and strengths in thematic plans such as the solid waste plan were considered. Second, staff, stakeholders, and the general public were consulted about the vision statement and preliminary goals and targets. Third, staff was consulted about refining the goals to ensure targets would be based on best practices. Finally, partners outside city government, including the public, were asked to help achieve the goals. These steps clearly demonstrate Whitehorse's successful integration of sustainability planning into its city government and active engagement with the public (City of Whitehorse 2015b).

Table 10.6 | *Values, themes, and principles of 2015 Whitehorse Sustainability Plan*

Plan components	Description
Vision	"Whitehorse will be a well-planned, self-sustaining, innovative community that leads in management and conservation of wilderness, energy, and resources for the future. Whitehorse will strive for a good quality of life for all, a stable economy, and a socially diverse community."
Seven values	Sense of community Quality of life Nature and beauty Contributions of First Nations Leadership Vibrant arts Local business
Themes	Lead through partnerships Citizen stewardship Integrate sustainability into city business Focus on existing assets Stay the course (use the plans) Continuous learning—move toward measuring progress, with clear, ambitious, long-term goals.
Principles	Fundamentals, decision making, and process

The Whitehorse Sustainability Plan's Twelve Goals, and Strategies with Targets (Sustainability Indicators)

The Whitehorse Sustainability Plan features twelve goals and strategies (listed in table 10.7). The strategies for each goal were developed collaboratively by staff, the general public, and stakeholders. Forty action-associated targets (indicators) were included in the Whitehorse Sustainability Plan as a method for measuring progress toward sustainability. For example, one of the goals, "Efficient low-impact transportation," is accompanied by a target (indicator) to "Increase active transportation and transit mode share," with milestones set for 2020, 2030, and 2050 at 35 percent, 48 percent, and 55 percent, respectively (City of Whitehorse 2015b: 18). A variety of specific strategies for operationalizing each goal and target are listed in an appendix to the plan. These goals and targets, with specific activities, also delegate oversight of the plan to a governing body at the city. The sustainability targets encompass all domains of sustainability. In order to keep the public and experts alike informed and engaged, the Whitehorse Sustainability Plan also features a communications plan featuring a webpage with easily understandable dashboards (City of Whitehorse 2015b: 29–30).

The city has clearly articulated the limitations of the plan. For example, the text includes the following caveat on data quality and monitoring: "Monitoring is still in its early phases. In general, data that is reliable, available, and specific to Whitehorse is limited. Obtaining good information, both pertaining to City operations and in partnership with other data collectors for topics outside City jurisdiction, remains an important task" (City of Whitehorse 2016: 1).

Table 10.7 | *Whitehorse Sustainability Plan: Twelve sustainability targets (indicators)*

Strong downtown and livable neighborhoods	Efficient low-impact transportation	Green building and infrastructure	Healthy environment and wilderness
Energy and greenhouse gas (GHG) reduction	Dynamic and diverse culture, heritage, and the arts	Social equity, affordable housing, and poverty reduction	Connected, engaged, participatory community
Safe and healthy community	Diverse local economy	Zero waste	Resilient, accessible food system

It took many years for Whitehorse's community sustainability planning to get to this point. The city's milestones and achievements may be familiar to some cities and instructive for others. The key components of the city's programs evolved over time with strong top-down direction from city staff, elected officials, and experts. These were largely enabled and supported by Yukon government funding under the gas tax (Yukon Government 2013). It is questionable whether the impressive sustainability efforts would have been achievable if not for the funding provided by the Yukon government. The city integrated the top-down approach with a bottom-up approach by engaging the general public and stakeholders at several town hall meetings and charrettes. The integrated top-down/bottom-up approach provides extra benefits of engaging the community to support sustainability policy (Fraser et al. 2006). The long timeline for success, with slow plans and targets (indicators), reflects the cumbersome and significant time necessary for planning processes and the plodding pace of institutional change found in any government system. It took sixteen years for Whitehorse to move from sustainability vision statements to measurable sustainability indicators (goals and targets). As sustainability plans were developed and adopted, it became clear to the city that the action goals and targets would become realized only by hiring staff to guide the work. Sustainability was then institutionalized by the creation of a new position in the Planning office, which is now referred to as the Planning and Sustainability office. The Planning and Sustainability office prepared a comprehensive list of sustainability indicators, which reach across all programs, along with a website with easily readable dashboards for each of the sustainability targets shown in table 10.7 (City of Whitehorse 2019).

Highlights from Whitehorse's Sustainability Goals and Targets

A sample of five of Whitehorse's twelve sustainability goals and targets (indicators)—zero waste, green building and infrastructure, diverse local economy, resilient and accessible food systems, and connected, engaged, participatory community—illustrates the city's significant innovation in charting and tracking its progress toward its specific sustainability goals. Based on in-person interviews and government documents, several aspects of Whitehorse's goals and targets bear particular significance for the community.

Goal: Zero Waste

Some of the unique and interesting aspects of Whitehorse's sustainability goals and targets (indicators) have to do with the way progress is measured. Whitehorse's sustainability goals include targets that exceed national objectives, in acknowledgement of the community's identity as "The Wilderness City." The goal of zero waste is ambitious, given the city's remote location and limited opportunities, but it aligns with the aspirations and concerns of Whitehorse's current mayor (in-person author interview with Dan Curtis, 27 September 2018). When asked to describe the issue most important to him, he replied, "Of all the issues, solid waste keeps me up at night thinking about what is the solution." One of the major reasons for Mayor Curtis's top concern is the cost of the current and future liability for managing and closing the city's landfill facility. Each year, the city is legally obligated to set aside funds for the landfill closure liability fund (City of Whitehorse 2018a). The funds are directly correlated with the total volume of waste going into the landfill. The estimated cost to properly close the landfill is $13 million (US) (City of Whitehorse 2018b). Other Canadian cities, such as Edmonton, Halifax, and Nanaimo, are models for Whitehorse, as they are diverting more than 50 percent of their waste. Whitehorse has developed several initiatives to increase its diversion rate by recycling and composting. By developing specific goals and targets for each of the waste types (e.g., organics, glass, cardboard, plastics, paper, metals), the city provides specific information and knowledge necessary for reaching the higher diversion rates. As a result of this work, recycling diverted more than 3,500 metric tons of paper, cardboard, plastics, tin, and glass in 2015 (City of Whitehorse 2018b). The city composting program has also expanded since 2008, when the city started a curbside organic waste collection program. Now, the city compost is being sold; as of April 2017, the city compost is listed by the Organic Materials Review Institute, which means people can use it in organic crops, gardens, and operations (City of Whitehorse 2018b). City solid waste and planning officials agree that having goals and targets has contributed to increases in waste diversion from the landfill. As one told me, "In general, having a [firm] goal identified in the 2015 Solid Waste Action Plan contributed to waste diversion in the area of cardboard and commercial waste."

Table 10.8 | *Green building and infrastructure: Targets and progress made*

Target	Measure	Progress
City-owned buildings: Make new buildings 50% more efficient than the National Energy Code (NECB)	Achieve 50%	The new Operations Building will be 80% more efficient than the NECB goal. The new fire hall will be 50% more efficient.
City-owned buildings: Make building retrofits with a 20-year or longer lifespan 30% more efficient than the NECB	Achieve 30%	Modeling for upcoming renovations to city hall and transit building are not available.
New buildings in Whitehorse to be 30% more efficient than the NECB, National Building Code, or will achieve comparable targeted EnerGuide Ratings	Change requirements by 2029	No progress
Reduce per capita water consumption	10% decrease by 2020	Per capita water consumption has held steady at approximately 450 liters per day since 2014.
Manage all infrastructure, buildings, and natural assets in asset management system	90% completion by 2020	Asset management continues at the city.

Source: City of Whitehorse Sustainability Plan 2015–2020, p. 21.

Goal: Green Building and Infrastructure

Whitehorse has made progress toward the goals for green building and infrastructure and, in some cases, has exceeded goals and expectations. Three of the targets for building standards far exceed the National Energy Code, which is particularly impressive for a northern community with historically high heating costs. Table 10.8 lists the targets and progress made.

Goal: Diverse Local Economy

As Yukon's capital city, Whitehorse is the service center for all levels of government in the territory. The single highest employer in Whitehorse is government (public administration) with nearly 24 percent of the workforce working in territorial, municipal, First Nations, or government services. (Yukon Government 2016). While the community enjoys substantial employment and associated economic benefits from public sector jobs, diversifying the local economy is a major sustainability goal. The Sustainability Plan states three targets for measuring economic progress: (1) maintain a long-term financial plan, (2) increase the economic diversity index, and (3) increase the number of business licenses (City of Whitehorse 2019). Given that government employees make up a large share of Whitehorse's workforce, the goal of increasing private sector jobs is important for the sustainability of the city and region. One of the growth areas, wilderness recreation, continues to expand, and now attracts hundreds of thousands of independent travelers each year.

Goal: Resilient and Accessible Food Systems

As is true in other northern economies, a major barrier to quality of life and sustainability is food security, so it is no surprise that this issue is receiving increasing attention from northern communities such as Whitehorse and Fairbanks (table 10.9). The Fairbanks North Star Borough recently identified food security as one of its top three sustainability issues. With more than 95 percent of their food imported, most northern remote communities are food insecure (lacking access to affordable, acceptable, and adequate food to meet their daily needs and preferences; Kassie et al. 2016), despite the availability of subsistence resources. Whitehorse is no exception. In 2012, more than 17 percent of Yukon households were food insecure. Northern urban communities are even more dependent on imported foods than northern rural communities. Several northern urban and Arctic communities are currently developing indicators for measuring

Table 10.9 | *Production, processing, distribution, and sales of local, healthy food to all residents*

Target	Measure	Progress
Increase consumption of local food	Set targets	Metric to be determined
Increase number of community garden plots	35% increase by 2020	Five neighborhoods or organizations have community gardens, up from two in 2014
Increase amount of finished compost produced by the city each year	10% increase by 2020	2,457 tons of raw compost was collected in 2017, up from 2,222 ton in 2014

Source: City of Whitehorse Sustainability Plan 2015–2020, p. 37.

food security; some are receiving assistance from the federal government for food security initiatives, including hoop farms. As communities build their capacity to produce a small percentage of their own food, it could generate jobs and fresher food, and help diversity the economy. Citizen engagement has been an important feature of the development of this goal, with focus groups, surveys, and city meetings held in 2016 and 2017 (City of Whitehorse 2015a).

Whitehorse's Community Economic Development Strategy 2015–20 further contributes to the resilient and accessible food systems goal by identifying facilitation of "the development of an agriculture and food production strategy within the city and surrounding area" as one of eight focus activities (City of Whitehorse 2015a: 5). Progress toward food security goals is being helped along by the increase in availability of compost generated locally, an example of the kind of synergies that work to advance multiple sustainability goals (Kenny 2018).

Goal: Connected, Engaged, Participatory Community

The connected, engaged, participatory community goal in the Whitehorse Sustainability Plan seeks to increase civic engagement, agency, and empowerment. This goal and its targets (indicators)

Table 10.10 | *Targets for connected, engaged, participatory community*

Target	Measure	Progress
Increase the number of neighborhoods with active and engaged community associations.	35% increase by 2020	7 community associations are now registered in good standing under the Societies Act, up from 5 in 2014.
Increase number of city partnerships on special events and joint projects.	5% increase by 2020	City partnerships numbered 38 in 2017, up from 35 in 2014.
Increase percentage of population that regularly volunteers.	5% increase in volunteerism by 2020	Information not yet available.
Increase number of new, unique, or annual opportunities for public participation.	3% increase by 2020	Public engagement events dropped to 47 in 2017 from 60 in 2014.
Increase direct engagement with hard-to-reach audiences (% of major consultative processes with at least one direct opportunity).	10% increase by 2020	Not available.

Source: City of Whitehorse Sustainability Plan 2015–2020, p. 29.

feature very innovative and nontraditional metrics. The targets are summarized in table 10.10.

Each of the targets (indicators) in table 10.10 has a corresponding goal set for 2020, 2030, and 2050.

One interesting feature of the Whitehorse community is its citizens' high level of trust in the government and public process in general. This could influence how the general public might receive sustainability planning and indicators. When asked who makes decisions in Whitehorse, our interviewees typically responded, "The people make decisions." Considering a large percentage of the citizens are government employees, this is not entirely surprising. Political polarization was not mentioned among our interviewees as a major issue in Whitehorse.

The contrast with the US context is clear. The Fairbanks North Star Borough's community leadership under former mayor Karl Kastle included a new style of a town hall meeting called Sandbox, wherein the mayor used live polling to get a sense of public opinion and as a tool in engaging the public in discussion (Engman 2017). As a threat to sustainability, political polarization is an issue that needs attention in sustainability planning so that greater unity may be achieved as a facilitator of progress toward sustainability.

Whitehorse Sustainability Monitoring Report 2016

The 2016 Whitehorse Sustainability Plan Monitoring Report exemplifies the city's strong commitment to monitoring its progress. The Whitehorse Sustainability Plan was adopted by the city in 2015 and is an update of the 2008 Strategic Sustainability Plan. It measures twelve community-wide goals, with forty associated targets that serve as a measure of progress toward sustainability goals (City of Whitehorse 2016). Dashboards the city is using to track goals and targets include a short description of the goal, with one to eight targets for each goal, and additional information displayed graphically along with information about trends.

The dashboards used in the monitoring report are also used on the Whitehorse Sustainability Plan website, which is administered by the city's Department of Planning and Sustainability (figure 10.1). The dashboards on the website present more detail, including specific quantitative measures with benchmarks. They also display progress made toward each benchmark. A rationale for each goal is provided, as is information about the city's jurisdiction; its authority to effect

Figure 10.1 | *Sustainability dashboard. Screenshot by the author.*
Note: Screenshot of the zero waste goal, one of Whitehorse's twelve sustainability goals, showing target (indicator) measures, progress, and other information on the Whitehorse Sustainability Plan, from the website (City of Whitehorse 2019).

change on an issue is rated as high, medium, or low. Progress is also shown with a graphic of a round gauge showing the current status of each goal, with a pointer indicating weak, fair, moderate, or good.

Analysis, Next Steps, Discussion

The American Planning Association's PAS 578, titled *Sustaining Places: Best Practices for Comprehensive Plans* (Godschalk and Rouse 2015) was used in part as a method for evaluating the level of implementation of the Whitehorse Sustainability Plan. Ten of the best practices under the American Planning Association's accountable implementation component were used as a reference or checklist to evaluate how Whitehorse's sustainability implementation was done. PAS 578, one of the few available reference documents with standards for sustainability in comprehensive plans, was published in 2015 (Godschalk and Rouse 2015). The standards include six principles, two processes, and two attributes. The American Planning Association considers these ten components collectively as guidance for how sustainability should be integrated into comprehensive planning.

The American Planning Association considers implementation of planning as a set of actions that carry out the proposals of a plan over time. PAS 578 ties the goals and proposed actions to defined timetables, activities, budgets, and agencies; reports their effectiveness to the public; and revises the plan based on the reported findings (Godschalk and Rouse 2015).

Traditionally, comprehensive plans have been open to criticism because they usually do not connect goals and policies to actual implementation, with the occasional exception of revising zoning and development regulations (American Planning Association 2016). By contrast, accountable implementation weaves the plan into the daily activities of the local jurisdiction and its various departments, including budgeting and capital program funding (American Planning Association 2016). Figure 10.2 shows ten actions listed in PAS 578 that must be taken to ensure a sustainability plan is implemented (see Godschalk and Rouse 2015 Appendix B for definitions).

Applying the list in figure 10.2, shows how well Whitehorse has implemented its sustainability plan. Overall, Whitehorse has taken most of these actions. For example, addressing 8.1 and 8.6, the Whitehorse Sustainability Plan includes a highly readable table for each of the twelve sustainability goals; the table features targets, measures with benchmarks, and progress updates along with an appendix for additional specific actions that could help achieve the goals (see figure 10.1). Regarding 8.2, 8.3, and 8.5, funding for implementation is generally provided with revenue from the federal gas tax that is specifically designated for community sustainability. The capital budget is linked to the sustainability plan. The interagency cooperation recommended in 8.4 is foundational to the sustainability plan's origin; funded by Government of Yukon and requiring First Nations cooperation, sustainability planning in Whitehorse has necessitated a large polycentric approach from the outset. Municipal, territorial, First Nations, and nongovernmental organizations have all played important parts in the Whitehorse Sustainability Plan.

Whitehorse has also accomplished the monitoring and reporting recommendations of PAS 578 (8.7 and 8.8; Godschalk and Rouse 2015); since 2002, the sustainability plan has been reviewed, refined, expanded, and updated. Reports have also been published for public review; the 2010 achievement reports and the 2016 monitoring report demonstrate Whitehorse's commitment to monitoring and reporting.

8. Accountable Implementation
8.1 Indicate specific actions for implementation.
8.2 Connect plan implementation to the capital planning process.
8.3 Connect plan implementation to the annual budgeting process.
8.4 Establish interagency and organizational cooperation.
8.5 Identify funding sources for plan implementation.
8.6 Establish implementation indicators, benchmarks, and targets.
8.7 Regularly evaluate and report on implementation progress.
8.8 Adjust the plan as necessary based on the evaluation

9. Required Attributes:
9.0 Consistent Content
10.0 Coordinated Characteristics

Figure 10.2 | *Accountable implementation factors. Created by the author.*
Source: Godschalk and Rouse 2015, Sustaining Places: Best Practices for Comprehensive Plans PAS Report 578, American Planning Association. Retrieved 6 January 2019 from http://www.joslynutc.org/apa_sustaining_places.pdf.

The City of Whitehorse has done exceptional work in its approach to integration with existing plans and consistent formatting, use of websites, and user-friendly language. All of these approaches address 9.0 and 10.0, which require consistency across plan subcomponents, transparency, and multiformat accessibility.

Next Steps for Implementation

In-depth insights offered by city officials have provided a balanced critique of the utility of Whitehorse's dashboards and the city's efforts to institutionalize sustainability planning and indicators. At least three specific strategies have been deployed to maintain progress toward the sustainability goals in a variety of city governance processes and policies. The first strategy is to require that projects in the city's capital budget support the goals in the Whitehorse Sustainability Plan. Second, biannual city environmental grants require applicants to demonstrate how their projects will support the Whitehorse Sustainability Plan's goals; this initiative helps keep the sustainability plan relevant to interest groups and the general public. Third, the sustainability goals have been integrated into the OCP since 2007. As the most important ongoing planning document, the OCP retains and dovetails with sustainability goals.

The Whitehorse Sustainability Plan could be strengthened by increasing staffing; this would accelerate implementation of the many sustainability goals and help the city reach its targets. However, for a small city of less than thirty-five thousand people, it is unusual to even have environmental coordinators with sustainability planning and implementation as part of their portfolios. In order to monitor progress of the many sustainability goals, more staff are needed. Also, access to the sustainability plan and its goals could be improved by reducing the number of layers of webpages a viewer has to browse to find information; though sustainability information is clearly presented, website accessibility needs to improve. Finally, it does not appear that the city conducts formal educational programs on its sustainability goals. Integration of the sustainability program into existing primary and secondary school curriculum and short programs for the general public would enhance the exchange of knowledge among members of the public, other stakeholders, and the city.

Factors for Successful Sustainability Implementation

Preconditions for implementing sustainability plans and indicators are becoming more apparent as more cities are developing sustainability plans and addressing the challenges of implementation. Though full implementation of a sustainability plan is rare, it can be achieved if the right factors or conditions exist. Based on this Whitehorse case study and research conducted in other cities, five general characteristics have emerged as prerequisites for implementation of sustainability plans and effective use of indicators.

The first characteristic is a shared commitment to learning. The high level of community engagement in Whitehorse illustrates how the community has learned together; as professionals have learned about public values and everyday life in Whitehorse, citizens have learned about overarching frameworks (Sapountzaki and Wassenhoven 2005) for achieving progress toward sustainability. Public meetings, charrettes, well-designed websites, dashboards that consolidate information for decision makers and the general public: all of these things contribute to consensus building and two-way learning processes.

A second critical contributing factor is that the sustainability plan must align with broader city planning. In Whitehorse, the plans and dashboards (with focused, results-oriented strategies, including milestones and targets for improvements) have been properly aligned with city priorities.

The third critical contributing factor involves the community's culture of acceptance of government participation in sustainability planning as a legitimate and useful government function.

The fourth characteristic involves accessible and highly readable planning documents.

Finally, funding and resources must be made available, especially to maintain a dedicated office and staff tasked with implementation and funding.

Discussion

Sustainability definitions, holistic approaches, and long-term goals may sometimes seem to be at odds with the immediate tangible needs and outcomes of local stakeholders. Government officials, researchers, and academics have an opportunity to initiate a two-way learning process to overcome what has proved to be a wicked problem of failed consensus building around sustainable development and planning. Whitehorse met this challenge with regular planning activities that include public engagement in combination with highly readable and synthesized documents.

The most striking aspect of Whitehorse's sustainability planning and indicators effort is the relationship between the city's copious and robust sustainability plan, the monitoring plan, and the city council's annual priorities, and the integration of the plans and priorities into Whitehorse's programs and projects.

Each year, Whitehorse City Council reviews the Sustainability Plan at its city council retreat; every two years, the Official Community Plan is updated in reference to the Whitehorse Sustainability Plan's long-term 2050 vision. From the beginning of Whitehorse's sustainability journey (represented by Official Community Plan in 2002) (City of Whitehorse 2002), we see an integrated approach that includes all municipal programs and issues. Although sustainability's major tenet is to use a systems and integrated approach, cities around the United States often fall back on focusing narrowly on energy and efficiency, working from an incomplete vision of sustainability (Powell 2012). Whitehorse avoids this, and does so while ensuring the public stays informed and involved.

Conclusion

As a result of its attention to fostering shared learning, aligned planning, and civic buy-in, Whitehorse stands out among Arctic cities as a leader in implementing and actualizing sustainable development at the municipal level. One Whitehorse city official interviewee mentioned that, beyond a commitment from city staff and management, long-term planning for sustainability will require an ongoing push from the public and endurance from staff.

Whitehorse's sustainability planning and implementation serves as a model for other communities in northern and Arctic urban communities. Sustainability planning efforts may not have occurred so successfully, however, without the city's leadership and its partnerships with and substantial support from the federal and regional governments. Many cities around the globe and in the Arctic use comprehensive sustainability plans and have lists of targets or sustainability indicators. However, very few communities successfully implement their sustainability plans (Powell 2012). After reviewing several other northern cities in North America and in northern Europe, Whitehorse's implementation of its sustainability plans and indicators stands out as most impressive. The characteristics of Whitehorse's successful sustainability planning and indicators program may help guide other cities that are considering putting in place an effective, active, and measurable local sustainability effort.

James Powell is assistant professor of public administration at University of Alaska Southeast, Juneau, Alaska.

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CONCLUSION

Next Steps for Measuring Arctic Urban Sustainability

Robert W. Orttung

Introduction

This book has sought to further our understanding of Arctic urban sustainability in several ways. First, it applied various metrics defined by ISO 37120, the international standard for measuring urban sustainability, to a variety of Arctic cities to see if the metrics are applicable and useful. Second, it provided an overall critique of the standard; some chapters in this book offered extensions to the current standard that can be used in conjunction with the current ISO metrics to increase our understanding of urban sustainability in Arctic conditions. Third, the chapters laid out a considerable amount of case study material about the Arctic cities themselves. Urban studies in the Arctic is a relatively young field and this book hopefully will deepen our knowledge about sustainability processes in some of the most prominent Arctic cities. The chapters use the ISO as a starting framework but include other extensive rich data to fill in the gaps left by the ISO itself. As Vera Kuklina and Natalia Shishigina's chapter put it, we tried to include the creativeness and beauty of the Arctic cities as well as the raw data. This concluding chapter will tie together the most important findings and lay out areas for future research.

ISO 37120 provides a wide-ranging overview of urban sustainability and brings together data on everything from economic indicators to wastewater management. Applying the metrics in the standard make it possible to compare policies and outcomes across cities in countries as diverse as Canada, Finland, Greenland (Kingdom of Denmark), Iceland, Norway, Russia, Sweden, and the United States.

Although ISO 37120 presents itself as the international standard for measuring urban sustainability in all cities on the planet, we do not see it as the final word in measurement, but rather a useful tool to help uncover issues and start discussions. We did not attempt a complete application here because the ISO contains 128 indicators, and there are approximately fifty Arctic cities with a population of more than twelve thousand people. Collecting the 6,400 data points (128 x 50) for a comprehensive comparison is a task for the future—one that we are currently trying to implement. In the meantime, however, it is possible to raise several general and specific questions about the standard.

What Is the Theory of Sustainability?

One general question that deserves attention is whether there is a theory of sustainability in ISO 37120. Certainly, the document laying out the standard does not differentiate causes from effects. It simply uses its definitions to measure the level of sustainability the cities have achieved.

Sustainability theory is at core an assertion that we need to pay attention to how current practices will affect living standards in the future and that economic, environmental, and social processes are intertwined in ways that cannot be separated. The hypothesis is that cities that approach decision making in a holistic manner will achieve better outcomes that make life better for future generations.

Why do some cities perform better than others in terms of sustainability? Because we have not fully implemented the ISO indicators for the Arctic cities in a comprehensive manner, we are not in a position to state authoritatively how the cities compare to each other. While we have measured some aspects of sustainability across a few of the cities, these analyses provide only a partial picture of the overall sustainability story.

In order to answer the question of why some cities perform better than others, we will need answers to an additional question: Do one or more of the items measured drive sustainability or is it the combination of all the elements taken as a whole that is important? Depending on your background, you might argue that the real driver is governance, or the effort to reduce greenhouse gas emissions, or some other factor. A political scientist, for example, might say that sustainability is the result of effective political leadership from above or active citizen participation from below, or, more likely, some combination of these two elements and their interactive effects. Research has shown that such interaction is crucial in numerous areas of human development, including democratization (Lussier 2016), police reform (Marat 2018), and urban design (Ryan 2017; Sanoff 2000: 7). Engineers might be more inclined to look at ways to reduce greenhouse gas emissions, and argue that such efforts are central to sustainability regardless of the way that society is organized politically. Others will focus on elements of culture or a whole range of other potential drivers.

Of course, as Jim Powell's chapter on Whitehorse makes clear, sustainability planning is largely meaningless if cities do not take steps to implement their plans. Many sustainability plans exist only on paper and are not implemented, as Alexander Sergunin noted in his survey of Russian cities. The ISO has no measure of implementation for sustainability planning, which gives the measurements included in the index a rather static feel. Much more attention needs to be paid to turning the dry statistics of the ISO index into something that would inspire the citizens of various cities to take action in ways that boosts the city's performance on these indicators.

After we have collected more data and analyzed the patterns among them, it will likely be possible to provide more of an answer to these questions. Perhaps it will be possible to point to a few key components of sustainability that are crucial, both in the conceptualization of sustainability and in its implementation in practice. Or it may turn out that everything matters, and for a city to make progress it must somehow find ways to integrate effective policies for improving everything from energy efficiency to wastewater management.

A Lack of Forward-Looking Dynamics

Marlene Laruelle's study of Norilsk shows that the ISO indicators can provide a good picture of the city's current state of affairs, but do not really capture the dynamics of the city as it moves from its past into its future. The indicators do not give a sense of what legacy each city carries with it. Nor do they take into account how the nineteen components of the standard need to interact with each other in order for a city to make progress. Existing sustainability plans often fail to take into account this integration, as Sergunin's survey of Russian cities showed.

By simply providing a snapshot of sustainability, the indicators do not explicitly measure what efforts the various actors are taking to improve the level of overall sustainability. Do the local officials and citizens make a conscious effort to push sustainability policy forward (Portney 2013)? Is there a dialogue among the various stakeholders to develop a coherent and representative sustainability plan? Such interactions are crucial for success in achieving sustainability, but the ISO does not really ask if they are taking place.

Who drives the process of enhancing sustainability forward? In the case of Norilsk, it is really international actors who are pressuring the city to improve its wretched pollution situation. Without this outside force, the corporate interests that dominate the city would be more likely to focus on making bigger profits than caring about the city's environment or the social fabric of the city. In Whitehorse, for example, it is incentives from the federal government that drive efforts to promote sustainability while measuring progress toward a defined set of sustainability goals. Innovative firms took the lead in developing renewable sources of energy in Nome. In Vorkuta, pressure for change may come from residents who are barely eking out a living and who are turning to all variety of methods to survive. Of course, in conditions of poverty, just getting by is the main goal rather than sustainability, but the difficulty of the conditions in which these individuals live forces them to find solutions that might help them improve their overall situation in ways that make the city more sustainable.

A Failure to Integrate across Topics

While the ISO 37120 seems to provide a comprehensive list of the components that make up urban sustainability, it does not really make an effort to explain how the various components are interconnected. The chapter examining energy and governance in Nome and Lavrentiya found that the ISO measures did a good job analyzing the energy situation in the two cities. It fell short, however, in the area of governance and particularly with regard to the linkages between governance and energy policy, one of the key factors needed to make a sustainable city. The main governance indicator in the ISO focuses on the number of women elected to public office at the city level. This indicator certainly measures a worthy goal, but it does not give us much purchase in explaining why one city is able to adopt more sustainable energy supplies than another. To do that we would need to examine such things as the ability of the city government to offer incentives to the private sector to build renewable energy sources or even to develop those resources by the state. In other words, to truly understand the energy security of a city, it is necessary to measure its actual energy use and the source of its supplies alongside a fine-grained understanding of how the city governs its energy consumption.

Of course, it will always be difficult to measure the level of governance with quantitative indicators. Beyond doubt, it is true that there are vast differences in the governance of Arctic cities, including the differences between authoritarian Russia and the democratic West, or more fine-grained differences in electoral systems for urban legislatures, or whether the mayor is elected directly by his constituents or appointed by the city council. But knowing how the city government functions will provide useful insight into improving our understanding of what city governments can do to improve sustainability performance and what constrains them. Accordingly, it is necessary to continue studying what works in terms of governance at the city level and what does not.

Andrey Petrov's chapter on fate control makes an argument for measuring how well cities are represented in regional governments rather than looking at the nature of the city-level government. With the exception of Singapore, cities operate within the context of their larger countries and often do not have full control over the policies and conditions that shape their sustainability policies. Understanding how cities navigate these constraints is certainly an important component of understanding their governance.

Does the ISO Apply to Arctic Cities?

Another question raised by the international standard is whether it is possible to apply a set of metrics designed to measure all cities around the world to Arctic cities. Arctic cities differ from other cities in obvious ways—their extreme and rapidly changing climates, remote locations, thin economies often based on resource extraction, and strong emphasis on Indigenous culture. Arctic cities differ from their southern counterparts in that some of them are built on permafrost: As this permafrost thaws, these cities will have to take action to protect buildings, roads, pipelines, and other infrastructure. The silence on permafrost is one way that that the current edition of the ISO lacks a region-specific understanding of Arctic conditions.

Many of the metrics in the ISO seem to work as well in Arctic conditions as they do in other parts of the globe. As Carrie Schaffner's chapter makes clear, Arctic cities play many of the same roles as other cities farther south. By collecting ISO data about all cities, we can get a sense of how Arctic cities compare to them and better understand the extent of the challenges people face living in the North.

In the following we examine areas where the ISO metrics do not really give us a good sense of life in the Arctic. The chapters in the book propose solutions to these issues.

Transportation to Isolated Cities

Arctic cities are frequently remote from the rest of human civilization and lack connectivity to the outside world. The combination of isolation and a dependency on outside supplies of food and other essential goods means that Arctic cities experience a kind of vulnerability that cities in more heavily populated areas of the world do not. While airports can typically function year-round, cities that rely on ice-roads or river transportation can find themselves cut off from supplies during some seasons.

In the case study of Vorkuta and Salekhard, we find that the transportation indicators included in ISO 37120 do not provide much insight to the problem of isolation that is often characteristic of Arctic cities. The ISO transportation indicators focus on the extent of public transportation within a city. Such metrics certainly make sense when examining how much local transportation a city provides to its residents, and that number helps determine to what extent a city is sustainable. However, the exclusive focus on those measurements requires the assumption that the cities themselves are linked to a well-developed transportation network. In the Arctic context that assumption does not hold across cities and instead should be an object of measurement. In this sense, the ISO is missing a way to measure the remoteness of a city, which is crucial to measuring urban sustainability in Arctic circumstances.

Aleksandra Durova's chapter examining cities in the Sakha Republic takes this analysis one step farther by inquiring whether regional policymakers take into account climate change as they are planning transportation systems in the republic. Because the climate is changing rapidly in northern latitudes, cities that depend on outside sources to supply themselves will find that they are facing a growing set of challenges in terms of potential connectivity gaps. It is necessary to take steps now to ensure that any problems that arise in the future can be addressed through appropriate means. Gaining a better understanding of the planning process to address these problems is crucial to understanding whether policy responses will be adequate or, alternatively, perhaps will cause more problems. The ISO for urban sustainability does not really address any of these issues though it is clear that effective planning is crucial for ensuring future urban sustainability in Arctic conditions.

Economic Diversity

As with the transportation indicators, the ISO metrics do not consider the diversity of a city's economy in measuring its sustainability. Rather, the indicators focus on measures of unemployment; the assessed value of commercial and industrial properties; and the number of businesses, patents, and hotel-night stays. The ISO does track population demographics, including a profile measure for the number of pensioners.

Overall, a measure of economic diversity is crucial to identifying a city's reliance on one industry for its survival. This is a major problem in the Arctic overall, including in both Russia and the Western countries. One-industry towns are extremely vulnerable to gyrations in international commodity markets and therefore have little control over their own fate. While levels of employment give a general picture of a city's economic health, understanding the city's ability to survive over the long term requires a more comprehensive picture of economic diversity.

Culture

As Vera Kuklina and Natalia Shishigina's chapter on culture in Yakutsk makes clear, ISO 37120 includes indicators for culture and sports, which it lumps into one category. However, measuring the number of cultural institutions, such as theaters, movie houses, and libraries, is only a starting point for understanding the cultural vitality of a city. Kuklina and Shishigina argue that sustainability is based on an appreciation of the intimate relationships between humans and the local environment. These cultures can be quantified in some ways, but have to be considered in specific national, regional, and local contexts for comparisons across different cities and countries.

One factor that is clearly missing from the ISO urban sustainability indicators is a way to account for Indigenous cultures. Most cities around the world typically fail to acknowledge Indigenous contributions, though the Indigenous communities are increasingly visible in a growing number of areas. Indigenous contributions have long been recognized in the Arctic context. As the culture chapter in this volume argues, there is a strong need to use extensive qualitative data to better understand the Indigenous cultures where education, language preservation, subsistence activities, and environmental problems are closely interrelated. While these relationships have evolved within Indigenous cultures, in the urban setting they have been mediated by infrastructural development, as Kuklina and Shishigina point out. Since ISO 37120 is silent on many of the concerns of the Indigenous community, it might best be seen as a companion to indexes that specifically seek to measure the quality of Indigenous life in Arctic conditions.

Attachment to Place

Several of the chapters mention the need to address the issue of attachment to place (Giuliani 2003; Low and Altman 1992). Residents of depressed and polluted cities often want to continue living there despite the objectively poor conditions that surround them. They feel strong emotional bonds to the areas where they are located and refuse to leave, even when offered financial incentives to do so. Such attachments seem to explain why people are willing to live in places like Vorkuta or Norilsk.

However, measuring such ties is particularly difficult using quantitative rubrics. The attachments are largely emotional and it is difficult to find ways to quantify them. It might also be hard to explain why people feel pride of place in areas where past accomplishments were coerced through forced labor that resulted in extensive human suffering. We cannot replicate such passions by formula.

Given the nature of these emotional ties, the index can only be one of many tools used to measure urban sustainability in the Arctic. It must be combined with other techniques, including purely qualitative ones. Hopefully, the case studies of cities included here provide some insights into the nature of these emotional attachments that help to drive sustainability policies forward.

Extensions to the Existing International Standard

Given these criticisms of ISO 37120 in general and in its specific application to Arctic cities, does it make sense to propose extensions to it? While some might assert that the current standard has a certain elegance and parsimony, it is possible that it should be expanded in some ways to take into account factors that are missing now and could help it provide a more complete portrait of urban sustainability.

Forward-Looking Urban Planning

In the area of urban planning, the core indicator in the ISO is the amount of green space in a city. Supporting indicators examine the amount of land devoted to informal settlements, the jobs–housing ratio, and proximity to basic services. Profile indicators include the number of trees, population density, and built-up density. All of these indicators are important for understanding urban life, but they do not really tell us much about how a city can take actions to ensure that it will remain sustainable for generations to come.

Alexander Sergunin's chapter that discusses several Russian cities provides a brief primer on urban planning and examines how well several Russian Arctic cities apply these principles. Most importantly, it is necessary to measure to what extent cities engage in planning, how much they incorporate community input into this planning, and what kind of personnel and financial resources they devote to actually implementing the plans they develop. Jim Powell's chapter celebrating Whitehorse's successes in these areas gives us a sense of what a successful model of implementation might look like. Understanding these processes would truly increase our ability to forecast how well Arctic cities will be able to anticipate and prepare for hazards they might face in the future. A visit to Whitehorse in the summer of 2019 revealed that the city's planning team was not happy with the results of their work so far and was actively seeking ways to improve the implementation process. To ensure continued success, even cities that seem to do well in their sustainability performance need to keep finding ways to enhance their performance.

Fate Control Index

Andrey Petrov's chapter similarly focuses our attention on the issue of the extent to which communities and individuals control their own destinies. His examination of fate control in Arctic cities demonstrates that generally cities in northern Scandinavia perform the best, while urban settlements in the Russian Arctic lack many of the most important elements of fate control, with Canadian and US cities positioned somewhere in between. Being able to control one's fate is crucial to ensuring the sustainability of one's community. Petrov's chapter proposes a number of ways to measure this issue; his chapter includes some of the indicators from the ISO, though organized differently. In this sense, the Fate Control Index is a useful supplement to the ISO, but is not comprehensive enough to replace it.

The Role of Corporations

Stephanie Hitztaler and Veli-Pekka Tynkknen's chapter examining the role of corporate social responsibility in pushing forward sustainability issues draws our attention to the role of various actors beyond the state and citizens in the governing process. Corporations have extensive resources and can advance the sustainability agenda through programs designed to help cities if given the right incentives. Hitztaler and Tynkknen's analysis of Gazprom Neft and its actions in the Yamal Peninsula is quite critical of the company's overall behavior, so this particular corporation cannot be considered a model. Even though the company has built sports and arts facilities, the corporation's total sustainability impact on the area where it operated was negative. But finding ways to effectively measure corporate social responsibility so that it effectively pushes cities toward more-sustainable actions would be a real contribution to the ISO and help it find ways to mobilize resources in achieving greater urban sustainability.

Future Research

This analysis has shown that ISO 37120 is not a perfect measure of urban sustainability and that it lacks some features that would help it better measure conditions in the Arctic. Nevertheless, the general finding of the case studies was that it is a useful general measure of urban sustainability, particularly as a way to identify key issues that need discussion and as a way of stimulating further research.

The real promise in the standard, however, is in collecting the full set of data for all Arctic cities. Doing that would make it possible to better understand the interconnected issues that affect urban sustainability in a holistic manner. Having all the numbers would make it possible to see how the different variables—education, economics, governance, health, transportation, solid waste, and water among them—influence each other and affect the overall level of sustainability in the city. While collecting such a large dataset will require years of effort by numerous researchers, it will greatly improve our understanding of urban sustainability in all of its complexity. Hopefully, the chapters in this book have helped us move closer to this goal by providing a valuable set of case studies that demonstrate how the ISO indicators can be used, both on their own, and more fruitfully as part of a multimethod approach that allows us to go deep into understanding how urban sustainability works and what is necessary to drive it forward. The PIRE team is actively collecting a full dataset and we hope to report those results soon.

Robert W. Orttung is research professor of international affairs at the George Washington University Elliott School of International Affairs, and is director of research, Sustainable GW.

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