Localizing the United Nations Sustainable Development Goals in northern Norway: Transdisciplinary approaches for sustainable coastal development

Jessica Leyla Fuller

Thesis for the degree of Philosophiae Doctor (PhD)
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To my parents and sister, thank you for everything. Thank you for all your support and guidance as I explore my career far away from home, and thank you for keeping me grounded with wisdom, laughter, weekly FaceTimes, and pictures of the family pets. And thanks especially to my mother, who inspired me from a young age to get a PhD just like her, for her help editing this final thesis, for helping me see that knowing a little bit about a lot of things is as important as knowing a lot about one thing, and for showing me how my inter- and transdisciplinary PhD is like Picasso's art.

Early in his career, Pablo Picasso was ridiculed because of his outlandish painting style, but he persevered. Even though he was a classically trained painter, he saw the world in a different way and chose to represent that. I think this is what interdisciplinary and transdisciplinary research is. We are Picassos as we work with classical disciplines that many other people know a lot more about. We know (mostly) how the world works, and we know how to study ecology and people. We take pieces of those disciplines and visualize them together and we paint that knowledge into a new image, a different way of thinking that can be something important and useful for the world.

BERGEN, 13 October 2023

Abstract (in English)

In 2015, the United Nations launched the "2030 Agenda for Sustainable Development" with a unique and ambitious framework for global sustainability that includes a framework of the 17 Sustainable Development Goals (SDGs). Since then, many leaders worldwide at the community, regional and national levels continue to grapple with the challenge of localizing sustainability. How do we go from global to local? Despite the variety of international guidelines on the SDGs themselves, the literature does not elaborate on how the SDGs should be implemented at the national level nor how they should be integrated through regional and local levels of governance. This is a challenge for United Nations members, including Norway, that must reconcile their sustainability policies to the global agenda.

In this PhD, I have examined how the SDGs can be localized in the case study area in northern coastal Norway in ways that are legitimate, salient, and credible, leading to social transformations for global sustainability and sustainable development for the prosperity and wellbeing of future generations.

The integration and operationalization of the SDGs via sustainable development policy is crucial for the achievement of the goals and for long-term sustainability transformations. Such operationalization should take the form of a localization process that anchors the SDGs to on-the-ground contexts and integrates the needs, priorities, and values of individuals in the local communities who must abide by the policies. Through this PhD thesis, I explored this SDG localization process using a transdisciplinary approach to sustainability studies that drew on principles of Post-Normal Science and made use of the Three Spheres of Transformation for Sustainability framework. I applied established research methods and analytical frameworks from the social sciences (Social Network Analysis and Q-methodology) to investigate how the SDGs could be anchored to a local context and adapted to local needs, while maintaining integrity and relevance to the global aim of sustainable development worldwide. Three main questions emerged to explore the SDG localization process: (1) How can knowledge and information be tracked within a multi-sector and mega-organizational institution?; (2) What is the local discourse on sustainable coastal development in northern coastal Norway and how does this knowledge inform or facilitate SDG localization?; and (3) How does the SDG localization process illustrate fractal agency for social transformation?

Through this thesis I first demonstrate that the structural and social complexity of an institutional network affects the sharing of knowledge and information. However, the individual human connections and shared goals within that network form the basis for institutional coherence, functionality, efficiency, and effectiveness. I have also highlighted the individual perspectives on sustainable coastal development for the local case in northern Norway of Andøy Municipality and showed how shared perspectives that emerge from the local community can serve as a starting point for multi-sectoral cooperation and discussion.

Finally, I conclude that to assure that the SDG localization process enables social transformations for sustainability, individual capacity must be activated and encouraged through participatory processes and stakeholder engagement that empowers social agency in ways that are self-sustaining and transcend scales. The SDGs, and sustainable development policies, are complex. They must stimulate transformative change across political, practical, and personal spheres by being rooted in universal values. I put forward an SDG localization process founded on principles of scientific quality and credibility, government legitimacy, and reflective of local and national needs. This unique approach provides a responsible, innovative, and trusted way forward for the integration of the global goals for sustainability into local society.

Abstract (in Norwegian)

I 2015 lanserte FN «2030 Agenda for Sustainable Development» med et unikt og ambisiøst rammeverk for global bærekraft som inkluderer 17 bærekraftsmål (SDG). Siden den gang har mange ledere over hele verden på lokalt, regionalt og nasjonalt nivå fortsatt å kjempe med utfordringen å lokalisere bærekraft. Hvordan går vi fra globalt til lokalt nivå? Til tross for mangfoldet av internasjonale retningslinjer for selve bærekraftsmålene, utdyper ikke litteraturen hvordan bærekraftsmålene kan implementeres på nasjonalt nivå, eller hvordan de kan integreres gjennom regionale og lokale styringsnivåer. Dette er en utfordring for FN-medlemmer, inkludert i Norge, som må forene sin bærekraftspolitikk med den globale agendaen.

I denne doktorgraden har jeg undersøkt hvordan jeg kan lokalisere bærekraftsmålene i en kommune i Nord-Norge på måter som er legitime, fremtredende og troverdige og som kan føre til sosiale transformasjoner for global bærekraft og bærekraftig utvikling for fremtidige generasjoners velstand og velferd.

Integrering og operasjonalisering av bærekraftsmålene via bærekraftig utviklingspolitikk er avgjørende for å nå målene og videre for å kunne implementere langsiktige bærekraftstransformasjoner. Slik operasjonalisering bør ta form av en lokaliseringsprosess som forankrer bærekraftmålene til kontekst på grasrotsnivå og integrerer behovene, prioriteringene og verdiene til individer i lokalsamfunnene (som må følge retningslinjene). For å oppnå dette, foreslår jeg en vei for å muliggjøre transformativ endring for bærekraft som overskrider individ, kultur, teknologi, politikk og det naturlige miljøet til sosial-økologiske systemer. Gjennom doktorgradsavhandlingen utforsket jeg denne SDG-lokaliseringsprosessen ved å bruke en transdisiplinær tilnærming til bærekraftsstudier som bygger på prinsipper for post-normal vitenskap og de «Tre Sfærene for Transformasjon» for bærekraft. Jeg brukte etablerte forskningsmetoder og analytiske rammeverk fra samfunnsvitenskapene (Social Network Analysis og Q-methodology) for å undersøke hvordan SDGene kunne forankres i en lokal kontekst og tilpasses lokale behov. Samtidig tilstrebet jeg å oppnå integritet og relevans for det globale målet om bærekraftig utvikling. Tre hovedspørsmål for å utforske denne SDG-lokaliseringsprosessen ble utviklet: (1) Hvordan kan kunnskap og informasjon spores innenfor en multi-sektor og mega-organisatorisk institusjon?; (2) Hva er den lokale diskursen om bærekraftig kystutvikling i Nord-Norge og hvordan informerer eller legger denne kunnskapen til rette for SDG-lokalisering?; og (3) Hvordan illustrerer SDG-lokaliseringsprosessen «fractal agency» for sosial transformasjon?

I avhandlingen demonstrerer jeg først at den strukturelle og sosiale kompleksiteten til et institusjonelt nettverk påvirker deling av kunnskap og informasjon. Imidlertid danner de individuelle menneskelige forbindelsene og felles mål innenfor dette nettverket grunnlaget for institusjonell sammenheng, funksjonalitet og effektivitet. Jeg har også belyst de individuelle perspektivene på bærekraftig kystutvikling slik de kommer til uttrykk i Andøy kommune og vist hvordan felles perspektiver som kommer frem fra lokalsamfunnet kan tjene som utgangspunkt for flersektorielt samarbeid og diskusjon.

Til slutt konkluderer jeg med at for å sikre at SDG-lokaliseringsprosessen muliggjør sosiale transformasjoner for bærekraft, må individuell kapasitet aktiveres og oppmuntres gjennom deltakende prosesser og interessentengasjement som styrker sosial «agency» på måter som er selvopprettholdende og overskrider lokal, regional og nasjonal kontekster. Bærekraftsmålene og bærekraftig utviklingspolitikk er komplekse. De må stimulere transformativ endring på tvers av politiske, praktiske og personlige sfærer ved å være forankret i universelle verdier som gjelder for alle mennesker. Jeg presenterer en SDG-lokaliseringsprosess basert på prinsipper om vitenskapelig kvalitet og troverdighet, myndighetslegitimitet og gjenspeiling av lokale og nasjonale behov. Denne unike tilnærmingen gir en ansvarlig, innovativ og pålitelig vei videre for integrering av de globale målene for bærekraft i lokalsamfunnene.

List of publications

Paper I

Fuller, J. L., Strehlow, H. V., Schmidt, J. O., Bodin, Ö., & Dankel, D. J. (2023a). *Tracking Integrated Ecosystem Assessments in the ICES network: A Social Network Analysis of the ICES expert groups*. ICES Journal of Marine Science, 80(2), 282–294. https://doi.org/10.1093/icesjms/fsac242.

Paper II

Fuller, J. L., van Putten, I., Kraan, M., Bjørkan, M., & Dankel, D. J. (2023b). *"Sustainability is not a vegan coffee shop." Eliciting citizen attitudes and perspectives to localize the UN sustainable development goals*. Journal of Environmental Planning and Management, 1–22. DOI: 10.1080/09640568.2023.2223761.

Paper III

Fuller, J. L., Bjørkan, M., Iversen, L., Aarflot, J. M., & Dankel, D. J. (2023c). *Ethical approaches for engaging extended peer communities: insight into responsible workshopping with citizens*. Submitted.

Introduction

The world has faced several global crises that changed the way humans think and live. Throughout history, humans have survived, adapted to, and evolved in response to (mostly self-perpetuated) environmental and social change. The first agricultural revolution (the Neolithic Revolution) saw humans transition from sustainable hunter-gatherer and nomadic lifestyles to settlements (Weisdorf, 2005). The domestication of plants and animals through agricultural revolutions allowed our ancestors to rapidly grow the human population, and the subsequent industrial and digital revolutions have set us on a course of existence that is changing the very nature of our planet (Putterman, 2008; Moore, 2010; among other studies). However, as we are witnessing, these leaps and bounds in intellectual innovation and agricultural, industrial, and digital advancements have led to irreversible environmental crises (Zhang et al., 2011; Wadanambi et al., 2020; Berrang-Ford et al., 2021; among other studies) while simultaneously providing us with new tools, technologies, and knowledge to mitigate and adapt to these crises (e.g., green technology for renewable energy (Taranto et al., 2018), gene modification for more resilient agriculture species (Naqvi et al., 2022) and aquaculture species (Rosendal et al., 2023), and new advances in healthcare (Naik et al., 2022), among many others). Now we are in the Anthropocene and we are facing environmental and social crises at unprecedented rates and scales (Kagan and Burton, 2018), fueled by the danger of global climate change. This portends an uncertain survival for future generations. Scientists have known about these dangers for more than half a century (IPCC, 2023), and despite the numerous global, regional, national, and local efforts to induce necessary change, our engrained institutional and societal cultures persist the status quo (Stoddard et al., 2021). Therefore, how can we ensure the survival of our current and future generations if what advanced humanity centuries ago – our stubbornness in the face of adversity – impedes change today? How do we avoid being hoisted by our own petards? Have we already failed beyond repair? Current data and forecasts certainly predict so.

The 2023 Climate Change report from the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2023) is unequivocal in its conclusion that human activities, primarily through the emissions of greenhouse gases, are responsible for global warming. The global surface temperature is almost 2^{o}C higher than the last century, with global temperatures increasing faster since 1970 than any other 50-year period over the last two millennia (IPCC, 2023). This has led to widespread impacts on atmospheric, oceanic, and terrestrial systems affecting weather and causing extreme climate events across the world. It has resulted in catastrophic losses and damages to nature and people. Sea level rise from retreating glaciers, warming ocean temperatures, extreme heatwaves, flooding, and drought are some of the most direct effects of climate change attributed to human influence. Along with indirect effects, which include biodiversity loss, species extinction, reduced food security, and increased environmental conflict over natural resources and space, climate change disproportionally affects marginalized communities, small-scale food producers and harvesters, and lower-income households.

"Climate change has caused widespread adverse impacts and related losses and damages to nature and people that are unequally distributed across systems, regions and sectors. Economic damages from climate change have been detected in climate-exposed sectors, such as agriculture, forestry, fishery, energy, and tourism. Individual livelihoods have been affected through, for example, destruction of homes and infrastructure, and loss of property and income, human health and food security, with adverse effects on gender and social equity…" (IPCC 2023, para. A.2.6).

There is an urgent need to address these crises for future generations. Despite the decades of research and policies to develop effective adaptation and mitigation measures, and even some improvements in adaptation planning and implementation (IPCC, 2023), world leaders have systematically and categorically failed to prevent further ruin (Stoddard et al., 2021). But perhaps the fault lies not in the failed implementation of proposed measures, but in the way those measures have been created? The process of policy-making, action planning, and implementation significantly determines if that policy is fit-for-purpose.

In 2015, the global machinery of United Nations General Assembly Members and Parties adopted a vision of sustainability through the Sustainable Development Goals (SDGs) of the 2030 Agenda (UNGA Resolution 70/1, 2015). These goals are considered historical for several reasons, foremost of which is that for the first time in history, all 193 United Nations member countries are committed to a common target: a better and more sustainable future for all. Furthermore, these goals include the environment as a specific target, unlike the preceding Millennium Development Goals that primarily focused on economic and social targets. This amendment, combined with improved funding and partnership mechanisms, poise the SDGs for unprecedented impact. The 3-year development process of the SDGs also adopted a new paradigm for cooperation: the political and high-level negotiations taking place over the text of the SDGs took place in parallel to an open consultation process with stakeholders, including non-governmental organizations, civil society groups, businesses, and other individuals who could share their needs and priorities with the panel responsible for crafting the 2030 Agenda.

While the 2030 Agenda on Sustainable Development is a significant departure from the preceding Millennium Development Goals (2000–2015) in terms of being more comprehensive, far-reaching, people-centered, and universal (Swain, 2018), there remain significant shortcomings to them. Namely, the Goals were developed without the use of a guiding framework to ensure synergistic cooperation between the Goals (Swain, 2018; Kagan and Burton, 2018; Mair et al., 2018), resulting in some Goals with contradicting outcomes and others with vague indicators which suggest a lack of consensus on how to achieve them. What is also clear from the 2030 Agenda process is that implementing the SDGs calls for an integrated, holistic, and multi-stakeholder approach (Reynolds et al., 2018) that is guided by a clear framework. While the 2030 Agenda may not have been drafted with an established conceptual or theoretical framework, the Agenda does allude to three key components that are found in the leading sustainability theories for the Anthropocene: society, economy, and the environment. Chiefly, these three components comprise an interconnecting concept of sustainability categorized as “pillars” (Basiago, 1999; Pope et al., 2004; Gibson, 2006; Waas et al., 2011; Moldan et al., 2012; Schoolman et al., 2012; Boyer et al., 2016; Purvis et al., 2019), or “dimensions” (Stirling, 1999; Lehtonen, 2004; Carter and Moir, 2012; Mori and Christodoulou, 2012), or “components” (Du Pisani, 2006; Zijp et al., 2015), from which a clear theoretical pedigree on the study of society and nature emerges.

As a signatory to the United Nations 2030 Agenda on Sustainable Development, Norway is committed to achieving all 17 SDGs by 2030 to “…take the bold and transformative steps which are urgently needed to shift the world onto a sustainable and resilient path” (Preamble, UN General Assembly Resolution 70/1). At the national level, Norway has adopted the SDG indicators into its national database (Statistics Norway, n.d.) and undergone two voluntary National Reviews in 2016 and 2021. The latter focused on the implementation of the SDGs at the regional and local levels. A point highlighted in the 2021 national review is the potential for leveraging the SDGs to trigger innovation and cooperation across sectors and through multiple levels of governance in Norway (Ministry of Local Government and Modernisation, 2021, p. 98), while emphasizing the localization of the SDGs to anchor them to local communities and their needs, thus making these global goals locally and contextually relevant to Norwegian society. As one of the most developed countries in the world, Norway has already achieved many of the targets identified in the 17 Goals. Thus, Norway is focusing its participation to the SDGs on development aid and partnerships with developing countries (Goal 17). However, despite the relatively good status of Norway in comparison with

many other countries in terms of social and economic indicators (OECD, 2022), Norway is still facing a series of environmental sustainability challenges, including, among others: continued greenhouse gas emissions (Gavenas et al., 2015; Sparrevik and Utstøl, 2020; Sandberg et al., 2021; Ziegler et al., 2022); oil and gas drilling, usage, and export (Gavenas et al., 2015; Foulds et al., 2022; Cook et al., 2023); and environmental impacts from aquaculture (Olaussen, 2018; Bohnes et al., 2022) and agriculture (Roer et al., 2013; Burton and Farstad, 2019). Overall, Norway scores quite low in terms of achieving environmentally focused SDGs, such as SDG 11 (sustainable cities and communities), SDG 12 (responsible consumption and production), SDG 13 (climate action), SDG 14 (life below water), and SDG 15 (life on land) (The Sustainable Development Report, n.d.).

Over the years, Norway has pursued several areas of innovation for addressing environmental sustainability, including technological, societal, and policy developments for energy transitions (Standal et al., 2020; Vasstrøm and Lysgård, 2021; Doran et al., 2023). As a global powerhouse for marine economy (Koilo, 2020; Solberg, 2020; EC, 2021; Guerreiro, 2021; Ministry of Trade, Industry and Fisheries, 2021; EC, 2023) and ocean policy (Ehler, 2021; Fasoulis, 2021), Norway has adopted an integrated ecosystem-based approach to ocean management (Olsen et al., 2007; Ottersen et al., 2011; Dale, 2016; Gullestad et al., 2017; Sander, 2018), which uniquely considers humans as an integral part of nature (Alexander and Haward, 2019; Winther et al., 2020) even though this consideration is often superficial and requires more focus than is typically given (Hornborg et al., 2019; Piet et al., 2019). Thus, there is a need for an improved understanding of human-nature relationships that comprise the social-ecological systems in which they reside.

As Norway and other global communities face unprecedented impacts from climate change, simply adapting to these changes may not be sufficient. The emerging theory from research and academia on sustainability sciences and the need for a radical shift to address climate change challenges is the concept of transformational change (O'Brien, 2012; O'Brien, 2017; Díaz et al., 2019; Eichinger, 2019; Fedele et al., 2019; Folke et al., 2021; O'Brien, 2021). These transformational changes should occur throughout all dimensions of a social-ecological system, especially if they are to achieve the humanitarian, ecological, and technological ambitions of the SDGs (Scoones et al., 2020). Examples include structural transformations that focus on the configurations of a system, such as how to transform current markets to circular economies or how to catalyze shifts in power and control among race, class, or gender groups leading to structural changes in communities (Scoones et al., 2020). Systemic transformations focus on social-ecological systems as interconnected and dynamic structures that emphasize the development of knowledge of the interdependency of social and ecological systems, and the management of those system dynamics and approaches to develop technological innovations, such as for renewable energy systems (Scoones et al., 2020). Enhanced social attributes and individual capacities can empower communities to take action and enact structural and systemic transformations for sustainability (Bennett et al., 2019; Linnér and Wibeck, 2020; Scoones et al., 2020; O'Brien et al., 2023). This can lead to inclusive and sustainably-focused societies where behavioral and practical changes are grounded in personal and universal values and ethics (O'Brien and Sygna, 2013; O'Brien et al., 2023; Fuller et al., 2023c). Transformational changes, informed by the SDGs, are needed to shift social-ecological systems to become more resilient to change, or to create new systems altogether that are both sustainable and resilient and bound by an ethical frame based on transparency, reflexivity, integrity, equity, and inclusivity.

During my first year of interviews with local stakeholders in Andøya (*Andøyværinger*[1]), I encountered several different worldviews from the people who lived and worked on the island. The discussions revealed a tension between the importance of building and developing the Andøyan economy to maintain its existence as a municipality and sustain its contributions to the Norwegian economy, and the importance and pride the locals placed on their natural environment and heritage. Some people had a very pro-

[1] Norwegian word for "people from Andøya".

development viewpoint and argued that the socioeconomic need to grow the municipality also meant sacrificing some of the natural spaces that had long defined the island. Other people presented a more pro-conservation viewpoint and emphasized the value and significance of the island's pristine nature not just for their own experience but also as a cultural representation of Norway. That is not to say that pro-developers were necessarily anti-conservation or vice versa. Rather, it became evident from the beginning that the conversations and decision-making around development in the municipality were more nuanced and complex than a simple dichotomy. History, tradition, culture, innovation, progress, and, of course, profit, among many other considerations are interwoven in the sustainable development debate for the island.

Over time as I learned more about the local community through my research, I realized that these tensions, while legitimately perceived of course, had the same end goal: everyone I spoke to want a sustainable life and a sustainable municipality. The challenge was that they wanted different pathways to that end goal. These tensions were honed into reality when I interviewed the municipal planner, whose job is to balance the needs of both pro-development and pro-conservation community members, work with elected officials who often came to the table with their own agendas, *and* somehow implement the SDGs into the municipality (as instructed by the national government). Despite these challenges for sustainable and equitable coastal development in Andøya, the municipality and the local stakeholders agreed that their pathways towards sustainability needed guidance and a clear process that would give equal consideration in decision-making to all perspectives, needs, and concerns. Seemingly a monumental task, how can the Andøya municipality do this? How can development plans be merged with the SDGs? How can the municipality balance competing interests from its citizens? How should the SDG localization process take place for the municipality?

Overall research aim

Norway has noted the need for a localization process for the SDGs but has not produced a clear guide or framework for how this should be done. My overall research aim, through the LoVeSeSDG-PhD project, was to identify a quality-based legitimate, salient, and credible SDG localization process that enables social transformational change for sustainability, eventually leading to structural and systemic changes.

In essence, the project addressed the **main research question**: how would a legitimate, salient, and credible SDG localization process enable social transformative change for sustainability across the personal, practical, and political spheres of structures and systems?

Research objectives

To achieve this overall goal, my general objective was to develop and test an interdisciplinary methodological application of the SDG localization process for Norway that adheres to the overall ambition of the SDGs (to achieve peace and prosperity for the people and the planet, now and into the future), and leads to social transformations for sustainability.

This general objective was addressed through three methodological approaches, resulting in three manuscripts (two published papers and one under review) that explored the application of these methods to three research questions.

Research question I: How can knowledge and information be tracked within a multi-sector and mega-organizational institution?
Research method I: Social network analysis (SNA) was applied to study the connectivity of integrated ecosystem assessment (IEA) knowledge in the expert group network of the International Council for the Exploration of the Sea (ICES).
Paper I results: This paper demonstrated that the structural and social complexity of an institutional network affects the sharing of knowledge and information, however the individual human connections within that network form the basis for institutional coherence, functionality, efficiency, and effectiveness.

Research question II: What is the local discourse on sustainable coastal development in northern coastal Norway and how does this knowledge inform SDG localization?
Research method II: Q-methodology was applied to understand individual perspectives in the local case study – Andøya, Norway – about sustainability and sustainable coastal development.
Paper II results: This paper introduced the concept of a policy vehicle (i.e., the Norwegian Planning and Building Act) as the implementing mechanism, or proxy, for the SDGs, and described how the localization of the policy vehicle hypothetically anchored the SDGs to the local context. The study revealed unique and shared perspectives of the individuals in the local case study about sustainability and sustainable coastal development, and highlighted areas for cooperative discussion and collaboration among different sectors and the local municipality to discuss issues of common concern, such as the shared use of the marine and ocean space for fisheries, tourism, aquaculture, research, and military defense, among others.

Research question III: how does the SDG localization process facilitate fractal agency for social transformation?
Research method III: This paper applied an ethical typology of post-normal science, T.R.U.S.T., and the Three Spheres for Sustainability Transformation framework to reflect on the cumulative exercise of the SDG localization process, a multi-stakeholder workshop with the local community of the case study area, and review it within the social fractal agency theory.
Paper III results: The paper concluded that in order to assure that the SDG localization process enables social transformations for sustainability, individual capacity must be activated and encouraged through participatory processes and stakeholder engagement that empowers their social agency in ways that are self-sustaining and can transcend scales.

1 Background

1.1 Global climate change policy and the sustainable development paradigm of the United Nations

Despite an international portfolio of global agreements, treaties, and policies, developed over the last 35 years or so to address the most pressing environmental issues of our time our world remains inundated by a series of global crises that show no signs of abating: the ecological crisis of climate change and resulting biodiversity loss, the energy crisis of diminishing fossil fuels, the human population crisis of overgrowth and migration due to political or environmental instability, the economic crisis of capitalism and financial inequality that accentuates social and environmental problems, a crisis of work where intensifying labor that is unpaid or undocumented is becoming increasingly insecure and dangerous, and a social and cultural crisis that is instigated by the global model of consumerism and unrestrained growth resulting in an expansion of consumer debt and financial crises, and an erosion of social solidarity and cultural diversity (Kagan and Burton, 2018). These crises are a product of human ideologies and are sustained by systemic and institutionalized inequalities that are perpetuated by the actions of elite and dominating world leaders. The unequal distribution of social and ecological costs and benefits from our global economic system only strengthens the few who benefit from the embedded institutional cultures and social structures that perpetuate these inequalities.

1.1.1 A brief history of climate change policy in the global agenda

These crises and resulting inequalities arising from systemic inequalities of race, class, gender, and fossil fuel capitalism, perpetuated by rapid globalization (Garrett, 2000; Lahsen et al., 2010; Suresh, 2012; Hutton et al., 2015) are not a mystery to us. However, one of the leading consequences of these crises – climate change (Leichenko et al., 2010; Zhang et al., 2011; Godfrey and Torres, 2016; Asayama et al., 2021; Gabric, 2023) – was only indirectly mentioned in early global documents under the general headings of air pollutants and environmental conservation itself was only considered at first in the context of natural resource utilization (Jackson, 2013; International Institute for Sustainable Development, 2023).

In 1949, the first United Nations (UN) Scientific Conference on the management of natural resources for economic and social development took place (United Nations Department of Economic Affairs, 1951), however, this conference focused on the use of the resources, and not their conservation (Jackson, 2013). In the subsequent years, several publications likely influenced the change in public and political perceptions of environmental importance (United Nations Environment Programme, 2015), including published works of "Silent Spring" by Rachel Carson in 1962 and "The Population Bomb" by Paul Ehrlich in 1969. In 1968, the UN Economic and Social Council was the first to include environmental issues in their agenda (United Nations General Assembly, 1969) and decided to hold the first UN Conference on Human Environment in 1972 (UN, 1969, p. 15, para. 89). This conference adopted a declaration that set out principles for the preservation and enhancement of the human environment, along with a plan for international environmental action (United Nations, 1972, p. 27, rec. 107). Principally, this Declaration included the very first mention of climate change: "…evaluate the likelihood and magnitude of climatic effects and disseminate their findings to the maximum extent feasible…" (United Nations, 1972, p. 20, rec. 70). The Declaration also established the UN Environment Programme (UNEP, currently known as UN Environment; United Nations, 1972, p. 6, rec. 2). However, climate change was not explicitly included until more scientific evidence emerged of its connection to acid rain in Europe and North America in the late 1980s to early 1990s (Wright and Schindler, 1995; Vet et al., 2014; Grennfelt et al., 2020; Prakash et al., 2023), leading to several UN agreements and other international programmes to combat the phenomenon.

With the establishment in 1988 of the Intergovernmental Panel on Climate Change (IPCC) (United Nations General Assembly, 1988), climate change became central to the global agenda on environmental issues. The year 1989 emerged as the seminal year for climate change, during which several global efforts were taken: the UNGA adopted resolution 44/207 on the protection of global climate for present and future generations of humankind (United Nations General Assembly, 1989), the Malé Declaration on Global Warming and Sea Level Rise was presented to the UN Secretary-General by the Maldives (Maldives, 1989), the Helsinki Declaration on the Protection of the Ozone Layer was adopted (United Nations Environment Programme, 1989), and the Montreal Protocol on Substances that Deplete the Ozone layer entered into force after being adopted in 1987 (United Nations Environment Programme, 1987). In the 1990s, international cooperation and negotiations on climate change skyrocketed.

The 1990 World Climate Conference declared that climate change was a global problem and required a global response, spurring the organization of the 1992 United Nations Conference on Environment and Development (United Nations, 1993) – also called the Earth Summit – leading to the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) by the end of that year (United Nations, 1992). However, it took until 1994 for the Convention to enter into force. This six-year gap – from 1988 (when the UN Resolution 44/207 endorsed the UNEP Governing Council's request to begin preparations with the World Meteorological Organization for negotiations on the Convention) to 1992 when it was adopted and 1994 when it entered into force – highlights the immense complexity involved in arranging international cooperation on major environmental issues where scientific evidence is compelling, but not certain. The UNFCCC led to the most significant climate change efforts taken to date, amongst which are the adoption of the Kyoto Protocol in 1997 (United Nations, 1997), and the Paris Climate Agreement in 2015 (United Nations, 2015). Nevertheless, climate change remains an increasingly dangerous and challenging problem for humankind.

1.1.2 Sustainability and sustainable development in the global discourse

Around the time that climate change was becoming a focal point for international environmental cooperation, sustainable development was emerging as a parallel but still unrelated concept in the global agenda. It was only during the 1992 Rio Conference that climate change was linked to sustainable development (United Nations, 1993, para. 9.6 of Agenda 21), and it would take several years before a holistic perspective of climate change and its connections to sustainable development became mainstream in the global discourse.

The Report of the World Commission on Environment and Development "Our Common Future" – also known as the Brundtland Report on Sustainable Development, published in March 1987 – is widely considered to be the first internationally agreed definition of sustainable development: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, para. 1). While the United Nations often refers to "sustainability" and "sustainable development" interchangeably, the two concepts hold slightly different connotations that should be distinguished. The concept of "sustainability" refers to the perpetual existence of society in ways that remain within the natural (biological, ecological, atmospheric, etc.) limits of our world – it is the ability to create and maintain the wellbeing of nature and humankind for present and future generations. The concept of "sustainable development" brings in the universal values of equity and equality and acknowledges that essential needs should be provided for all, particularly for the world's poor, and that achieving these needs for present and future generations should not surpass our planetary boundaries. Therefore, sustainable development is a complex issue that combines efficiency, equality, and intergenerational equity across social, economic, and environmental dimensions (Swain, 2018), and should foremost be considered through the questions of: sustainability *of what* and sustainability *for whom* (Benessia and Funtowicz, 2015). Not clearly

distinguishing these two concepts – sustainability and sustainable development – in early mainstream definitions meant that the inclusion of human wellbeing (including equity) as a key issue was often overlooked (Johnson et al., 2018).

Climate change is widely acknowledged to have a dual relationship with sustainable development: climate change influences key natural and human conditions (and thereby also social and economic development), and society's priorities on sustainable development influence greenhouse gas emissions that cause climate change (IPCC, 2007, section 2.1.3). It would be several years before this dual relationship is made explicit in the global agenda, as evidenced by the lack of climate change and environmental foci in the Millennium Development Goals (MDGs).

1.1.2.1 The Millennium Development Goals (2000–2015)

In September 2000, all 193 member countries of the UNGA adopted resolution 55/2 on the Millennium Declaration and set the Millennium Development Goals (MDGs) into motion (United Nations, 2000). By agreeing to eight goals with a total of eighteen targets and 48 indicators to be achieved by 2015 (Figure 1.1.2.1), they set a precedent for the adoption of the SDGs by providing a common language to reach global agreement (Fukuda-Parr, 2014; Hickmann et al., 2023). The MDGs stimulated the development of more international initiatives for health programmes and funding streams to support the achievement of the goals (Lomazzi et al., 2014), further cementing the influence that a global agreement has for bringing nations together around a common issue.

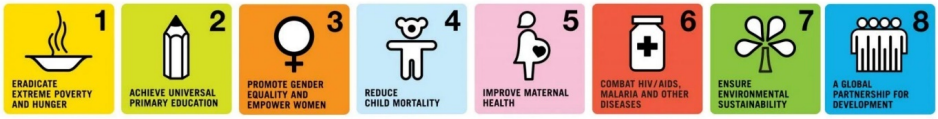

Figure 1.1.2.1: The eight Millennium Development Goals. Icons reproduced from IISD (2021).

The MDGs are hailed as a success for several reasons (United Nations, 2015), including reducing income poverty, improving access to clean water and sanitation, reducing child mortality, and improving maternal health. The measurable targets also encouraged the development of a variety of monitoring and evaluation tools to measure progress towards the MDGs, as well as highlighting discussions on the need for enhanced data quality and information gathering (Lomazzi et al., 2014). The implementation of the MDGs provided a framework for countries to plan their social development policies, thus harmonizing national efforts for the achievement of shared goals.

However, because the MDGs included only one goal on the environment (Goal 7 on ensuring environmental sustainability), the contributions of the MDGs to global sustainable development remained incomplete as they focused principally on the social pillar of sustainability: poverty, hunger, maternal and child mortality, communicable disease, education, and gender inequality. Other criticisms (Attaran 2006; Easterly 2009; Lomazzi et al., 2014; Fukuda-Parr, 2014; Carant, 2017; Fehling et al., 2013, among others) are that the progress towards the MDGs was unequal among countries, the development of the MDGs was too narrow in focus and did not comprehensively address development needs, and the lack of clear leadership on the MDGs – both nationally and internationally – meant the MDGs did not stimulate enough relevant action from individual nations. Critically, the MDGs did not include sufficient or effective indicators to measure policy change at the national level that would lead to the long-term achievement of the goals. A review paper by Hickmann et al. (2023) considered the implementation of the MDGs to be a political process that

included planning, capacity building, and other political actions that focused on, for example, changes in national budgets or organizational structures. However, the eighteen MDG targets and 48 indicators did not include these types of changes to measure progress towards the goals (United Nations, 2000).

1.1.2.2 The Sustainable Development Goals (2015–2030)

Despite the shortcomings of the MDGs, they paved the way for the development of the Sustainable Development Goals (SDGs), which made the interconnectedness of human and environmental systems explicit through an integrated approach to framing the goals within the three pillars of sustainability: economy, society, and the environment.

The 2030 Sustainable Development Agenda and its Sustainable Development Goals were adopted in 2015 after a three-year open negotiation process that surpassed expectations (United Nations General Assembly, 2015), emerging onto the world stage with 17 Goals and a total of 169 Targets and 248 indicators. Not only did the 2030 Agenda build on the MDGs, but they also, for the first time in global policy, elaborated on the concept of sustainable development via an integrated approach to its three core pillars: the economy, society, and the environment (Figure 1.1.2.2). The SDGs also surprised observers with the speed with which the resolution text was developed. The Rio+20 Summit in 2012 mandated the creation of an Open Working Group to develop a draft agenda (United Nations, 2012, para. 248), which had its first meeting in March 2013 (United Nations Department of Economic and Social Affairs, n.d.). By July 2014, the first draft of the 17 goals were developed and finalized in member state negotiations by August 2015, when they were finally adopted.

Figure 1.1.2.2: The SDGs "wedding cake" (Azote for Stockholm Resilience Centre, Stockholm University CC BY-ND 3.0).

Furthermore, unlike the MDGs, the Open Working Group negotiation process took place in parallel with a transparent and participatory public consultation process, which invited perspectives and feedback from stakeholders. During the three-year SDG negotiation process, the United Nations facilitated several public consultation efforts, results of which contributed to the High-Level Panel on the Post-2015 Development Agenda and the Open Working Group (United Nations Development Programme, 2023). These efforts included 88 national consultations on the future that people want, 11 thematic consultations on sustainable development, six dialogues on implementation, door-to-door surveys, and an online "My World" survey asking people to highlight areas they wanted to see prioritized in the goals (United Nations Development Programme, 2023).

The underlying theme for all the SDGs, which has been singled out as a key area of concern, is climate change (United Nations Secretary-General, 2019). The argument is that failing to reach the climate targets identified by SDG 13 (Climate Action) and the Paris Agreement (United Nations, 2015) will jeopardize progress in other areas (e.g., to end all forms of poverty and to tackle inequalities). In many ways, the SDGs improved on several shortcomings from the MDGs: lack of public consultation and stakeholder engagement during the development process, and they considered sustainable development through a holistic perspective that addressed social, economic, and environmental issues. However, the SDGs are far from perfect and despite filling some gaps in the global movement towards sustainability, have failed to stimulate transformational systemic, structural, or social change.

1.2 The Sustainable Development Goals (SDGs): where are we now?

At the time of writing, the SDGs have been in force for just over seven and a half years (they entered into force in January 2016). Each year, the United Nations produces a report on the global progress towards the goals, based on the data reported to it by member countries. Despite the years since the SDGs were adopted and the world promised to "leave no one behind", that promise is in peril as signatories reach the halfway point in their mission to achieve the SDGs by 2030 (United Nations, 2023). Worldwide, only marginal progress has been made to achieve the SDGs, according to data reported by nations (The Sustainable Development Report, n.d.) (Figure 1.2).

1.2.1 Norway and the Sustainable Development Goals (SDGs)

Norway has been a staunch supporter of the SDGs since their adoption and provided a high-level statement endorsing the SDGs (Sachs et al., 2023, section 3.1). Norway has also undergone several efforts to adopt the SDGs at the national level, integrating SDG reporting into key processes and budgets of its government via relevant Ministries and Departments as well as sectoral and overarching strategic action plans. It has designated a lead government unit (The Norwegian Forum for Development and Environment) to coordinate and implement the SDGs across ministries. According to the 2016 report on Norway's follow-up to the 2030 Agenda (Ministry of Foreign Affairs, 2016), the *Storting* (Norwegian Parliament) annually reviews the national progress towards the SDGs and works closely with the Sámi Parliament (*Sámediggi*)[2] through dialogue with the ministries and formal consultation mechanisms. The Norwegian government has undertaken several dissemination and awareness raising campaigns on the SDGs, including the establishment of public consultation platforms to understand the level of national awareness on the goals and what the public wants to see prioritized (Ministry of Local Government and Modernisation, 2021, p. 29; Fløttum et al., 2022).

[2] In Norway, the Sámi Parliament is a representative elected assembly that deals with all matters concerning the indigenous Sámi people. It is a recognition that the Sámi are one of two peoples in Norway.

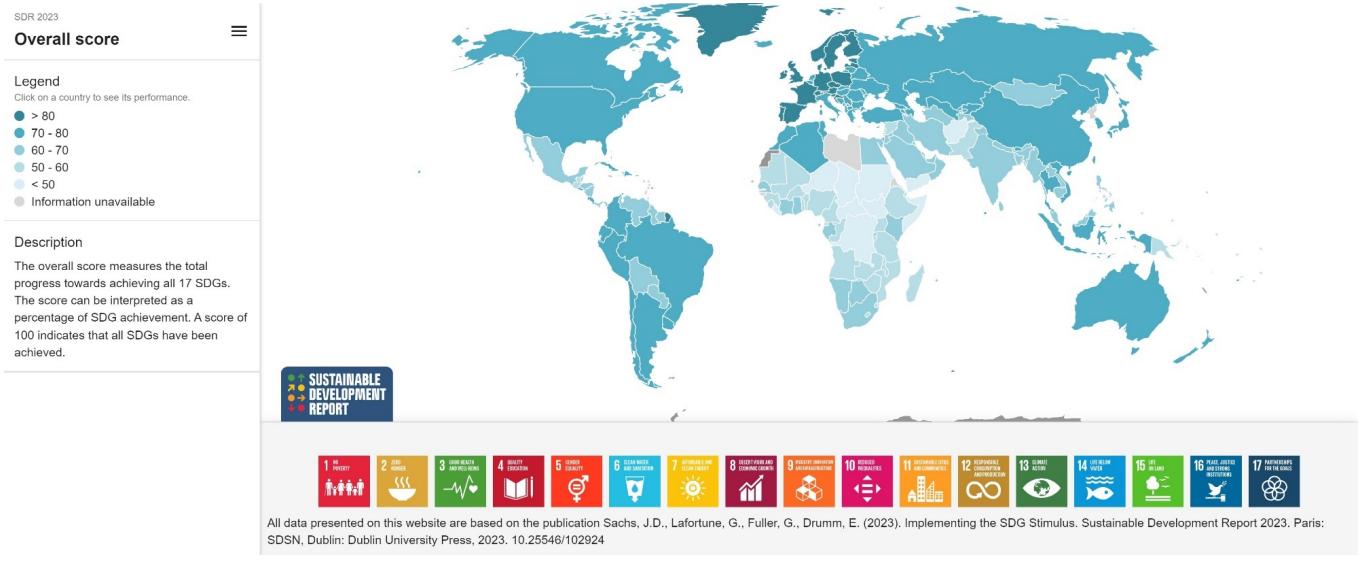

Figure 1.2: Status in 2023 of SDG progress worldwide[3]. Accessed on 7 October 2023 from: https://dashboards.sdgindex.org/map.

[3] The Sustainable Development Report (formerly the SDG Index & Dashboards) is a global assessment of countries' progress towards achieving the Sustainable Development Goals. It is a complement to the official SDG indicators and the voluntary national reviews. All data presented on this website are based on the publication Sachs, J.D., Lafortune, G., Fuller, G., Drumm, E. (2023). Implementing the SDG Stimulus. Sustainable Development Report 2023. Paris: SDSN, Dublin: Dublin University Press, 2023. 10.25546/102924.

It has incorporated the SDGs into all policy documents, budgets, and action plans (Ministry of Local Government and Modernisation and of Foreign Affairs, 2021, p. 32), and identified eight priority areas related to the SDGs for a national action plan on the 2030 Agenda (Ministry of Local Government and Modernisation and of Foreign Affairs, 2021, p. 34). Other areas where Norway ranked strongly for the SDGs include Goal 1 (no extreme poverty), Goal 3 (good health and well-being), Goal 5 (gender equality), Goal 7 (affordable and clean energy), Goal 10 (reduced inequalities), and Goal 17 (partnerships for the goals) (The Sustainable Development Report, n.d.).

However, the 2023 SDG index dashboard also shows that even though wealthy countries, including Norway, have a relatively high score in terms of SDG progress, the scores have only marginally increased since the adoption of the SDGs in 2015. This indicates that those countries entered the SDG game well ahead on most targets, hence their high score, but have failed to make substantial progress since then (Schmidt-Traub et al., 2017), and Norway is further behind than it should be on several environmental indicators, particularly for the marine environment (OECD, 2022). While Norway boasts a relatively high capacity for responsible natural resource conservation and utilization, in practice efforts are challenged by climate change, inefficient agricultural practices, and continued exploitation of oil and gas resources. The 2021 Voluntary National Review from Norway (Ministry of Local Government and Modernisation and of Foreign Affairs, 2021) highlighted several areas where the country needed more effort and focus to achieve the SDGs, particularly for water management, sustainable infrastructure, reducing waste, and sustainable management and use of natural resources (Ministry of Local Government and Modernisation and of Foreign Affairs, 2021, p. 54). Importantly, Norway remains among the top 30 countries for greenhouse gas emissions and ranks particularly low for responsible consumption and production and climate action (Ministry of Local Government and Modernisation and of Foreign Affairs, 2021, p. 54).

1.3 The Sustainable Development Goals (SDGs): revealing more gaps

From the 1987 Brundtland Report to the 2015 SDGs, sustainability has become central to many international development policies and programmes (Johnson et al., 2018). The SDGs are essential enablers of sustainability and addressed climate change directly through sustainable development, which was seen to be more effective than considering it as separate climate policy (Robinson et al., 2006). However, the SDGs still fail to address several issues of sustainable development. These additional gaps further demonstrate the complexity of sustainability and achieving it worldwide.

The scope and scale of the SDGs are double-edged in their ambitions. While the goals consider all issues under sustainable development to be a priority, nations must still weigh the choices when deciding which goals to prioritize in practice. For example, a study by Forestier and Kim (2020) showed that SDGs 1 and 8 on poverty eradication and economic growth were the most prioritized in 19 countries, including some high-income countries. Wealthier nations do not face the same disparities in terms of poverty as do other lower-income nations, and this explains the global north "cherry-picking" and prioritizing those goals that are easiest to achieve (Forestier and Kim, 2020; Biermann et al., 2023). Policy-makers cannot assume that policies targeting the SDGs will lead to zero-sum or clearly defined good or bad tradeoffs (Swain, 2018; Nilsson et al., 2018), and in most cases these decisions are made in favor of SDGs that are related to essential needs. The SDGs are also criticized for conflating economic growth with societal progress and failing to put this within environmental limits (Kagan and Burton, 2018), or having contradictory aims between socioeconomic and environmental goals (Swain, 2018).

A typology developed by Nilsson et al. (2016) scored the type of interaction between the SDGs, for example between Goal 14 (life below water) and Goal 11 (sustainable cities and communities) and noted several areas where Targets either complemented or reinforced each other, had no impact on each other, or contradicted or canceled each other. In the application of this typology, the study revealed that Goals 14

and 11, for the most part, were complimentary to each other although there were several cases where risk of contradiction or cancellation remained high (Nilsson et al., 2018): Target 14.2 on sustainable coastal zone management is supported by Targets 11.4 (on safeguarding cultural and natural heritage) and 11.6 (on reducing adverse per capita environmental impact of cities), because they all relate to safeguarding coastal ecosystems and coastal settlements (International Council for Science, 2017, page 196). However, Targets 14.2 and 14.5 (on conserving coastal and marine areas) contradict Target 11.c (on supporting the building of sustainable and resilient buildings using local materials) because construction efforts may damage coastal ecosystems (International Council for Science, 2017, page 197).

While several studies reveal trade-offs of the SDGs in terms of ecological sustainability and socioeconomic progress (Spaiser et al., 2017), these inconsistencies only persist if the economic systems, and social networks of our world do not change. Clearly, under our current global model, a reduction in CO_2 emissions by merely decreasing production will likely prevent economic and social growth, however if this reduction in greenhouse gas emissions occurs via the transition to renewable energy and a circular economy, then social and economic growth is possible. Sustainability policy and efforts should shift from consumption-based economic growth to one that emphasizes human wellbeing (in terms of health and education) and environmentally-friendly technologies (Spaiser et al., 2017; Swain, 2018). Recent research also points to the importance of sustainability transformations as critical to the achievement of the SDGs, which should happen under the overall framework of sustainability science, along with effective monitoring on the progress of the SDGs, assessing and capitalizing on interlinkages between the SDGs, and ensuring that the SDGs are aligned within the current planetary limits – i.e., not expect economic and social growth that surpasses environmental boundaries and thresholds (Allen et al., 2021).

The SDGs are not designed to induce political changes needed for long-term sustainability transformations, as argued by Biermann et al. (2023) who identified four core elements for government transformations that are lacking in the SDGs: differentiation, dynamization, legalization, and stronger institutionalization. Firstly, there is no *differentiation* of the goals for the different countries that would force wealthier countries to commit to the same sacrifices, changes, and compromises that lesser-developed countries must face[4]. For example, wealthier countries should not be allowed to only focus on goals they can easily achieve like zero hunger or no extreme poverty and focus instead on more technologically challenging and innovation-oriented goals like sustainable energy transitions or decarbonization. Secondly, the lack of *dynamization* of the goals also means that they are not adaptable to better-informed targets and indicators as science and knowledge grows. While there have been some internal UN processes to revise the individual targets, the process is not a regular requirement (like, for example, the 2015 Paris Agreement). Thirdly, the non-*legalization* of the goals also makes them less influential. While this was likely done to make the goals more amenable for all 193 nations to agree and adopt (i.e., no concrete commitment was required of them), a series of regional or multilateral legally-binding agreements could legalize elements of the SDGs. Finally, a *stronger institutionalization* of the goals is needed if they are to benefit from regulatory and financial frameworks. Some goals, such as for health and food security are already institutionalized through international bodies such as the World Health Organization (WHO), the World Food Programme (WFP), and the Food and Agriculture Organization of the United Nations (FAO), among other agencies. However, many of the goals could benefit from similar support to steer and cement them in international policy through legally-binding agreements. For instance, the establishment of a specific international institution for reducing inequality or transitioning to a renewable energy global model.

[4] *Authors note:* the lack of differentiation of the goals for different countries is recalled as a deliberate choice for the UN negotiators. They acknowledged that some countries would move faster in terms of achieving the goals, and therefore the expectation was to develop vague and large unquantifiable goals that could be made more specific by nations by designing bespoke targets using the agreed indicators (M. Niamir-Fuller, *personal communication*, 29 September 2023).

Adding to this failure at the international level, the 2023 UN global progress report is clear that member countries have universally failed to strengthen their *national* capacities – in terms of accountability and public institutions – to progress on the goals (Fukuda-Parr, 2014; United Nations, 2023, p. 6). Principally, member countries have failed to fully and effectively support domestic efforts to implement the SDGs (United Nations, 2023, p. 6), principally through the lack of allocating sufficient funds for their implementation (Orozco et al., 2021). This failure is also noted by the Norwegian government in the 2021 Voluntary National review, where the Norwegian Association of Local and Regional authorities note several remaining challenges for implementing the SDGs at the regional and municipal levels in Norway. Principally, they acknowledge that achieving the SDGs relies on efforts made at the local and regional level, which are the governing bodies closest to citizens, businesses, and civil society (page 94), yet very little support is offered by the national government in terms of guiding or funding these efforts. Other obstacles to SDG implementation at the subnational level include the unclear allocation of responsibility and insufficient coordination of enacting and monitoring SDG implementation between municipalities and government departments (Jönsson and Bexell, 2021). The core elements for government transformation in terms of policy development, institutional arrangements, funding allocations, and inter-agency/inter-regional cooperation (Biermann et al., 2023) are as relevant for the global implementation of the SDGs as they are for the *localization* of the SDGs.

1.4 SDG localization

Global-level goals do not easily transfer to the national and subnational levels, and tensions emerge between the global sustainability agenda and specific local conditions in which they must be implemented. This particularly happens if local actors in governments, businesses, and communities do not feel a sense of ownership of the SDGs (Horn and Grugel, 2018; Forestier and Kim, 2020; Moallemi et al., 2020; Hickmann et al., 2023; Reuter, 2023).

The SDGs and its targets are useful general guides but do not provide situational advice on how their implementation can be accomplished considering the unique circumstances of every local context (Gassen et al., 2018; Reuter, 2023). While the SDGs are primarily seen as a top-down effort to promote sustainable development, the United Nations also recognizes the bottom-up pathways needed to anchor the goals in the national and subnational contexts. This is further elaborated by the roadmap for localizing the SDGs (Global Taskforce of Local and Regional Governments, 2016), which recognizes that the SDGs are not locally relevant except in a broad sense (Reuter, 2023). There are several other international and UN-led initiatives to localize the SDGs, including the "SDG HelpDesk"[5] and "Local2030: Localizing the SDGs"[6].

The most common definition for SDG localization comes from the Global Taskforce of Local and Regional Governments: "'Localizing' is the process of taking into account subnational contexts in the achievement of the 2030 Agenda, from the setting of goals and targets, to determining the means of implementation and using indicators to measure and monitor progress. Localization relates both to how local and regional governments can support the achievement of the SDGs through action from the bottom up and to how the SDGs can provide a framework for local development policy" (Global Taskforce of Local and Regional Governments, 2016, p. 6). Other definitions include SDG localization as "…the city- or regional-scale interpretation and implementation of SDG targets…" (Hartley, 2020, p. 235), and "…the process of adapting, implementing and monitoring the SDGs at the local level" (Fox and Macleod, 2023, p. 519). Key among these definitions is the crucial step of transcending multiple scales of government to ensure that the SDGs are anchored to the local context by integrating the SDGs into local strategy, policy, and practice (Krantz and Gustafsson, 2021). Generally, this integration should be at the level of municipal government

[5] https://sdghelpdesk.unescap.org/
[6] https://www.local2030.org/

since 65 percent of the SDG targets are linked to local and regional governments (United Nations, 2023, p. 48–49). Integrating the SDGs into local policy and local sustainable development goals should still adhere to the overall ambitions and goals of the global agenda (Stafford-Smith et al., 2017; Krantz and Gustafsson, 2021; Orozco et al., 2021).

Localizing the SDGs requires several conditions that not only rely on the institutional and regulatory frameworks of the local case, but also on the local community contexts. An integrated approach that connects place-making, community building, downscaled targets and goals, and community participation to drive sustainability action (Szetey et al., 2021) is key to the success of the SDG localization effort for three reasons:

1. Local actors have intimate connections to and knowledge of the local context and are best suited to develop place-based solutions (Manzo and Perkins, 2006; Szetey et al., 2021).

2. Localizing the SDGs can distribute ownership of the goals across all levels of society and result in greater inclusiveness and connection to the global goals (Moallemi et al., 2020; Szetey et al., 2021; Ansell et al., 2022)

3. Top-down planning and change are often met with skepticism by local communities, especially if historical efforts have ignored local needs in the planning and decision-making processes (Frank and Reiss, 2014; Morrison et al., 2015). Focusing on the personal spheres of individuals to take responsibility for their actions and develop agency for change is often overlooked in literature on SDG localization.

Furthermore, the localization of the SDGs, through sustainability planning by a municipality for example, should connect sectors and align inter-municipal goals to ensure that the SDGs are anchored with concrete action. This will help avoid several limitations, risks, and challenges associated with SDG localization such as the lack of political support for sustainability efforts, the lack of resources, and the lack of organizational experience or capacity (Krantz and Gustafsson, 2021; Reinar and Lundberg, 2023).

1.4.1 General steps in the SDG localization process

The SDG localization process has taken on several forms in practice and how it has been described or advised to be in academic literature. Generally, an SDG localization process has four steps: identifying the local baseline, awareness raising, integrating the SDGs into strategies and plans, and monitoring, evaluation, and reporting[7]. These steps are described below and interwoven with examples of how to anchor the SDGs to the local context either via regulatory pathways (i.e., through existing policies and frameworks), or via social and cultural pathways (i.e., through awareness raising and relevance-tracing). These steps are presented in a chronological order, but they can be combined or implemented in parallel with another, depending on the local context and resources available (Figure 1.4.1).

[7] https://www.local2030.org/

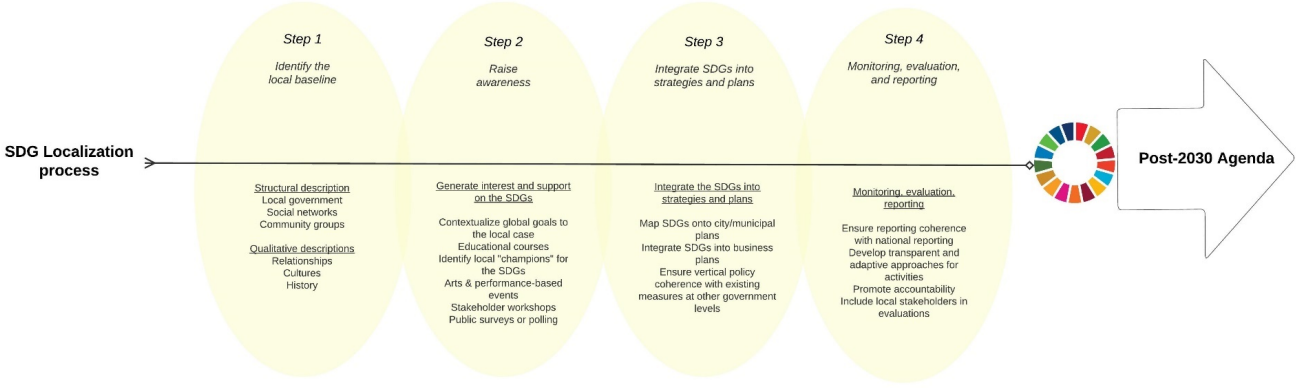

Figure 1.4.1: Summary of the four main steps in the SDG localization process.

1. Identify the local baseline

   The first step of the SDG localization process is to identify the local baseline. This involves describing the local context in terms of demographic statistics and other sources of information (i.e., community groups, etc.) to understand the baseline for the implementation process in terms of what organizational structures and social cultures comprise the local government and the local social networks and map stakeholders and relationships for engagement (Ansell et al., 2022). This would principally be a step for a top-down localization process since the local context will likely be unknown to non-local actors. However, in large or administratively disjointed municipalities this exercise can also serve municipality members to identify gaps and assets in communication or as knowledge- or resource-sharing. Consolidating data, both from quantitative sources (e.g., demographic statistics) and qualitative sources (e.g., public engagement and consultation processes) on the local community structure and relationships also serves to understand the local needs and different planning activities, which is important when it comes to identifying major themes and areas of shared interest or common ground for sustainable development policy (Szetey et al., 2021).

2. Awareness raising

   The second step is to raise awareness among government members and local communities on the SDGs to generate interest and support. This step comprises the context-building element of the localization process since the global goals may not be familiar or known to individuals in a local community. Raising awareness on the SDGs involves presenting them to local actors in a contextually-relevant way that connects local experiences to the global scale. Examples of awareness raising described in Fox and Macleod (2023) include free online courses for citizens on the importance of the SDGs, or performance-based events that showcase the goals in creative and interactive ways, or public recognition of individuals and businesses who contribute to the SDGs. Other examples include public surveys where individuals are asked directly which SDGs are most important to them (Szetey et al., 2021), or stakeholder workshops where the SDG targets are individually reviewed and selected for prioritization according to local needs (Blome and Dankel, 2021).

3. Integrating the SDGs into strategies and plans

   Multi-level governance mechanisms to integrate the SDGs are necessary for the third step and should include vertical policy coherence and collaboration mechanisms to strengthen and harmonize policy design and decision-making. An inclusive and transparent process is important in this step to accommodate marginalized social groups or small entities. This step includes directly mapping the SDGs onto city plans and strategies while accounting for existing sustainability initiatives that may not be using SDG-specific language (Fox and Macleod, 2023). This step also uses the local baseline description from the first step of the process to identify driving forces (or themes) and outcomes that would likely have significant influence on the future development of the community and link them directly with the relevant SDG targets (Szetey et al., 2021). Methods for integrating the SDGs also exist for business plans, for example, such as the SDG Target Relevance-Tracing methodology developed by Blome and Dankel (2021).

4. Monitoring, evaluation, and reporting

   The final step of the SDG localization process focuses on monitoring, evaluating, and responding to the direct outputs and outcomes of integrating the SDGs, and adapting or modifying approaches and activities as necessary (Ansell et al., 2022). This promotes the participation of local and

regional governments in national monitoring and adapts national indicators to local and regional contexts to ensure their relevance to local needs (Fox and Macleod, 2023). This also serves to promote accountability during the SDG localization process – a key factor in trust-building between citizens and democratic institutions – where transparency on local data management and reporting and responsive action from local leaders (political or citizen) (Krantz and Gustafsson, 2021; Szetey et al., 2021) affects the perception of local ownership of the goals and enhances their credibility and legitimacy for the local context.

In all, the steps summarized here for the SDG localization process represent an integrated approach that connects local sustainability efforts to global and national sustainability goals and harmonizes these efforts across sectors and municipal boundaries (Krantz and Gustafsson, 2021). The specific SDG localization process must be tailored to the local context to avoid pitfalls of a generalized sustainability process (Blythe et al., 2018). Such pitfalls include the burden of transformation (e.g., financial, systemic, structural, etc.) is unequally distributed among local and national entities, the translation of the global goals is either oversimplified (resulting in ineffective change) or remains complex (resulting in inaction), or different contexts and situations are not considered and accounted for leading to resistance or a failure to shift systems for change (Blythe et al., 2018).

1.5 Localizing the SDGs for Norway

According to the 2021 Voluntary National Review (Ministry of Local Government and Modernisation and of Foreign Affairs, 2021; VNR) produced by the, the national government has the overall responsibility for implementing the 2030 Agenda in Norway. Since regional and local authorities are responsible for providing most services to citizens, members and representatives of these authorities make a key group for SDG integration in Norway's multi-governance model for three main reasons (page 29):

1. Local and regional authorities are responsible for prioritizing, developing, and enacting policies at the regional and local levels.

2. Local and regional authorities are most familiar with local opportunities and challenges of individuals and businesses within their communities, since members of the authorities are also community developers, property owners, etc. themselves.

3. Local and regional authorities are responsible for most of the social and physical infrastructure that influences local development potential.

The Norwegian parliament decides on the deliverables and financial contributions to the SDG implementation process, but regional and local authorities determine how to deliver the services by using the SDGs in their regional and local planning.

In Norway, there is a large variation between municipalities when it comes to using the SDGs. Those that have worked longer with the SDGs and done more with leveraging networks and collaborations with stakeholders have operationalized and integrated the SDGs into their strategic plans and management processes. However, the 2021 Voluntary National Review notes that "there is no clear correlation between budgetary constraints and implementation of the SDGs in the municipal context. This indicates although financial resources and capacity can be an enabler, large financial and budgetary constraints do not seem to have influenced the speed and progress of the municipalities' implementation of the goals" (pg. 95). Essentially, engagement in networks and regional activity seems to impact the degree of SDG implementation the most, with municipalities with fewer resources also having succeeded. Importantly, a

key barrier noted by the regional and municipal authorities across the board to undertake this work is the "lack of support and clear guidelines from the national level" (pg. 96). The review also notes that despite the increasing availability of tools and methods for implementing the SDGs, small municipalities remain at a disadvantage because of their relative isolation from bigger, more central areas where taking part in regional networks is easier to facilitate.

Norway has yet to define a common SDG localization process, despite a wide recognition that municipalities are seen as key facilitators and enablers for enacting sustainability initiatives (Gustafsson and Ivner, 2018; Krantz and Gustafsson, 2021; Ministry of Local Government and Modernisation and of Foreign Affairs, 2021; Ansell et al., 2022; Global Taskforce of Local and Regional Governments, 2022; Reinar and Lundberg, 2023). According to national planning guidelines from the Ministry of Local Government and Modernisation (2019), the SDGs should be integrated into social and land-use planning. Several municipalities have already taken up this process, including: Trondheim, Asker, Bærum, Rana, Kristiansund, Kristiansand, Ålesund, Stavanger, Molde, Bodø, Narvik, Nærøysund, Karmøy, Haugesund, Voss, and Bergen as well as the regional authorities Møre og Romsdal, Trøndelag, Viken, and Nordland, among others (Norwegian Association of Local and Regional Authorities, 2021). Ultimately, the political commitment at the regional and municipal levels determines progress on integrating the SDGs: those municipalities with a political focus on the SDGs have generally progressed farther on integrating the SDGs into their municipal plans (Ministry of Local Government and Modernisation and of Foreign Affairs, 2021, p. 98). For many municipalities, in particular the smaller and more northern ones, priorities focus on economic development for their region first and foremost and sustainability is not always a top consideration for these activities (Norwegian Association of Local and Regional Authorities, 2021; Reinar and Lundberg, 2023). This is specifically exemplified with my project case study of Andøy Municipality in Nordland regional county of Norway.

1.5.1 The empirical case: Andøy Municipality

The islands of Lofoten, Vesterålen, and Senja (commonly known as LoVeSe) in northern Norway are home to fishers and cultural sites where traditional knowledge and fishing practices, boat building, and other ocean-linked trades are part of an integrated human-ecosystem heritage that has developed for over one thousand years. The northeast Arctic cod fishery exploits the largest cod stock in the world, and arguably the most important commercial fishery for Norway, which has supported generations of Norwegian enterprises with its high value (around 9.4 billion NOK of landed value in 2022) (Fiskeridirektoratet, 2022). Before the Norwegian oil boom in the 1970s, the northeast Arctic cod fishery was fundamental to the Norwegian economy, and it still holds immense economic and cultural importance today. However, these streams of revenue to, otherwise isolated, areas along the Norwegian coastline face major threats and impacts under global climate change. The municipalities that exist in this northern region of Norway have undergone many industrialization and urbanization changes but remain loyal to the concept of a fisher-farmer lifestyle – ecological awareness and rural areas dominate the region (Stein, 2019; Engen et al., 2021). This is reflected in both the lack of energy development (e.g., oil development or wind farms) and the promotion of ecological tourism (Ministry of Trade, Industry and Fisheries, 2017; Norwegian Ministries, 2017). As a result, these municipalities along the northern coastline of Norway tend to be smaller and more isolated from each other than those more southern and central and have seen unbalanced economic and social development (Stein, 2019). However, each municipality exhibits its own unique contribution to Norway and Norwegian society, and their relative sizes or influence does not denote their importance to the national economy or cultural identity of Norway.

One of these islands, located in the Vesterålen region, provides a useful example of the coastal development challenges faced by Norwegian municipalities. This particular island, Andøya, is the northernmost island in Vesterålen and is managed by the Andøy Municipality, which sits at the northernmost tip of Andøya,

about 300 km north of the Arctic Circle. Other villages in the municipality include: Bleik, Stave, Nordmela, Nøss, Bø i Andøy, Åknes, Sandnes, Skjoldehamn, Nygård, Bjørnskinn, Risøyhamn, Åse, Ånes, Dverberg, and Kvalnes. Andøya island has an area of 489 km^2, which makes it the 10th largest island in Norway. The Norwegian Sea lies to the west and the north, along with *Andfjorden* (east), *Risøysundet* (southeast), and *Gavlfjorden* (southwest). Geographically, Andøya is a relatively flat island with the innermost part consisting of bogs, marshes, and lakes although there are some mountain ranges that reach up to 700 m above sea level. Andøya has been populated since the Stone Ages, and the name comes from *Omd*, a name used on the island and mentioned in historical royal sagas from the Viking Ages – *Yngling* saga and *Olav Tryggvason* saga – which were written from about A.D. 850 to the year A.D. 1177 by Snorri Sturlason (c. 1179–1241) in the "*Heimskringla*", a collection of sagas concerning various rulers of Norway (Killings and Widger, 2009).

Approximately 5,000 people reside in Andøy municipality, with about 3,500 of those people living in Andenes, the municipal "capital". Andøya is defined by a variety of economic sectors including fisheries, agriculture (livestock production), and tourism (whale watching, puffin watching, northern lights, and hiking, among others). The fishing industry on Andøya is a major contributor to Norwegian fisheries. The island has three major fishing ports located in Andenes and in neighboring Bleik and Nordmela – all of which have fish processing plants. Since the 1970s, the Norwegian military has also had a major presence on the island, and in addition to supporting jobs for the island, it has also maintained and operated a military air station that includes services for a civilian airport. Another major industrial sector on the island is Andøya Space[8]. Established in 1962, Andøya Space is a civilian-operated research company that provides services to the European Space Agency (ESA) and the National Aeronautics and Space Administration (NASA), and to universities and other contractors for scientific and military research. As the legislative body for the island, the Andøy municipality must consider planning for Andøya Space and the fisheries industry, among other sectors such as tourism, aquaculture, and recreation such as the development of "The Whale"[9], and the maintenance of natural spaces for the community.

For my LoVeSeSDG-PhD project, an information-oriented sampling approach (Flyvbjerg, 2006) was used to select Andøy Municipality as the case for exploring methodologies for an SDG localization process. The island of Andøya, in Nordland County in Vesterålen, is a prime example of a small, fishing-dependent municipality that is facing some major changes to its economic infrastructure (for example the expansion of Andøya Space to adapt for larger rockets and satellites (Andøya Space, 2023), the development of land-based aquaculture facilities[10], and the building of "The Whale", a large museum and tourist destination), and thus presents the opportunity to integrate the SDGs into its planning processes. These changes are expected to have a significant impact on employment and population growth and for the municipality from an influx of highly-skilled citizens and their families, as well as increased revenue from tourism. In addition to this, the Andøy municipality has an interest in implementing the SDGs, as evidenced through a publicly-funded financing programme, SAMSKAP[11], which promotes sustainable business growth for the municipality. However, as with most other municipalities in the region, the Andøy administration generally struggles with a lack of resources and human power to perform its tasks let alone focus on SDG localization (E. Iversen, *personal communication,* 11 June 2020). More importantly, any framing of the SDGs for Andøya would need to acknowledge that the municipality's priority is to build its economy and generate

[8] https://andoyaspace.no/
[9] https://www.thewhale.no/en
[10] https://www.andfjordsalmon.com/en/
[11] SAMSKAP (2017–2023) was a restructuring programme for Andøy Municipality, funded by the Norwegian government, Nordland County, and Andøy Municipality. The programme supported projects that contributed to innovation, jobs, and increased housing in the municipality (https://www.samskap.info/).

growth[12], so any new measures or programs (based on the SDGs) would need to focus on sustainable economic benefits while also generating other sustainability benefits.

Several efforts have been made by municipalities around Norway to localize and implement the SDGs into municipal plans, but they have relied principally on the integration of these plans into existing policies and regulations, such as the Planning and Building Act (Ministry of Local Government and Regional Development, Act of 27 June 2008 No. 71 relating to Planning and the Processing of Building Applications). Any attempt to integrate global policy into municipal planning will result in translation challenges and difficulties moving from strategy to action for the operationalization of those municipal plans, including financial planning and municipal budgeting, thematic plans, and land-use planning, among others (Reinar and Lundberg, 2023). Commitment from elected officials and ensuring consistency and follow-up of SDG action throughout political transitions are other challenges faced by municipalities, often in the context of prioritizing other development efforts for their communities. While most efforts so far have focused on the legislative aspects of integrating the SDGs in Norway (see Section 1.5), studies have yet to reconcile the administrative anchoring of the SDGs (i.e., through municipal plans) with the cultural and social perceptions of local communities on sustainability. Without this simultaneous bottom-up defining process for *sustainability of what* and *sustainability for whom*, the anchoring of the SDG concept to local lives and individual action risks being dislodged.

The concept of *localizing* has taken various forms throughout the years, and the common thread among them is the idea of operationalizing or implementing theories, concepts, policy, or methods, etc. In other words, to adapt something to meet the requirements of a particular area. Two key points emerge from the idea of localizing. First is the idea of adapting, or changing, something to fit local needs. The second point is the implicit condition that the local context (including the social, economic, and environmental contexts) is fully understood. This latter condition, crucially, includes an articulation of the perceptions and values that define the social structures and institutions of the local context: "…efforts to localize the SDGs should consider ways diverse values and perspectives on well-being ultimately drive action…" (Sterling et al., 2020, p. 1139). Understanding the local context is a crucial part of the first two steps of the general localization process (see Section 1.4.1): *identify the local baseline* and *awareness raising*, which require on-the-ground knowledge of the social structures, ideologies, and perspectives that characterize the humans of that local place in terms of human-human and human-nature relationships.

2 Theoretical underpinnings and research approach

2.1 Inter- and transdisciplinarity

There is not a formal, global consensus on how inter- or transdisciplinary research is defined. I refer to the following interpretations in this PhD thesis. *Interdisciplinary* research is coordinated and integration-oriented collaboration among researchers from different academic disciplines that, in most cases, results in a new method or approach that combines several ways of thinking or applies a method to another discipline (Guimarães et al., 2019). *Transdisciplinary* research is proposed as a new research discipline altogether that includes non-academic stakeholders in the process of knowledge production (Rigolot, 2020). Interdisciplinary and transdisciplinary research share the ambition of creating new research methods, theories, or fields of practice from their multi-stakeholder or multi-lateral collaborations, but transdisciplinarity goes beyond academic or research-focused institutions to include other sectors including government, managers, and local communities (see Figure 1 in McPhee et al., 2018, for a helpful illustration of multi- vs. inter- vs. trans-disciplinarity). I adopted both approaches to my thesis by integrating research

[12] As communicated by two government stakeholders in interviews.

methods from the social sciences and psychology with theories from the sustainability sciences and political sciences to conceptualize the SDG localization process for Norway (the interdisciplinary part) and worked directly with non-academic stakeholders in the local community to explore what an SDG localization process might look like for that local context (the transdisciplinary part). The conceptualization of the research impact (*what do we want to achieve*) and an awareness of its philosophical underpinnings (*why do we want to achieve this*) also affects the quality of results (Mackenzie and Knipe, 2006; Lauckner et al., 2012; Jackson, 2013). A summary figure of this chapter is found in Figure 2.1.

2.2 Ethics of post-normal science (PNS): the research philosophy

Post-normal science (PNS) is the guiding research philosophy for my project. The foundational elements of PNS, as epitomized by its ethos of trust, robustness, uncertainty management, sustainability, and transdisciplinarity influence the worldview and values of the project researchers and the subsequent selection of theories, methods, and frameworks to conduct the project. All researchers and scientists have a responsibility to align their decisions and actions with ethical principles, and this is particularly important for researchers who work with community engagement and participatory approaches. The shared perspective within the sustainability discourse is that its complex problems are bound by *uncertainty*, and that its solutions need *people* (Hopwood et al., 2005; Blackmore 2007). Post-normal science (PNS) proposes to manage scientific uncertainty (either practical uncertainties involving technology and methodology or ethical and epistemological uncertainties) in a more transparent way than traditional science by making uncertainties explicit in how science is communicated to others (Kønig et al., 2017), and by including an "extended peer community" of all stakeholders[13] to set the standards and criteria for relevant research activities (Funtowicz and Ravetz, 1993; Funtowicz and Ravetz, 1994a; Ravetz, 1999; Betz, 2004).

This concept of an extended peer community in PNS is interwoven with managing uncertainty: ethical or epistemological uncertainties are managed by including all stakeholders in decisions regarding relevant research activities (*what research is relevant for the extended peer community?*). The latter is crucial for representing the "…plurality of perspectives and commitments, and the intellectual and social structures…" (Funtowicz and Ravetz, 1994b, p. 199) of the diverse cultural environments and contexts where decisions are being made. A simple example of PNS is the use of the terms *inform* or *base* when discussing scientific evidence for policy-making. The PNS distinction is that policy-making should be *informed* by evidence (evidence-informed), and not *based* on evidence (evidence-based) (A. Saltelli, personal communication, 18 November 2019). This represents a subtle shift in how scientific uncertainty is communicated to policy-makers and, in turn, how policy-makers and scientists can make decision-making processes more transparent for citizens. Crucially, it incorporates a clear *ethical framework*: "The dynamic of resolution of policy issues in post-normal science involves the inclusion of an ever-growing set of legitimate participants in the process of quality assurance of the scientific inputs" (Funtowicz and Ravetz, 1993, p. 752).

[13] "The post-normal methodology for a more robust 'science for policy' involves an extended peer community, both internally and externally. The internal extension involves expert elicitations where multiple disciplines work together on the assessment of quality and uncertainty. The external extension is the inclusion of representatives from all relevant stakeholders in the processes of problem framing, choices of indicators, and quality assurance" (Kønig et al., 2017, p. 13).

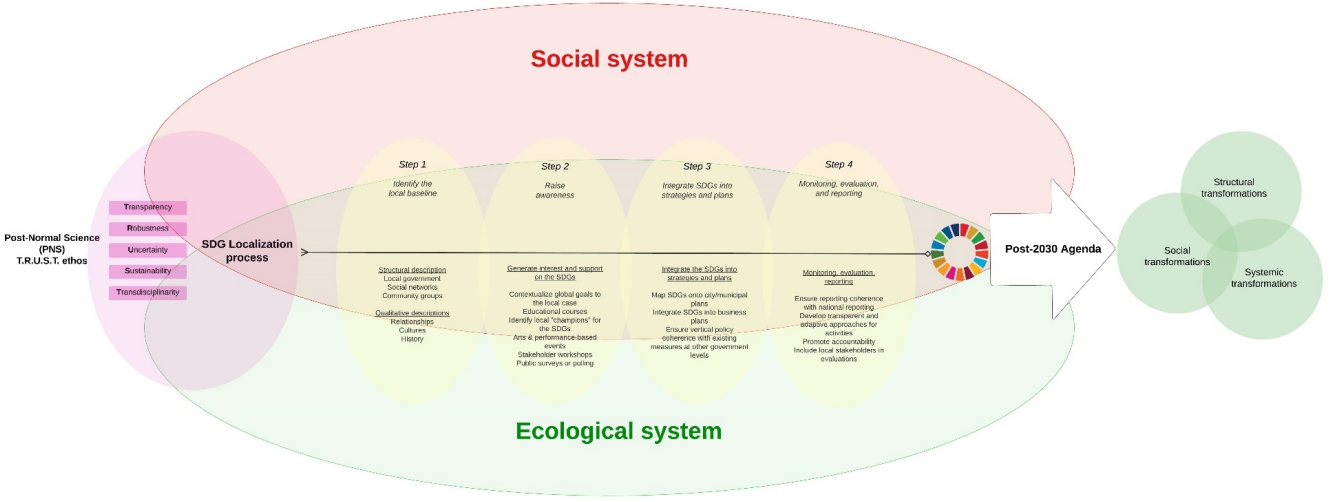

Figure 2.1: Conceptualization of the T.R.U.S.T. ethos (Kønig et al. 2017) as a research philosophy from which to begin the localization process, the social-ecological research lens representing the local context as a coupled social-ecological system, and the research ambition of transformational changes for sustainability as a future outcome beyond the post-2030 Agenda.

Post-normal science functions less as a framework and more as guiding principles, or ethos, in how to conduct research when answering complex, or wicked, problems. Central to PNS are approaches to science that are "…critical and reflective, uncertainty-aware, quality-focused, foster plurality in scientific and normative perspectives on complex issues, and actively engage extended peer communities in the production, appraisal and use of knowledge" (Dankel et al., 2017). The basic concept of using an extended peer community in PNS (i.e., incorporating citizen knowledge or engaging stakeholders in research) is not new (Mathur et al., 2008; Phillipson et al., 2012; Stange et al., 2015; Kujala et al., 2022). However, effective stakeholder engagement is often difficult to conduct in practice (Kunseler et al., 2015) and can result in unintended negative consequences if implemented without adequate consideration of the local context or respect for the stakeholders themselves (Nogueira et al., 2021). In stakeholder engagement practices, researchers must exercise anticipation, reflection, and responsive actions, and the PNS approach explicitly calls for this reflexivity through its ethos of **T.R.U.S.T.** founded on several values (ends of view, something to strive for and work towards) and norms (the how or means to achieve values) (Kønig et al., 2017): ***T****ransparency,* ***R****obustness,* ***U****ncertainty management,* ***S****ustainability*, and ***T****ransdisciplinarity*.

When applied to the SDG localization process, the T.R.U.S.T. ethos guides research approaches and methodologies so that there is strong public trust in the scientific results and science advice (Kønig et al., 2017). In this case, as a norm, *trust* should be present in the science creation and communication processes. As a value, trust should be embodied by the individuals working with communities on the localization process and who are perceived as *trustworthy*. Trust also ensures that the conditions of legitimacy[14], credibility[15], and salience[16] are met (Cash et al., 2003; Cash and Belloy, 2020; Bremer et al., 2022) for the SDG localization process to be fit-for-purpose and to also build trust, as shown with examples of other studies on building trust and natural resource management (Bodin et al., 2006; Davenport et al., 2007; Crona and Hubacek, 2010; Gonzalès and Parrott, 2012; among others). The foundational premise of my project is that an SDG localization process is only successful if it fulfills the conditions for legitimate, credible, and salient research and policy. Ensuring these conditions are met is dependent on the ethical philosophy – framed by the T.R.U.S.T. ethos – of the researchers, practitioners, and other stakeholders who are involved in the SDG localization process.

2.3 Social-ecological systems (SES) theory: the research lens

Since the mid-1990s, *sustainability* and *resilience* have emerged as two key paradigms to understand human-nature relationships (Johnson et al., 2018), conceptually known as social-ecological systems (SESs). SESs are nested, multi-level systems that provide essential services to society (Binder et al., 2013). The study of these intersecting systems is encapsulated by the fundamental premise that our world supports humans interacting with and relying on nature (Berkes and Folke, 1994, 1998; Ostrom, 2007, 2009; Colding and Barthel, 2019). **Social-ecological systems (SES) theory** provides a theoretical lens for viewing the world in which the SDGs must be achieved. The SDGs sit at the intersection of the social and ecological system(s) of our world by including goals with both social and environmental aims, as well as goals about the institutions that influence and govern human-nature interdependences (Selomane et al., 2015).

Commonly, studies of social-ecological systems use systems theory and dynamic modeling to explain the interdependencies and dynamics of connected social-ecological systems (Schoon and van der Leeuw, 2015; Preiser et al., 2018; Colding and Barthel, 2019; Schlüter et al., 2019). In the early years of SES modeling, more emphasis was placed on the application of ecological principles and methods to study system

[14] *Legitimacy* is if actors perceive the process in a system meets standards of political and procedural fairness.
[15] *Credibility* reflects if actors perceive information as meeting the standards of scientific plausibility and technical adequacy.
[16] *Salience* is the relevance of information for an actor's decision choices.

dynamics, likely because this body of knowledge emerged from ecological modeling and system dynamics (Kasperski et al., 2021). However, this emphasis on ecological principles and methods to study the sustainability and resilience of social-ecological systems overshadowed the possibility to ask other questions focused on the social systems, such as those that apply to social, economic, and political dynamics of society. This recognition to incorporate more social questions led to an integration of social and ecological systems into coupled social-ecological systems modeling (Schlüter et al., 2012; Martin and Schlüter, 2015) and more interdisciplinary research, which allowed for a wider research focus to include human dimensions of social-ecological systems. Examples of this include how the dynamic interactions between people, their behaviors, and their environments helps managers understand the resilience of socio-ecological systems to climate change (Cinner and Barnes, 2019), or how human motivations and information-sharing affects the success of fisheries management measures (Hunt et al., 2013; Cenek and Franklin, 2017; Kasperski et al., 2021). Importantly, these studies reflect the importance of a holistic approach for sustainability because these two systems cannot be studied or managed in isolation: the social system is both a part of and shapes the ecological system (Cote and Nightingale, 2012).

Aside from modeling and system dynamics, there are several methodologies from psychology, anthropology, social sciences, economics, and political sciences, among many other disciplines, that allow researchers to understand the individuals, organizations, and communities of a social system, and by extension, how that relates to or impacts the coupled ecological system. A social system can be studied for its *composition* and *structure* (how many people are in the system? How are they connected to each other?) and for its *qualities* (what do people think in these systems? How do they perceive their world?). Implementing the SDGs calls for an integrated, holistic, and multi-stakeholder approach (Reynolds et al., 2018), and this implies the need for systems thinking in practice that draws on research theories, tools, and techniques for facilitating better conversation and cooperation between actors and agencies. Understanding these two parts of the social system also informs the first two steps of the SDG localization process: the first step of identifying the local baseline, and the second step of raising awareness. The two methods used in my project are presented in the following subsections, where social network analysis is presented as an analytical tool to study the social structure of a system (Section 3.1), and Q-methodology is presented as a qualitative method to illuminate the inner world of individuals within the social system (Section 3.2).

2.4 Transformational change for sustainability: the research ambition

As the world faces increasing unprecedented changes, adaptation to these changes within a social-ecological system may not be sufficient and *transformational change*[17] will also be needed for social-ecological systems to shift to stability (World Commission on Environment and Development, 1987; Johnson et al., 2018): Importantly, a key difference emerges between these two concepts: adaptation refers to staying on the current pathway of change and response (and not changing the fundamental structures or systems that perpetuated the unprecedented changes), while transformation refers to shifting to a different pathway or creating a new system altogether by changing current structures and systems to a sustainable version (Johnson et al., 2018). Thus, **transformational change for sustainability** is presented as the ideal outcome for localizing the SDGs and provides the epistemological underpinnings for the third paper of this project (Chapter 10). This section makes the point that localizing and the achieving the SDGs will not be enough to result in transformative changes in systems, structures, or within ourselves but it does offer one of many pathways to anchor sustainable goals to individuals and enact small-scale and incremental changes that begin with a reflection of our personal values and ideologies and an anticipation of needs for a better

[17] "[transformational changes] towards sustainability' refer to fundamental changes in structural, functional, relational, and cognitive aspects of socio-technical-ecological systems that lead to new patterns of interactions and outcomes" (Patterson et al., 2017, p. 2).

world for future generations. Since the unprecedented changes have been created by human behavior, eliciting our inner world in this way places humans at the forefront of necessary change.

Scoones et al. (2020) conceptualizes three main approaches to achieving transformational change for sustainability: *structural*, *systemic*, and *enabling* – the last of which is focused on fostering the human agency and capacities necessary to act collectively and enact pathways to desired futures, which would include structural and systemic changes. These three approaches are not mutually exclusive, and transformations can be human-generated (e.g., from direct interventions by other actors, political-economic forces, or social processes) or catalyzed by environmental forces (e.g., from climate change) (Scoones et al., 2020). The overlapping elements among these three transformations is the fundamental change to the current state that is enacted by enabling approaches leading to social transformation (Figure 2.4).

My project takes the human-centered view of sustainability transformations and considers the SDG localization process as a type of enabling approach for *social transformation*, but which also utilizes enabling approaches to *localize the SDGs*. In this case, enabling approaches function as the means to an end both for localizing the SDGs, and also for (eventual) social transformation. By stimulating extended peer communities (defined in Section 2.2 on post-normal science) as part of the localization process, regional and local authorities can tap into existing potential (i.e., knowledge, skills, energy, motivations) and use that potential to craft areas for solution-oriented discussions and pathways forward. Engaging directly with local communities also enhances their agency and empowers individuals to act for change (Moallemi et al., 2020; Sterling et al., 2020). Enabling human agency for social transformations also serves as the foundation for subsequent (or parallel) systemic and structural changes, since it focuses on the values, relations, ideologies, and processes that underlie both structures and systems (O'Brien et al., 2013; Scoones et al., 2020). Furthermore, applying enabling approaches to the SDG localizing process is a way of scaling (*down*[18] and *deep*[19]) technical and managerial solutions and human behavioral changes to global-scale challenges. Enabling approaches to social transformation offer ways of exploring interventions and leverage points that are less obvious, but potentially more powerful, for a research agenda that effectively engages with the root causes of *un*sustainability so that people are reconnected to nature and our worldview and ideologies are reframed to be sustainability focused (Abson et al., 2017).

Generating social transformations for sustainability is not a simple endeavor and will require political, socioeconomic, and cultural changes that go beyond incremental physical actions to challenge the core beliefs and worldview of society. Localizing the SDGs will not be enough to transform the world, but it does offer one of many pathways if the localizing processes adhere to an ethical frame and instigate small-scale, local action that can transcend scales to result in larger, cumulative impact. The SDGs can thus be seen as essential enablers for transformative change. The SDGs and their localization process as a starting point for ethical social transformation is a key concept interpreted from the Three Spheres of Transformation Framework (Sharma, 2007; O'Brien and Sygna, 2013; Section 2.4.1). I refer to the Three Spheres as the practical framework within which to place my studies of an SDG localization process aimed at (eventual) overall transformational social change that transcends scales (O'Brien et al., 2023; Section 2.4.2). Chapter 10 of this manuscript includes the written article (submitted) for this section.

[18] *Scaling down* is when local involvement is supported and promoted in "non-scalable" projects (Lampinen et al., 2019; O'Brien et al., 2023).
[19] *Scaling deep* addresses the change of values and fosters new mind-sets in individuals (Lam et al., 2020).

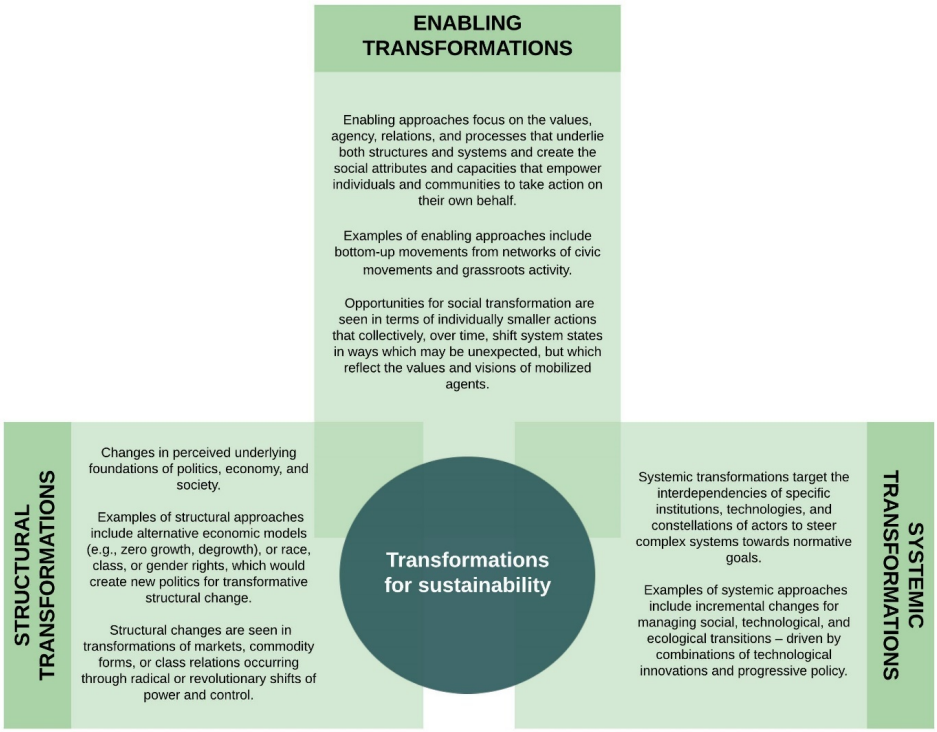

Figure 2.4: A diagram showing the characteristics of the three transformations to sustainability, as described by Scoones et al. (2020).

2.4.1 Three Spheres of Transformation Framework for Sustainability

By describing the social transformative potential of individual agency within the personal, political, and practical spheres of the **Three Spheres of Transformation Framework** (hereafter shortened to Three Spheres) for sustainability and the social fractal concept of transcending scales (Section 2.4.2), this project explores whether the SDG localization process for Norway would benefit from a focus on inter-personal attributes and inner values of individuals to empower local action and enhance individual agency for long-term and sustained social transformational change.

The Three Spheres is an actionable framework developed by O'Brien and Sygna (2013) in response to the social and ecological challenges arising from climate change. The premise of the framework is that transformation for sustainability occurs through three "spheres": a practical sphere, a political sphere, and a personal sphere (Figure 2.4.1). Engaging in actions through all three spheres of the framework results in sustainability outcomes that are permanently embedded by transformed systems, structures, and human ideologies: "By viewing the spheres together, it is possible to see the breadth and depth of transformations, as well as the multiple entry points for sustainability outcomes" (O'Brien and Sygna, 2013, p. 4).

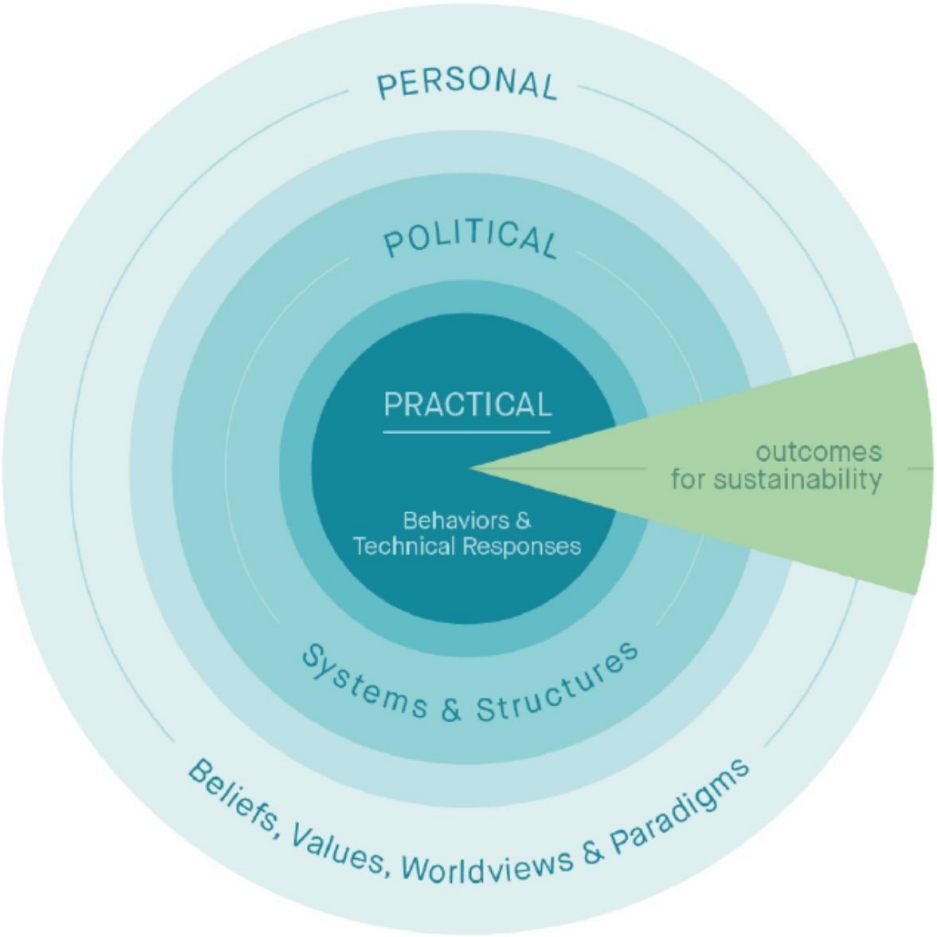

Figure 2.4.1: Three Spheres of Transformation Framework for Sustainability diagram (O'Brien and Sygna, 2013, *reproduced with permission*). As a visual, the Three Spheres circle has three layers embedded within each other: the practical sphere forms the core, embedded within the middle layer of the political sphere, and then placed within the outer layer of the personal sphere. The "slice" of those embedded circles represents the outcomes for sustainability that result in transformations in any one sphere or facilitate transformations in the other spheres.

The following text is a summary of the Three Spheres from O'Brien and Sygna (2013), integrated with the three approaches to transformation from Scoones et al. (2020): structural, systemic, and enabling.

The Practical sphere

The practical sphere, the inner core of the Three Spheres conceptualization, represents the technical solutions and behavioral changes of transformational change. It represents the know-how, the motivation, and the *change* to strategies, practices, and behaviors. Examples of changes within the practical sphere include changes in management practices (e.g., moving from single stock to multi-stock species assessments in fisheries management), the introduction of new technologies (e.g., battery-powered commercial airplanes), or behavioral changes (e.g., someone consistently opting for recycled or reusable products over single-use items). The practical sphere is where the actual changes are seen, and so this sphere is also where the measuring of those changes takes place through targets or goals. Considering this, the SDGs fall into the practical sphere as they offer a technical solution to sustainable development and include measurable indicators by which to achieve the goals. In line with the qualities found within the practical sphere (below in bold), the SDGs include:

- **Calls for policy change across several of the goals.** E.g., Target 13.2 (Integrate climate change measures into national policies, strategies, and planning) and Indicator 13.2.1 (Number of countries with nationally determined contributions, long-term strategies, national adaptation plans and adaptation communications, as reported to the secretariat of the United Nations Framework Convention on Climate Change),
- **Calls for the development of new technologies.** E.g., Target 9.4 (By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities) and Indicator 9.4.1 (CO_2 emission per unit of value added), and
- **Behavioral changes to achieve certain goals.** E.g., Target 12.5 (By 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse)[20] and Indicator 12.5.1 (National recycling rate, tons of material recycled).

Critically, sustainability solutions and changes in the practical sphere cannot take place independently of the other two spheres. Unless the larger systems and structures are also changed, technical solutions and behavioral changes within the practical sphere are short-term and risk causing unexpected problems "For example, although electric cars may replace petrol cars, mobility systems are not necessarily transformed" (O'Brien and Sygna, 2013, p. 6).

The Political sphere

The political sphere represents the economic, political, social, and cultural realities and norms that either enable or impede transformations in the practical sphere: "The political sphere includes the social and ecological systems and structures that create the conditions for transformations in the practical sphere" (O'Brien and Sygna, 2013, p. 4). Studying the conditions of the political sphere offer answers to why change does or does not happen in the practical sphere (e.g., understanding what political dynamics lead to social movements or revolutions or studying the roles of power and culture in collective thought). The political sphere is also where the systemic and structural approaches for transformation will take place (Scoones et al., 2020). "Structural approaches focus on changes in perceived underlying foundations of politics, economy and society, and the need for a complete overhaul of the ideological underpinnings of social

[20] While this goal does not specifically call for behavioral change, the concept of reuse and recycling generally requires a cognizant shifting of human behavior.

systems writ large" (Scoones et al., 2020, p. 66) and "Systemic approaches identify particular features of systems (such as system elements, drivers, levels) as targets for focused change" (Scoones et al., 2020, p. 66). These two approaches from Scoones et al. (2020) overlap somewhat in their concepts, but systemic approaches emphasize perspectives from social-ecological systems and the need for knowledge on system dynamics and resilience to the system state. Nevertheless, the common thread is that they both represent changes to the structures and systems within the political sphere, and without those changes transformational change for sustainability will not occur.

The SDGs do not explicitly fall into the political sphere because, for the most part, their implementation relies on existing political structures and economic systems (Eisenmenger et al., 2020) and do not (explicitly) call for or require fundamental and transformational changes to these dimensions in order to be achieved[21]. While the political impact of the SDGs has been found to encourage greater and broader discussion on sustainability in terms of how actors understand and communicate about sustainable development from local to national government levels, the overall transformative influence of the SDGs is limited (Biermann et al., 2022). However, the long-term and anchored changes to individual worldviews and ideologies generated in the *SDG localization process* could contribute to change in this political sphere by influencing the election of political representatives who enact policies in line with those sustainability changes. This concept of changing the "personal" of individuals within the local context moves into the personal sphere where beliefs and values become the focus for change.

The Personal sphere

The personal sphere represents the entirety of the individual who exists within the political sphere and works in the practical sphere. "The personal sphere includes individual and collective beliefs, values and worldviews that shape the ways that the systems and structures (i.e., the political sphere) are viewed, and influence what types of solutions (e.g., the practical sphere) are considered "possible" (O'Brien and Sygna, 2013, p. 5). The personal sphere is the inner world of every human on earth and, collectively, the beliefs, values, and worldviews that create and uphold the systems and structures in the political sphere. Changes in the personal sphere can lead to different ways of understanding or seeing systems and structures, which then affects the types of actions considered possible within the practical sphere. While changes and shifts within the personal sphere can be influenced to a certain degree, they cannot be forced, and the individual must discover and act on their own motivation for changing their worldviews, beliefs, and values (while still being guided by others). This returns to the importance of localizing the SDGs in a locally-relevant and anchoring way that impacts not just the systems and structures that are external to an individual, but also shapes their inner world.

Enabling approaches from Scoones et al. (2020) take place within the personal sphere for transformation and focus on the agency and empowerment of the individual. Enabling approaches aim to create capacity for those individuals to act on their own behalf that, while individual and small, cumulate over time as communities take action together, thereby incrementally creating larger impact from those individual

[21] Author's note: SDG 17 (*Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development*) does address political and economic systems and structures but only in terms of enhancing cooperation and coordination, not necessarily fundamentally transforming the status quo (such as, for example, switching from the global capitalist economy to a socialism model that allows for a more equal distribution of goods and services). Nevertheless, Goal 17 does include targets that are indirectly moving towards change. For example, Target 17.10 calls for a new "…universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization…", which is measured by the weighted-tariff average of countries. The average level of worldwide tariff rates can be used as an indicator of the degree of success achieved by multilateral negotiations and regional trade agreements (https://unstats.un.org/sdgs/metadata/?Text=&Goal=17&Target=17.10). A lower tariff average promotes more trade, but too low negatively affects production and to high prevents trade and affects the availability of products (A. Lajeunesse-Page, *personal communication*, 6 October 2023).

actions. Examples of enabling approaches include grassroots environmental action such as community organizing, door-to-door canvassing, local political campaigns, or arts and performance-based awareness raising, which aligns with the second step of the SDG localization process (raising awareness, see Section 1.4.1). While enabling approaches may begin with the individual, they are fundamental to systemic and structural shifts in ways that reflect the values and principles of the individuals who inhabit the three spheres, "…change may be more dispersed and grassroots in nature, cascading up from local innovations that disrupt system dynamics to create structural change" (Scoones et al., 2020, p. 68), but these changes cannot remain at the small-scale if global transformations in structures and systems are envisioned. This need for transcending scales to generate larger social, systemic, and structural change for sustainability transformation is conceptualized by *social fractal agency* (O'Brien et al., 2023).

2.4.2 Social fractal agency of the Three Spheres – a concept for social transformation

O'Brien et al. (2023) present a way to bridge the scalar gap between small-scale and individual action and global solutions by looking at how human agency – "…the capacity to change systems through conscious actions…" (p. 2) – can connect change through all three spheres by applying universal values[22] such as dignity, compassion, and equity to sustainable transformative action: "…scaling sustainability transformations depends on engaging with all three spheres in a holistic manner" (p. 2). The concept of *social fractal agency* uses the geometric shape from mathematics – *fractals* (similar and repeating patterns that grow infinitely larger and more complex; Image 2.4.2) – to illustrate how individual action, when generated from personal reflection and motivations founded on universal values, has the capacity to "…move the whole by generating patterns of change that scale" (O'Brien et al., 2023).

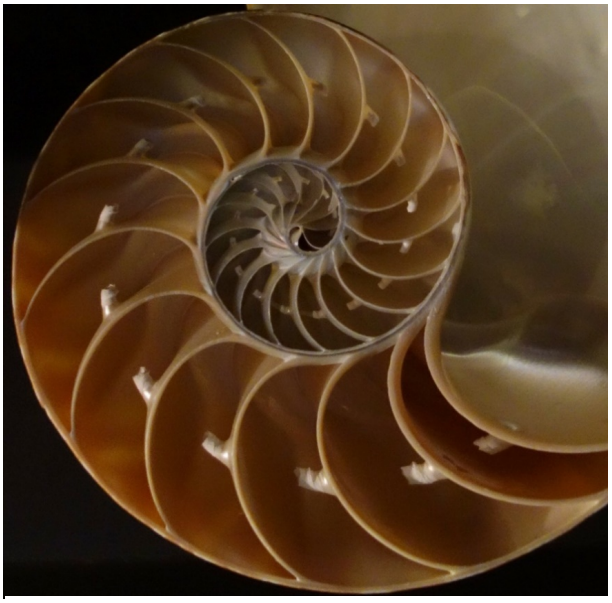

Image 2.4.2: Cross-section of a *Nautilus pompilius* shell showing nature's fractals (image from the Fernbank Museum of Natural History (2012), courtesy of Wikimedia Commons).

The social fractal agency concept visualizes in four steps how action within and throughout the Three Spheres can occur (O'Brien et al., 2023):

- Firstly, the **personal sphere** is examined to identify the universal values that apply to individuals and to the collective – *which universal values and principles will guide work, individual worldviews, and collective ideologies?*
- Secondly, decisions are collectively made on what

[22] Universal values are defined as "…intrinsic characteristics that connect humans and nature in a coherent, acausal way" (O'Brien et al., 2023).

technical solutions and behavioral changes in the **practical sphere** are necessary to achieve for desired outcomes – *what are the visible changes and measurable results desired?*

- Thirdly, the systems and structures in the **political sphere** are collectively reviewed to determine which norms, rules, regulations, or institutions need to transform in order for changes in the practical sphere to be realized – *what cultural and systemic shifts away from the status quo are needed?*

- The fourth and final step of acting on the social fractal agency concept is **being in action**, which connects to the enabling approaches for transformation presented by Scoones et al. (2020). Taking local, individual, grassroots, or collective action at this step should (after experiencing fractal-like growth that emerges from individual or small-scale action) eventually result in shifts in systems and structures in the political sphere and produce desired results in the practical sphere.

In simple terms, generating social fractal agency through the Three Spheres represents the notion that no action is too small and refutes the perception that individuals cannot change the world (the view that inevitably leads to apathy and acceptance of the status quo): "Fractal agency is based on a recognition that every activity and intervention can contribute to transforming the whole" (O'Brien et al., 2023). Social fractal agency and enabling approaches to transformation are already found in several existing practices in organizations and municipalities such as through educating competencies and capacity development that strengthens individual motivation and "sustainability-oriented culture" (Krantz and Gustafsson, 2021, p. 2645). I explored this concept in my PhD research by presenting the results of the study in a workshop to the local Andøy Municipality and other stakeholders in a workshop. The third paper in this manuscript (Chapter 10) describes this process and presents the workshop as an example of social fractal agency. Importantly, these actions should become institutionalized, encouraged, and engrained in all parts of society if sustainable transformational change is to begin from within the individual.

2.5 Applying a practical management tool to the SDG localization process

Science research and innovation comes with a moral responsibility of those producing and sharing the knowledge (Stilgoe et al., 2013). This moral responsibility not only included how the scientific knowledge and innovation products were to be used (or abused; see for example the ethical debates around genetic research and human cloning), but also their very purpose; the ethical reflection and inclusive deliberation of purposes and motivations of science or innovation (Owen et al., 2013; Stilgoe et al., 2013). A framework for responsible use of research in innovation (referred to as Responsible Research and Innovation; RRI) is proposed by Owen et al. (2013) in response to, among other things, the need to take care of the inherent uncertainty that also emerges from the complex (i.e., wicked) problems currently faced by sustainability research and innovation. Fundamentally, RRI serves as a guiding framework to produce ethical, sustainable, and socially desirable science and innovation products. The need for this framework is discussed in Owen et al. (2013) who offer a theoretical discussion of RRI and the need for such a guiding framework for science and innovation.

Owen et al. (2013) explain that, historically, responses to innovation problems (i.e., the unintended and sometimes undesirable impacts) were addressed post-hoc, with governance and regulation of innovation products (be it knowledge products or material products) emerging after the problems appear in society. Typically, in these cases, regulatory instruments are put in place to manage or control the negative or undesirable social or environmental impacts of the innovation product. This innovation governance can also be applied proactively through precautionary approaches (for example, through precautionary fisheries management, or climate change measures using model projections or other forecasting methods). However,

this reactive or proactive approach to innovation governance is not as effective when negative or undesirable impacts emerge as a result of highly uncertain science: "…burdened with imperfect foresight, we take a change, hoping to be excused from moral blame if it can be demonstrated we did not have sufficient knowledge of the future consequences of our actions at the time…" (Owen et al., 2013, p. 28). Therefore, the fundamental question underlying the RRI framework is: "[In the absence of certainty] How should we proceed responsibly under such conditions of ignorance and uncertainty?" (Owen et al., 2013, p. 28).

The RRI framework includes four dimensions (Owen et al., 2013; Stilgoe et al., 2013): **anticipation** (describing and analyzing intended and unintended social, economic, or environmental impacts), **reflection** (reflecting on underlying purposes and motivations), **engagement** (opening up purposes and questions to the broader public and diverse stakeholders, collectively deliberating through the process of dialogue and engagement, etc.), and **responsiveness** (reflecting on participatory and anticipatory approaches to ensure that the science or innovation process is adaptive and can respond dynamically to internal and external needs as they arise or become known). Reflection and responsiveness are often combined into ***reflexivity***, where reflection on *what* has been done is combined with the broader implications. In essence, the RRI framework applies critical questions to the decision-making steps of the science or innovation creation process to anticipate consequences, reflect on biases and underlying motivations, include a wider set of perspectives, and respond and adapt to needs, with the aim to produce ethically engaged, sustainable, and socially responsible science and innovation products (Owen et al., 2013; Stilgoe et al., 2013). While initially developed for the project and program development processes of the European Union, the application of RRI is widely relevant to SDG localization. In practice, my project draws on the guidance from RRI epistemological practice and takes the form of anticipatory lines of questioning that should happen during the planning process of SDG localization, summarized in Table 2.5.a, and performed with several action techniques or approaches, summarized in Table 2.5.b.

Table 2.5.a: The lines of questioning under the RRI framework that aims for an ethical and sustainable outcome, with reference to the SDGs as the *product*, the localizing as the *process*, and social transformation for sustainability as the *purpose*. Table and questions summarized from Owen et al. (2013) and Stilgoe et al. (2013).

Responsible Research and Innovation (RRI) questions *Summarized from Owen et al. (2013) and Stilgoe et al. (2013)*		
Product **(SDGs)**	***Process*** **(localization)**	***Purpose*** **(social transformation)**
How will the risks and benefits be distributed? (*anticipatory)* How might these change in the future? (*anticipatory, reflective*)	How should risks and benefits be defined and measured? (*anticipatory, responsive*) Who is in control? (*engagement, reflective*) Who is taking part? (*engagement, reflective*) Who takes responsibility if things go wrong? (*reflective*, *responsive*, *reflexive*)	Why are we doing this work? (*reflection, reflexivity*) Are these motivations transparent and in the public interest? (*reflection, reflexivity*) Who will benefit? (*reflection, reflexivity*) Who will bear the costs? (*reflection, reflexivity*) What are the alternatives? (*reflection, reflexivity*)

Table 2.5.b: A suggested way for viewing the similarities between the RRI dimensions and the T.R.U.S.T. ethos of PNS (not presented below in the typology order) to demonstrate overlap in concepts and direct action techniques or approaches to be conducted during a project or program management cycle.

Post-normal science T.R.U.S.T ethos (*directly associated norms and values)* (Kønig et al., 2017)	**Responsible Research and Innovation dimension** *Summarized from Owen et al. (2013) and Stilgoe et al. (2013)*	**Action techniques or approaches** *Summarized from Stilgoe et al. (2013)*
Robustnesss *(democratization, quality, flexibility, applicability, relevance, adaptability)* **Sustainability** *(quality, precaution, trust, holism, responsibility)* **Uncertainty management** *(adaptability)*	**Anticipate** *(foresight of the future of research and potential, undesirable impacts)*	Foresight Scenario-building Plausibility assessments
Transparency *(accessibility, honesty, trust, intelligibility, traceability, accountability)* **Transdisciplinarity** *(inclusiveness, democratization, integration, mutual understanding)*	**Engage** *(include different stakeholders from the outset)*	Co- production/design (e.g., stakeholder engagement) Citizen science Open innovation
Transparency *(accessibility, honesty, trust, intelligibility, traceability, accountability)* **Transdisciplinarity** *(inclusiveness, democratization, integration, mutual understanding)*	**Reflect (reflexivity)** *(reflect on institutional or public values/ethics/morals through early stakeholder engagement)*	Inter-, multi-, cross-, transdisciplinary collaboration Embedding ethics (e.g., Codes of Conduct) Training for reflexive capacity of scientists
Robustnesss *(democratization, quality, flexibility, applicability, relevance, adaptability)* **Uncertainty management** *(adaptability)*	**Respond (reflexivity)** *(adapt as new knowledge and values emerge by being open and transparent with engaged stakeholders)*	Transparency Value-sensitive design Adaptive regulation

3 Methodology

The following sections briefly review the methods used in my LoVeSeSDG-PhD project. The first paper used social network analysis (Moreno, 1934) as the methodology, presented in Section 3.1. The second paper used Q-methodology (Stephenson, 1935; Brown, 1980, described in Section 3.2) to elucidate individual perspectives on sustainability and sustainable development. Finally, the third paper wove the theoretical process of SDG localization with transformative changes (systemic, structural, and human) needed to result in actual change. Social transformative potential of individual agency within the personal, political, and practical spheres of the Three Spheres for Transformation Framework (O'Brien and Sygna, 2013) is presented in Section 2.4.1 along with the social fractal concept of transcending scales (O'Brien, 2023) in Section 2.4.2 as a way of enabling individual action that can be repeated in a fractal-pattern manner to result in incremental change starting from the individual. I show how the SDG localization process for Norway could include a focus on inter-personal attributes and inner values of individuals to empower local action and enhance individual agency by anchoring the sustainability concept to local contexts in an ethical way.

3.1 Social network analysis

I explored **social network analysis (SNA)** as a methodological tool for the first step of the localization process: *identify the local baseline*. Chapter 8 of this manuscript includes the published article from this work.

Understanding the structure of a network is a principal goal of social network analysis: "The network connecting nodes via links thus represents patterns of relations among social or political actors, and can be understood as a type of structure" (Ward et al., 2011, p. 246). Thus, social network analysis seeks to understand how an individual's social environment (in terms of connections to others, exposure to novel information, etc.) can explain the individual's decisions or characteristics (Borgatti et al., 2009). Revealing the structure of a social network and how its individuals and their relationships form and function within that structure adds a visual understanding of local communities and other social groups that can also be studied for their individual attributes or characteristics. A network structure may also reveal the stability of that network. For example, a sparse network with fewer or weaker ties is more fragile and more likely to fall apart over time than a denser network with more or stronger ties (Ward et al, 2011). Social network analysis can provide different ways to study the flow of information within a network (Swan et al., 2007), and be used to understand inter-personal relationships defined by attributes (like learning and leadership) and values (like trust) (Bodin et al., 2006; Ward et al., 2011).

Social network analysis can be used to understand the different ways that individuals organize their work within a community of practice (Goldsborough et al., 2011), how social network characteristics are related to actions that directly impact the incidental bycatch of sharks (Barnes et al., 2016), how land management is organized within pastoralist communities (Easdale et al., 2016), or how conflict and cooperation that can emerge from collaborative approaches to environmental problems (Bodin et al., 2020). The social structure description of the local baseline can also establish the areas of shared interest or common ground for the second step of raising awareness (Szetey et al., 2021), which can be done with several participatory approaches to stakeholder engagement including surveys, interviews, and interactive workshops. Social network analysis can also be used to identify human cornerstones of a community, and activate those individuals for collaborations, participatory engagement in research, or raising awareness. The combination of social network analysis with stakeholder analysis can also be used to determine the boundaries of a network for study, which is useful for targeting research activities (Prell et al., 2009).

Social networks represent the primary pathways through which information is shared and received – both formal (such as through organizational procedures) and informal (such as through social customs) (Moolenaar and Sleegers, 2010). Studies have shown that in the context of policy-making, the exchange of information via social networks is influenced primarily by shared ideologies and social trust (Ferrin et al., 2006; Leifeld and Schneider, 2012). Trust is a strong determinant for how knowledge is disseminated through social networks (Nepal et al., 2011). If information-sharing and communication between two individuals is dependent on the level of trust in both, the existence of trust within a network or community – both in terms of trustworthy people and trusted processes – is crucial to the cohesion and stability of that community. In a study by Evans and Wensley (2009), social network measures for *homophily* and *closeness* are shown to have predictive capacity for certain characteristics of trust: a high measure for homophily and closeness could be expected to have highly trusted relationships. When applied to the process of SDG localization, it follows that a local community can be studied with social network analysis to measure homophily and closeness of that community, thereby predicting the degree of trust, thus determining the success or effectiveness of that SDG localization process.

3.2 Q-methodology for localization

Identifying and extracting individually-held values in a society is a first step to developing and implementing solution options to sustainability problems in that society because it increases individual participation in problem-solving, generates social legitimacy, and stimulates the transformational potential of those values (Horcea-Milcu et al., 2019). With a pedigree in psychology and medical research, Q-methodology (Stephenson, 1935) has been used successfully to understand contentious environmental issues and perspectives of stakeholders involved with those issues. Q-methodology has been used to identify potential barriers or alignments to policy (Frantzi et al., 2009; Curry et al., 2013), by looking at how individuals "think about" environmental issues (Barry and Proops, 1999; Swedeen, 2006; Ellis et al., 2007; Doody et al., 2009; Webler et al., 2009; Pike et al., 2015; Armatas et al., 2017; Rybråten et al., 2018; Zabala et al., 2018; Sneegas et al., 2021); improve public participation (Cuppen et al., 2010); and offer a way to understand and potentially resolve contentious issues (Durning, 2006; Zabala et al., 2018), or at the very least indicate the "failure" of such solutions and point effort and resources in another direction for resolution (Bjørkan and Veland 2019).

Q-methodology is used in this study to understand the perspectives of local Andøya stakeholders on the complex topic of sustainable coastal development. Chapter 9 of this manuscript includes the published article from this work. The Q-methodology exercise reveals whether there is a consistent pattern(s) in the subjective value orientations of the local stakeholders. It also reveals similarities or commonalities among stakeholders from different economic sectors affected by coastal planning decisions. A unique advantage of Q-method over R-method (normal factor analysis), for example, is that Q-method allows for the examination of a single topic among a group of people (inter-rater comparisons), rather than the view of a single person over multiple topics (intra-rater comparisons). The other unique advantage of Q-method is that it does not require large numbers of subjects, a Q-method factor analysis could be done with a single subject. This is particularly useful to use for small groups of subjects (like in Andøya) who are not statistically representative of broader society, and instead are unique or "niche" in terms of their qualitative characteristics. However, this does mean that conclusions from the study are limited to those who participated in the study, i.e., they are a non-representative sample (Brown, 1993).

While Q-methodology is not the only research technique to reveal social perspectives, its advantage is that the participant's responses can be directly compared in a consistent manner because everyone is reacting to the same set of Q-statements (Brown, 1993; Brown, 2004; Webler et al., 2009, Watts and Stenner, 2012). Participants sort statements according to how those statements fit into their beliefs and understandings and the analysis of those Q-sorts then reveal patterns across the other Q-sorts. Social perspectives are identified

by looking for patterns in individual's Q-sorts using factor analysis (Webler et al., 2009). Once the qualitative meaning of those factor arrays is identified by the researcher, it becomes a social perspective and a product of the Q-study. Individual Q-sorts are "individual perspectives" and factor arrays reflect deeper organizing principles and are called "social narratives" (Webler et al., 2009) – they are generalizations of attitudes held by people, and as such they allow direct comparisons of attitudes irrespective of the number of people who subscribe to them.

4 Summarizing the research findings

The findings of my PhD thesis are reported in full detail in Papers I, II, and II. This section focuses on the relevance of those findings to the overall research aim.

4.1 Focusing on the "personal" in the SDG localization process

Of the several disciplinary and interdisciplinary theories and frameworks available to use as a research framework, my research showed that using an interdisciplinary and transdisciplinary combination of theoretical approaches and practical methodologies provided the analytical tools to view the transformational potential of the SDG localization process in Norway through different scales. By using post-normal science (PNS) as the umbrella philosophy guiding the research, social-ecological systems (SES) theory as the research lens by which the methods of social network analysis (SNA) and Q-methodology were selected, and the Three Spheres framework, the credibility and salience of the research was assured. I conceptualized the SDG localization process from the foundational value of trust and how it is an essential attribute for change that is embodied through the legitimacy, credibility, and salience of that process. By framing the research within the T.R.U.S.T. ethos of PNS, the subsequent selection of methods for each step of the project adhered to an ethical approach to research not just in practice but also in philosophy (Table 4.1).

Table 4.1: A summary of how the I adhered to the relevant dimensions of the T.R.U.S.T. ethos during my PhD.

Post-normal science T.R.U.S.T ethos (*directly associated norms and values)* (Kønig et al., 2017)	**Research response**
Transparency *(accessibility, honesty, trust, intelligibility, traceability, accountability)*	Ethics approvals and applications for gathering research data. Consistent communication with research participants and relevant stakeholders on the status of the project. Sharing the published research with research participants. Local stakeholder workshop, presented relevant results to the local case study community and verified how the results *and* the method could be relevant to their potential needs.
Robustnesss *(democratization, quality, flexibility, applicability, relevance, adaptability)*	Consultation with disciplinary experts to ensure correct methods application and analysis of results. Method selection specifically for applicability outside of academia; the Q-method, for example, was seen by several non-academic participants as a very interesting tool they could apply to their own work.
Uncertainty management *(adaptability)*	I adopted a hybrid approach during the COVID-ap pandemic so as many interviews as possible were conducted online (including some Q-sortings), and the others were eventually conducted in person once travel restrictions were lifted. Language barrier: I do not speak Norwegian, so several approaches were used to minimize this shortcoming, including translations of the Q-sort cards into Norwegian, recording of interviews for translation, and enlisting the assistance of native Norwegian speakers to conduct some of the interviews.
Sustainability *(quality, precaution, trust, holism, responsibility)*	Deployment of research methods with a strong academic and disciplinary foundation and rationale and reasonably replicated by non-academic users without needing extensive knowledge about the academic theory behind the methods or requiring expensive tools or other resources (besides time). I chose and tested methods that could inform and build an independent and self-sustaining and municipal SDG localization process without needing constant expert guidance.
Transdisciplinarity *(inclusiveness, democratization, integration, mutual understanding)*	Participatory engagement methods aimed to reach different people from the various business sectors in the local case study area and generate a comprehensive view of the community that captured the diverse perspectives that defined it. Active reflection on the challenges, risks, and potential benefits of stakeholder engagement when selecting the Andøy Municipality as a case study.

The SDG localization process described in much of the literature so far is based on the concept of policy translation (Stone, 2012), where the SDGs are integrated into planning processes and policies that generally stops at the level of local government (Reddy, 2016; Jones and Comfort, 2020; Biggeri, 2021; Guarini et al., 2022; Sarkar et al., 2022; Fox and Mcleod, 2023; Reinar and Lundberg, 2023). I argue that these localizing pathways only partially anchor the goals because they remain within the practical sphere of the Three Spheres framework as a tick-the-box exercise and do not result from transformational change within the political and personal spheres. My findings reinforce the importance of localizing the SDGS into the personal sphere of human ideologies, values, and worldviews (Sausman et al., 2015; Fox and Mcleod, 2023) as this leads to systemic and structural changes for sustainable transformation in the political sphere.

The complexities of human behavior and psychology are a fundamental condition for how the world functions, so transformational change should start from there: "…for socially just and equitable transformations (in line with the ambitions of the SDGs) to occur, necessary structural and systemic changes will demand enabling and emancipatory change as well." (Scoones et al., 2020, p. 68). Some studies have focused on participatory approaches for SDG localization and integration into local planning, such as Szetey et al. (2021) who co-created a sustainability plan with the local community, framed within the SDGs using in-person polling at community events and SDG-ranking dialogues with select community members (people were asked which goals were most important for their community after a discussion about the development plans). A study in Cantabria, Spain, implemented multi-sectoral working groups to agree on an effective rural development plan with associated SDG targets (Diaz-Sarachaga, 2020), and a research group in Uruguay used "backcasting"[23] with stakeholders to set targets and development pathways for the national beef sector (Kanter et al., 2016).

While these examples engaged directly with community members to select relevant goals that should be integrated into local or municipal planning processes, the studies do not explicitly focus on the beliefs, values, or worldviews of participants (*what do they think about sustainability*). This is where the application of Q-methodology in my project becomes an interesting approach for localizing the SDGs *for transformational change*. The Q-method helped me to study *subjectivity* and with that to explore topics that go beyond the SDGs themselves and illuminate shared values and perspectives about value-laden concepts like climate change or sustainability. With time, drawing on and promoting these shared values and perspectives in how sustainability change is communicated can build collective motivation to transform systems and structures in the political sphere using practical measures that are beneficial to everyone (O'Brien and Sygna, 2013; Horcea-Milcu et al., 2019). I recognize that this need to engage with the inner world of humans in order to achieve behavioral change for sustainability is well-studied in the behavioral sciences and other disciplines, but research on the transformational potential of personal and universal values for sustainability is not a single-disciplinary interest and it should be explored through various ontologies, epistemologies, and paradigms to fully understand and leverage the extent of human capacity for change.

[23] Backcasting is a method that envisions desirable future scenarios and then works backwards to determine the actions needed to achieve that future (Phdungslip, 2011).

My LoVeSeSDG-PhD project findings lead me to call for a stronger emphasis to be placed on the personal spheres of individuals when deciding actions for transformative change. The relevance of the definition of SDG localization presented in Orozco et al. (2021), with my additions to the definition in bold:

SDG localization refers to the integration and implementation of the SDGs into policy at the regional and municipal government levels ***that is accomplished alongside local community engagement that embeds the ambition of sustainable transformation into the beliefs, principles, and worldviews of individuals through the articulation and integration of universal values in policy-making and grassroots action.***

In my project, I explored the individual perspectives and the local realities of the case study municipality of Andøya to define the localization process for the SDGs. However, I avoid offering a generalized action plan for localization in Norway because that contradicts my argument that a localization process must be specific to each unique case. The results of this project and the frameworks presented show that any localization action has the potential to create larger impact if it begins from the personal sphere: ***change starts with the individual***. Furthermore, this project showed that despite the methods selected for the operationalization process, there are fundamentals that form the core of that process: map the institutional structures involved (groups, networks, etc.) and see what you have. Then map the perspectives of people within that structure about your subject (contextualize it and see how it is relevant to the local context). Then build on those perspectives with commitments and action that start from a place of shared and universal values.

4.1.1 Contributing to the steps 1 and 2 of the SDG localization process

My research showed that an important part of assuring local actors and communities that the process of localizing the SDGs can, in fact, be trusted is to first understand how that social system is structured and characterized (*what is the local baseline?*). Secondly, social systems are not just defined by the mechanics or hierarchies of that structure (e.g., who knows who), but also the ideologies and values that influence the human-human relationships within that social structure, which in turn impact the human-nature dynamics of the larger social-ecological system (*raising awareness*).

Most localization processes focus on the structural and systemic elements of transformation for sustainability, talking about the political (government) and economic institutions in place that must integrate with the SDGs to produce change. However, the enabling of individual agency and action is not directly addressed in these efforts, apart from general considerations of the need to change institutional culture, for example, and to practice more integrated ways of working across departmental silos within municipalities. My project explored the SDG localization process through a social perspective of the capacity of individuals within the municipalities, from government workers to citizens and community members, using both a descriptive (describing characteristics or phenomena) and a normative (asking how/when/why characteristics or phenomena occur) approach to the research. I offer findings and conclusions relevant to steps 1 and 2 of the SDG localization process: *identifying the local baseline* and *raising awareness*.

SDG Localization Step 1: identify the local baseline

My findings show that a description of the local baseline for an SDG localization process must include not only the demographic and ideological characteristics of the individuals inhabiting the local context, but also the social structures of community groups and institutions that influence how information and knowledge is shared within the local context. In the SDG localization process where global concepts are translated and adapted to local levels, the institutional structures where that translation happens should be made explicit (Reinar and Lundberg, 2023). The social network analysis (SNA) method used in this project is primarily a descriptive tool that visualizes the social structure of a system, i.e., the "local baseline" of the community. Academically, SNA offers an interesting method to study relationships and their implications for phenomena such as information flow or knowledge transfer, or characteristics such as the presence or absence of trust between actors. The practical use for SNA is not always visible, since most people already have a good idea of who they need to speak to for information, for example. However, the usefulness of SNA becomes more apparent in very large or highly complex organizations or communities as it could reveal hidden connections or unexpected keystone actors. A small municipality might not need to conduct an SNA, but a large municipality with many agencies and departments could benefit from the exercise. The social structure of a community is an important feature to understand when seeking to localize the SDGs in an integrated and locally-relevant way and social network analysis is a type of descriptive science that can do this objectively.

SDG Localization Step 2: raising awareness

My research shows that Q-methodology functions as a methodological tool for both the first step of the SDG localization process (identify the local baseline) in terms of elucidating individual perspectives on sustainability and sustainable development (understanding the values and inner world of individuals in the local context), and the second step (raising awareness) by presenting the SDGs to local stakeholders in an integrated manner using the Q-methodology concourse. Q-methodology is both a descriptive and a normative tool that describes the variety and range of perspectives on a subject (thus also contributing to step 1 of the SDG localization process) and allows for an interpretation of how those perspectives manifest as collective thought (or common perspective) within a community. Q-methodology is very applicable across academic disciplines and has the potential to be a useful tool for municipalities to organize and collate individual views and perspectives within their communities on, for example, a planning proposal, and create an interpretation of those views that reflects the most common perspective. There are several methods to gather public opinion (e.g., polling), however those tools only represent what is being stated and Q-methodology allows for an exploration of new or different perspectives building on "what exists". This can be very useful for identifying shared perspectives on controversial subjects that generate conflict or persistent disagreement between stakeholders. Q-method could be used as a first step in public engagement and advocacy to determine where to target awareness raising resources: the Q-study could either reveal shared perspectives where efforts should be targeted to generate public interest or acceptance of a planning proposal or reveal that there will be no collective agreement and save resources for other approaches (e.g., as also found in Bjørkan et al. (2019)).

A key advantage in Q-methodology is that, in many ways, it works best as a dialogue tool rather than a data-generating tool. The dialogue between the subject and the facilitator during the sorting process can provide more interesting and useful information than the Q-sort itself and this dialogue is often presented in Q-studies alongside the factor analysis for interpretation. This is a particularly useful tool for the second step of the SDG localizing process – *raising awareness*. Not only can the SDGs be presented to individuals in the form of Q-statements (either verbatim or translated), but a collaborative discussion between the participant and the researcher also served to anchor the understanding of the SDGs into a lived experience. Before the start of each Q-sort in the second study paper (Chapter 9), each participant was shown an image of the SDG color wheel asked if they knew about the SDGs. Most said they had heard about them, or seen

them on the news, but did not know what they were. However, during the dialogue on the Q-statements, it became evident that the essence of the SDGs, the sustainable development of economic, social, and environmental aspects of the local community, were well understood and contextualized within the participant's daily life.

4.1.2 Conceptual framework

This PhD project has illustrated how an SDG localization process can be a legitimate, credible, and salient pathway for enabling social transformative change through the personal, practical, and political spheres of structures and systems. The localization process, consisting of four steps, was built on four theoretical underpinnings (PNS philosophy, SES lens, transformational change for sustainability, and RRI) and made use of three different methodologies (SNA, Q-methodology, and participatory stakeholder engagement).

Figure 4.1.2 illustrates how this is presented in my PhD project. The figure illustrates the framing T.R.U.S.T. ethos of post-normal science, and the overlap of this ethos with the Three Spheres Transformation framework, which is premised on the notion that successful transformational change emerges from universal values that guide sustainability action. The four general steps of the SDG localization process are integrated into the Three Spheres framework, and the first two steps of that process are connected to the enabling methods used in this project to identify the local baseline and raise awareness for SDG localization, which connect to the personal and practical spheres that are activated for enhancing social fractal agency. Not all localization processes will require application of all these tools, but the conceptual framework provides a way to connect the tools and/or to show gaps in the toolbox used in any localization process.

The methods I explored in this PhD have several uses for a practical application in a non-academic setting, which is important for the dissemination of this research into management and policy-making. Social network analysis visualizes the social structure (either of individuals or of institutions and groups) of the local case where SDGs are to be integrated and can reveal hidden connections or unexpected keystone actors with community influence (e.g., as a key transmitter of information or community leader) that can be activated for sustainability action and advocacy. This method is particularly useful for larger or more complex social networks and structures. Q-methodology illuminates shared perspectives within a community and that can serve as a starting point for discussion or be integrated into targeted action and advocacy for sustainable change. These operate under the assumption that a community that endeavors to localize the SDGs is defined by different priorities and opinions among its actors. Therefore, the first step in engaging those actors is to find common ground around universal values that apply to all. Engaging with people for research, whether it is individuals or communities, risks failing if the motivations, planning, and conduct of that engagement are not aligned with ethical standards. This is where the T.R.U.S.T. ethos should be used to frame the outlook and worldview of researchers and practitioners. Indeed, with the amount of uncertainty and skepticism that we face today, scholars of post-normal science should be more concerned with the credibility and stakeholder legitimacy of the scientific process than of the scientific product (Funtowicz, Silvio. "Knowledge for Partnerships". *SDG Conference*, 8 February 2019, Bergen, Norway. Keynote Address). As my project findings show, the research itself can be assured of integrity and sustainability if it follows a reflexive and responsible framework such as RRI.

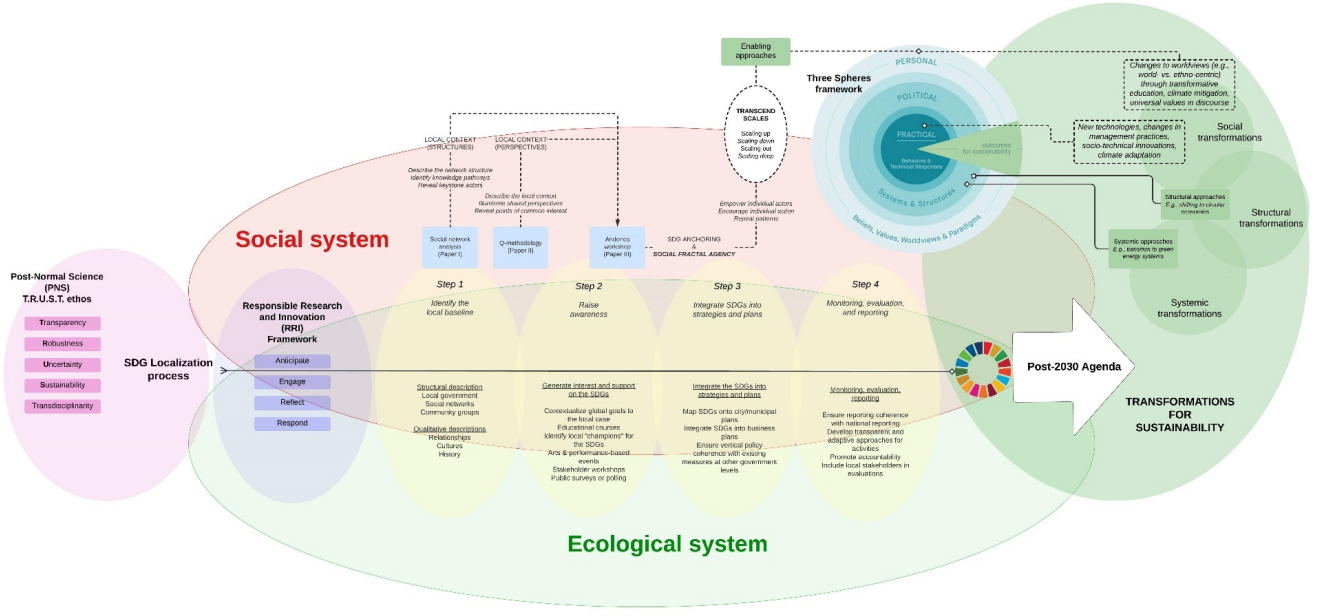

Figure 4.1.2: A conceptual framework for the localization of the SDGs for transformational change.

5 Conclusions

As we move through the Anthropocene Epoch, we continue to build on existing knowledge and improve methods to study both the social and the ecological systems of our world. Crucially, we should continue to promote, fund, and teach interdisciplinary and transdisciplinary research that examines the interconnected relationships of humans and nature that both understands the structures *of* those systems (the components within) and the relationships within those systems (e.g., ecological and social processes, linkages, and interdependencies). Qualifying our social structure and understanding the values, ideologies, and motivations of individuals helps us understand what drives people to make the decisions they make. Revealing perspectives and themes among different actors can help us generate cooperation, collaboration, and collective agreement. Making the SDG localization a more human-focused process that moves through the personal and political spheres to generate concrete action and measurable change in the practical sphere is a more comprehensive and cohesive approach to sustainable development.

The T.R.U.S.T. ethos of post-normal science (PNS) forms the research philosophy of my PhD project. As cross-cutting guiding principles, PNS offers an alternative perspective to "normal" science. It aims to study complex environmental problems and policy processes holistically, transparently, and inclusively in a rapidly changing world experiencing unprecedented consequences from climate change and social conflict. In addition to representing the central research philosophy of my thesis, the principles of PNS also provide important epistemological underpinnings for the critical element of *trust* in the science-policy interface of the SDG localization process. Is the SDG localization process *trusted* by people and is it performed by people who are *trustworthy*? Without trust that builds legitimacy, credibility, and salience, sustainable and effective science to policy process cannot endure. Ensuring these conditions are met is dependent on the T.R.U.S.T.(ed) philosophy of the researchers, practitioners, and other stakeholders involved in the SDG localization process.

The SDG localization process, as a stepwise guide, contains four general steps (see Section 1.4.1), of which the first two (*identify the local baseline* and *awareness raising*) are the key determinants for the last two steps and for the overall successful localization of the SDGs. Although the first two steps appear to be simple, they are the most critical to get right because they establish the necessary conditions for building trust that then pave the way for an accepted *and trusted* integration process of the SDGs into strategies and plans (third step), and the monitoring, evaluation, and reporting of the newly integrated plans (fourth step). Therefore, the research questions I developed at the beginning of the PhD aimed to address the first two steps of the localization process: what methods can we use to identify the local baseline of a case study, and what are some ways we can raise awareness of the SDGs and embed them into local thinking?

How can knowledge and information be tracked within a multi-sector and mega-organizational institution? And how is this useful for an SDG localization process? The first research method applied in this PhD is social network analysis (SNA), with the aim to visualize the structure of a social system and build an understanding of what relationships comprise that social structure. While the application of the method in the published article by Fuller et al. (2023a) tracked integrated ecosystem assessment (IEA) knowledge within the expert group network of the International Council for the Exploration of the Sea (ICES), the overall purpose of the method is very relevant to building an understanding of the social network structure of the local case where the SDGs are to be localized. Social network analysis can be used to predict trust between two people, or it can be used to reveal hidden connections or unexpected keystone actors in larger or more complex networks. Social network analysis can also be used to target individuals for stakeholder analysis for SDG localization. For example, highly connected people within the network could be activated for community-led action, or identifying more outlying individuals for targeted participation and discussion would ensure that everyone's voice is equally heard in the localization process. Social network analysis is helpful to form an understanding of the composition and structure of the social system where the SDGs are

to be localized. However, the SNA only paints part of the picture and it is also important to study the *qualities* of the individuals and their relationships within that system. Not only does this offer an understanding of the inner world of individuals within the local case but can also serve to raise awareness on the SDGs, their purpose, and ambitions.

What is the local discourse on sustainable coastal development in northern coastal Norway and how does this knowledge inform SDG localization? Q-methodology was applied to the second research question of this PhD because it offered several advantages for conducting research with a small group of participants who possessed diverse viewpoints and perspectives on a complex subject (sustainable development). The methodology revealed several unexpected instances where individuals from the fishing community, for example, agreed on the same topics of sustainable development as individuals from co-located sectors that overlap in space and time and leading to the perception of competition for space with Andøya Space, for instance (Fuller et al., 2023b). Not only did this illuminate potential starting points for discussion within the community on the contentious issue of planned coastal development along the Andøya coastline, but it supported my initial impressions of the *Andøyværinger* I spoke with: there was a common end goal of a sustainable life and sustainable municipality but that the pathways to achieve that end goal were different. As part of an SDG localization process, Q-methodology can perform the dual function of building the local baseline for perspectives and values *and* raise awareness of the SDGs by framing them with locally-relevant planning activities and regulations during the Q-sorting exercises. Thus, the SDG localization process has the potential to craft a common pathway to sustainability (a common end goal) that is based on the range of diverse perspectives and values found on the island.

So far, the two methods I applied in this PhD, SNA and Q-methodology, function to build a valid picture of the social structure and inner world of individuals within the local case. The next step was to determine how that knowledge can be used to inform and motivate social transformational change that moved beyond the local scale: *how does the SDG localization process facilitate fractal agency for social transformation?* The concept of social fractal agency emerges from the transformational change literature and argues that enabling and empowering individual agency and framing their actions with universal values through the Three Spheres of Transformation Framework can generate patterns of sustainable action that repeat across scales. Much like the post-normal science approach where the focus is to improve the quality of science and not necessarily create new science, the social fractal agency concept highlights that transcending and repeating sustainability action is dependent on the *quality* of that action (the values that drive action) rather than the type of action (e.g., focusing on technologies or products). In terms of the SDGs, the social fractal agency concept and Three Spheres framework underpin the dual direction (top-down and bottom-up) of the localization process. Bottom-up (from the individual) sustainability action (conducted within the practical sphere) is guided by the beliefs and values of the person's inner world (personal sphere) as they align with others in their community for shared desired outcomes (transformational changes to the structures and systems of the political sphere) founded on universal values. When applied to the SDG localization process within a municipality, social fractal agency can look at grassroots campaigns, door-to-door canvassing, or other small-scale and local activities that promote change through the localization of the SDGs. In my project, social fractal agency was activated using a workshop with local stakeholders and the Andøy municipality to present results from the project (Fuller et al., 2023c).

The true potential of social fractal agency, crucially, is if the motivations from within the personal sphere inspire concrete action in the practical sphere that are aimed at changing the systems and structures in the political sphere. We know that fundamental and large changes are needed to overhaul the entirety of *un*sustainable structures and systems. We know (for the most part), how structures and systems should change to be more sustainable (e.g., to become an equitable global economy founded on the concept of circularity: reuse and recycle). We already have several technologies, programs, products, etc. that aim to change small parts of these unsustainable structures and systems and are developed and used within the practical sphere. We also have growing social movements that call for sustainable living, which relies on

the inner behavioral change of individuals. However, I argue that these efforts are disconnected from each other. They address parts of the systemic and structural problems and only offer adaptive capacity rather than transformative capacity. The Three Spheres framework developed by O'Brien and Sygna (2013) offers a way to connect sustainability changes in all three spheres, so that their effects and impacts are coordinated (for the same goal) to affect real transformative change.

Creating a legitimate, credible, and salient SDG localization process developed around the Three Spheres Framework organizes and connects action for sustainability. The Three Spheres Framework lends clarity and emphasis on generating social fractal agency from within the personal sphere. This does not mean that current progress needs to stop or reverse, rather the development of all the technology, products, knowledge, projects, and programs that currently fit within the practical sphere are piecemeal solutions and must have an explicit and long-term vision to eventually shift the structures and systems within the political sphere.

In my PhD studies, I have worked with many individuals: citizens and bureaucrats on the island of Andøya, fellow students at the University of Bergen, researchers from science institutions in the #LoVeSeSDG project network, scientists from the International Council for the Exploration of the Seas (ICES), an extended peer community in the organization cCHANGE in the "Transformational Leadership for Sustainability" course, and my international network from the Food and Agricultural Organization of the United Nations (FAO). I have learned from these intellectual experiences and interactions that enhancing and promoting a sustainability worldview within the personal sphere can help us reach that long-term objective of social transformation for sustainability. Most of the (much needed) work we are doing at present sits within the practical sphere, but these practical solutions need to be understood holistically and with an interdisciplinary and integrated approach if we are to address complex sustainability problems. Disciplinary researchers are critical for providing the expert knowledge on technologies, tools, theories, approaches, and much more. However, transdisciplinary practitioners are equally as important to understand how knowledge fits together so that individuals, institutions, and societies can reach their integrated and full potential for sustainable development.

6 Reflections, future work, and outlook

The first year of my research was spent building my baseline knowledge of the Andøy municipality and its local community through field visits and interviews with different stakeholders. It became clear early on that the well-known tension found in sustainable development – how to balance socio-economic development and conserve nature – is as evident on this small island as it was across the globe. A conversation with an *Andøyværing* during my first year of stakeholder interviews offered an alternative, if simplistic perspective on this tension (I included this perspective in the statements for the Q-methodology study), where they essentially argued that prioritizing the environment in sustainable development would always benefit society in some way or the other. Certainly, curbing overpopulation, for example, will relieve stress on the environment, however this can only be done through society-focused policies on education and family planning. Reducing and eliminating greenhouse gases will slow (and possibly reverse) climate change, but this can only be done through a fundamental shift in the social structures and systems that rely on fossil fuels. Banning all commercial fishing will certainly help restore overfished stocks and degraded ecosystems, but how would this affect the livelihoods of people who depend on fishing, not just economically, but also as a fundamental part to their culture, traditions, and identity? In short, the reality is that society and the environment are equal and so intricately linked that you cannot understand or prioritize one without including the other.

Andøya offers a unique situation that highlights this challenge of managing both society and the environment with equal focus. The Andøya Space and military presence on the island, while young

compared to the centuries-old fishing traditions of coastal Norway, dominate local municipal planning. The political forces behind both enterprises promote the employment benefits to the Andøya community, but do not comment on how the decision-making processes that prioritize those two enterprises fail to integrate local community concerns, especially for the Andøya fishing community. The research and national defense benefits from both Andøya Space and the NATO military base are global as well as Norwegian, however this should not erase local communities. After all, the political and financial support behind Andøya Space and the military is dependent on votes and taxes from Norwegian citizens. So then what is social transformation for Andøya? If viewed as the social fractal agency concept, social transformation is each Andøya citizen acting on their values and beliefs for a common desired outcome. That is not to say that community-level coordination and advocacy does not exist in Andøya, far from it: community-led campaigning in Andøya successfully prevented the development of wind farms in a key ecological area of the island, denied permits for the building of offshore aquaculture in the biodiverse *Andfjørden*, and has maintained the ecological and natural integrity of the island through the strong collective belief that "Andøya is a Mecca for nature". However, if sustainability can be framed within a person's mind that no single action is too small, perhaps this will empower and emancipate *everyone* to take action.

In an ideal-world PhD program where time and money were not limiting factors, this research would be applied across several municipalities in the LoVeSe region of Norway. Andøya may represent a typical (yet unique) case for a small, northern coastal municipality, however the reality of municipal planning is also restricted by time and money. Conducting this research across different municipalities within the same county, for example, would offer some regional perspectives on SDG localization and allow for coordinated regional programs where different municipalities can share knowledge, resources, and experiences (for example, through the inter-municipal coastal zone planning framework of Vesterålen, Norway). Several other methods to identify the local baseline and raise awareness on the SDGs could be used as well, ranging from very structured experimental approaches to semi-structured interviews, surveys, or ethnographic observations. The selection of any method should reflect the specific needs of the study area and localizing case. Furthermore, while the RRI framework is an emerging practice in government to develop projects, its application could be expanded to municipal planning and research development. Most of the dimensions of the RRI framework and values of the T.R.U.S.T. ethos are likely already applied by researchers and practitioners, however their application could benefit from following the typology and lines of questioning outlined in Table 2.5a and Table 2.5b to ensure that all dimensions and values are captured in the anticipatory and reflexive processes of project development and implementation.

If my research can be summarized into three main points, it will be, apart from the methods, about the *approach* to SDG localization. Firstly, the *sustainability of what* and *sustainability for whom* needs to be made explicit before a localization process can begin. This is a critical step that combines the concepts of transparency, inclusion, and equity from the T.R.U.S.T. ethos and RRI framework to elaborate on the personal sphere of individuals who will be affected by and also affect the localization process. What exactly are the desired outcomes for the SDG localization process (the *what*)? What would the end goal look like? Consider the actors, groups, and cohorts who will be impacted by the localization process (the *whom*), will they be impacted equally? Why or why not? Does the end goal reflect all perspectives within the community? How can the distribution of the risks and benefits of the localization process be shared in a more equitable way within the community?

Secondly, the language used in SDG localization when referring to the science-policy interface should become more focused on the importance of adaptive and responsive policy processes when faced with new, different, or uncertain scientific information. The language around sustainable development, including policy language, science language, and community engagement language should reflect a more transparent admission that we cannot plan for future impacts without significant uncertainty. Science and technology advances allow us to anticipate consequences of policy or technological interventions, but reputation and the need to maintain credibility frequently overshadow the willingness to be transparent about scientific

uncertainty within the scientific and political communities. Once revealed, these uncertainties can serve to further erode weakly-bonded trust links between people and/or institutions. The "culture" of communicating uncertainty is a common practice within the scientific community, but this culture is often eroded during the translation of science into policy. No doubt there are numerous reasons why this is, but I argue there can be a simple way of shifting our collective mindset from one that desires certainty to one that accepts uncertainty: we should be implementing evidence-*informed* policy, not evidence-based policy.

Thirdly, we need to shift our collective worldview (and how most policy is currently developed) that society is separate from nature to one that emphasizes society *as part of* nature, as part of an interconnected and complex combined social-ecological system. Society (our constructed systems, structures, and worldviews) is fully dependent on nature, and our actions fully affect nature. A social-ecological perspective of the SDGs recognizes that even though the environmentally-focused goals are few, they form the foundation for society to exist as we know it. This is being reflected more and more into policy, through the shift to a holistic view of the environment where the human dimension is managed alongside the environmental resource: for instance, ecosystem-based fisheries management considers the entire ecosystem of the species being managed so it can provide services to humans. Integrated ecosystem assessments (IEAs) are an even more holistic example of ecosystem-based management where humans are seen as an integral part to ecosystems and decision-making processes must balance the tradeoffs between the social and ecological systems being managed.

So far, there is limited evidence of the SDGs making an impact beyond a change of rhetoric (Biermann et al., 2022). The failure highlighted here is that the SDGs only served to repackage the status quo and result in superficial changes that do not affect the roots of the *un*sustainability problem. To some extent, the SDGs are useful in that they offer a collective language from which to begin discussing how to transform. They also offer the opportunity for nations to revisit their sustainable development policies and see if they remain fit-for-purpose. However, SDG localization is only one part of a process that is not just about the SDGs themselves but also about inspiring action to fundamentally transform our social-ecological structures and systems, starting with society. Planning for the post-2030 Agenda is underway, even though seven years remain until the 2030 SDG "deadline". As with the conclusions from the MDGs, lessons learned from the SDGs will form an integral part of that planning, but the question remains if UN members will be willing to undergo fundamental (and critical) changes to the status quo. Perhaps the discussions for the post-2030 Agenda should be renamed to reflect the oxymoron of a globalized local experience: "glocal" (Belousa and Pastore, 2015), thus highlighting a paradoxical agenda that both localizes global experiences and globalizes local experiences.

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8 Paper I

Tracking integrated ecosystem assessments in the ICES network: a social network analysis of the ICES expert groups

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Original Article

Tracking integrated ecosystem assessments in the ICES network: a social network analysis of the ICES expert groups

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The advice the International Council for the Exploration of the Sea (ICES) provides to its member countries is crucial for the sustainable management of shared marine resources, and the conservation of relevant marine ecosystems. In 2014, ICES made a strategic decision to integrate marine and social sciences in a new type of assessment framework called "integrated ecosystem assessments" (IEA) to deliver advice on societal trade-offs between different policy options. The IEA-focused expert groups formed before and after this period now cover all major ecoregions. To track the progression of IEAs in the ICES network over time, we conducted a social network analysis (SNA) on expert group attendance for the years 2015–2019. The IEA-focused expert groups generally ranked lower in the overall ICES network. Our study shows that some IEA-groups become more connected over time, while others decline. We also evaluated the role of workshops in the ICES network, particularly their role in the development of IEA knowledge. Our study shows that workshops play an important role in ICES network connectivity. The study demonstrates how social network analysis can be used to study an organization such as ICES and determine the effectiveness, or impact, of that organizational function.

Keywords: expert groups, ICES, information-sharing, integrated ecosystem assessments, social network analysis.

Introduction

Since its founding in 1902, the International Council for the Exploration of the Sea (ICES) has focused on meeting societal needs for impartial science and research on our oceans and the sustainable use of the marine resources within. Central to its work is the aim to "advance and share scientific understanding of marine ecosystems and the services they provide" (ICES, 2022b). This work is coordinated by the ICES Secretariat and supported by a network of over 6 000 marine scientists from over 700 institutions in 60 countries. Much of the ICES network is comprised of 150 Expert Groups that meet annually to conduct the scientific work that is used to generate high quality advice for conservation, management, and sustainability goals.

Over 100 years after its naissance, ICES leadership made a strategic choice in 2014 to integrate marine and social sciences in a new type of assessment framework called "integrated ecosystem assessments" (IEA), a framework with success in other large national marine science and advice organizations in North America (e.g. the National Oceanic and Atmospheric Administration; NOAA) and Australia (e.g. the Commonwealth Scientific and Industrial Research Organisation; CSIRO). The broad aim of ICES IEAs was to provide scientific knowledge and advice to ICES member countries for specific objectives on sustainability, adopting a holistic and comprehensive perspective to include information on physical, chemical, ecological, human, and environmental processes affecting regional seas and their ecosystems. To do so, ICES structured the IEA geographical areas using a regional seas approach and capitalized on existing interdisciplinary (social science and marine science) research groups within its network in Northern Europe.

IEAs are "a formal synthesis and quantitative analysis of information on relevant natural and socioeconomic factors, in relation to specified ecosystem management objectives" (Levin *et al.*, 2009), and have become a core component to the work of ICES. ICES itself defined IEAs at the 2012 Workshop on Benchmarking Integrated Ecosystem Assessments (WKBEMIA) as an interdisciplinary process of combining, interpreting, and communicating knowledge from diverse scientific disciplines in such a way that the interactions of a problem can be evaluated to provide useful information to decision-makers (ICES, 2013; Dickey-collas, 2014). What sets IEAs apart from other ecosystem assessments is the integrated nature of the information analyzed, which aims to "underpin guidance on meeting **ecological**, **social**, and **economic** objectives" (ICES, 2022a) (*emphasis Author's own*). Given the growing interest in IEAs within the scientific and management communities, it becomes necessary to understand not just how IEAs are, or can be, conducted, but also how emerging knowledge on them is, or can be, shared between groups for enhanced critical analysis on the assessments

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Table 1. Acronyms and full titles of ICES Expert Groups for integrated ecosystem assessments.

ICES Acronym	Full title	Year of est.[1]
WGIAB	Joint ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea	2007
WGNARS	Working Group on the Northwest Atlantic Regional Sea	2010
WGEAWESS	Working Group on Ecosystem Assessment of Western European Shelf Seas	2011
WGINOSE	Working Group on Integrated Assessments of the North Sea	2011
WGINOR	Working Group on the Integrated Assessments of the Norwegian Sea	2013
WGCOMEDA	Working Group on Comparative Ecosystem-based Analyses of Atlantic and Mediterranean marine systems	2014
WGIBAR	Working Group on the Integrated Assessments of the Barents Sea	2014
WGICA*	ICES/PICES/PAME Working Group on Integrated Ecosystem Assessments for the Central Arctic Ocean	2016
WGIAZOR	Working Group on Integrated Assessment of the Azores	2020
WGIEAGS	Working Group on Integrated Ecosystem Assessment of the Greenland Sea	2020
WGIEANBS-CS	Working Group on Integrated Ecosystem Assessment of the Northern Bering Sea-Chukchi Sea	2021

*In 2015 WGICA was known as the ICES/AMAP Workshop on Integrated Ecosystem Assessment for the Central Arctic Ocean (WKICA).
[1]Determined by the year of the first published meeting report.

and the application of the assessments to management and policy.

As a science network, ICES responds to the latest ecological challenges by providing scientific advice to its members, thus adopting the de facto role of a "science leader" for collaborative learning and solving complex environmental problems. This includes much of the scientific knowledge used for IEAs. In such a leadership role, the ICES network provides the core support for IEA science, and thus impacts that science at the regional and international scales. Maintaining and optimizing the ICES network to further support IEA science is an increasingly important aspect of organizational management and responsible leadership for a more sustainable world, especially considering that IEAs and interdisciplinary sciences are crucial to understanding how to bring about social and systems change.

Under the framework of the ICES Integrated Ecosystem Assessment Steering Group (IEASG), Expert Groups develop quantitative and interdisciplinary evaluations and syntheses of biophysical and human social information to provide the scientific understanding to deliver advice on societal trade-offs between different policy options (ICES, 2022a). Twenty-two expert groups exist under the IEASG, with 11 of those Groups specific for IEAs (Table 1). These IEA expert groups were established as early as 2007 (the Joint ICES/HELCOM Working Group on Integrated Assessment of the Baltic Sea—WGIAB), with the most recent inauguration in 2021 (the Working Group on Integrated Ecosystem Assessment of the Northern Bering Sea-Chukchi Sea—WGIEANBS-CS).

With these IEA expert groups ICES now covers all its ecoregions (Figure 1), which presents new opportunities and challenges for regional scientific collaboration.

ICES expert groups are comprised of scientists from various background to generate scientific knowledge and conduct the analyses that underpin ICES advice. In total, ICES hosts 150 expert groups (as of the time of writing). ICES expert groups are considered to include two types of groups: working groups (statutory groups with terms of reference updated triennially), and workshops (more ad-hoc meetings to discuss issues as needs arise). Some workshops meet regularly, some meet only once. In this paper, "expert groups" refers to working groups and workshops, unless otherwise specified. The study specifically looks at the impact of workshops on the overall connectedness of the ICES network because of the relatively ad-hoc

Figure 1. Regional sea areas covered by ICES integrated ecosystem assessments. Map reproduced with permission from the ICES Secretariat (ICES, 2020).

nature of workshops but with much evidence that workshop outputs are key inputs to ICES scientific advice. Measuring the impact of workshops on the ICES network structure can help to target resources to support the timely organization of workshops and ensure their outputs are integrated in an efficient way to ICES.

A growing field of research in the last three decades has interested itself with how organizations function and how their structures influence this function, such as the study of organizational knowledge (Blackler, 1995), organizational culture (Hatch & Schultz, 1997) (Schneider, Ehrhart, & Macey, 2013), organizational learning (Lam, 2000), and organizational innovation (Alves & Galina, 2018). The theoretical framing for this research is social network analysis, which can be used to study how organizations and institutions interact, and how the quantity and quality of those interactions then determines the effectiveness, or impact, of that organizational function. How connected are the ICES expert groups to each other, and does the type of connection determine the level of influence those groups have?

The application of social network analysis (SNA) to the study of institutional structures and networks broadly agrees that better organization at the institutional level means better aligned policies and action (Böhmelt & Spilker, 2016; Schlattmann, 2017; Karali *et al*., 2020), and therefore exposing the network structure of institutions allows us to evaluate where collaborations and connections could be improved. This has particular significance for an organization like ICES, which relies on networks of groups and sub-groups to perform its work. These "networks" do not exist in isolation from one another, and by acting as both a "source" and a "target" for information, these institutional network structures are conditionally shaped and informed (Böhmelt & Spilker, 2016). SNA can also be used to increase awareness among ICES managers and leaders about the scientific and collaborative power of its network, to further optimize relationships and connections among expert groups, and strengthen the capacity of the ICES network to act collectively (Hoppe & Reinelt, 2010).

Furthermore, understanding the network structure of an institution with multiple sub-groups, or expert groups such as in ICES, and the information sharing of scientific knowledge or institutional goals can help reduce variability, uncertainty, and duplication of efforts among the sub-groups with regards to what the other expert groups are working on. Expert groups have their own terms of reference and individual mandates, in particular the expert groups focused on IEAs, but without a consistent or clearly harmonized structure of how the different initiatives fit (or should fit) together, expert group members might spend a considerable amount of time networking with other groups in an attempt to coordinate their work, which might lead to a high number of connections but not necessarily improved outputs (Bodin, 2017).

Given the multi-institutional and intergovernmental nature of the organization, ICES offers a unique perspective on the functionality of international cooperation and collaboration in the pursuit of common goals. This unique perspective drives the key research framework for this study, which aims to understand where the IEA network is nested within the broader structure of ICES, and how the IEA network supports the development of IEA knowledge for ICES member countries. In pursuing this research, the scope of the evaluation also included how knowledge is fostered in the ICES network in general.

Our research objectives were to track the development of regional IEAs over time and to assess the role of workshops in the ICES network. To achieve these objectives, the degree of connections between ICES expert groups in the ICES network were compared over time and the overall network cohesion affected by the presence or absence of workshops determined. We hypothesized that (1) IEA-focused expert groups become more connected with the overall ICES network over time and their network position relative to other meetings becomes more influential, and (2) the presence of workshops serves to play an important role in ICES network connectivity, which would be indicated by a higher density of the ICES network compared to one excluding workshops.

Methods

This paper builds up on previous work of the ICES Working Group on Maritime Systems (WGMARS) applying SNA to ICES (see supplementary material). The authors used the ICES database of attendees at expert group meetings to quantify the connectivity (the number of shared experts between different groups) of an expert group in relation to other expert groups for each year from 2015–2019. ICES classifies "expert groups" as an umbrella term that includes both working groups and workshops.

Social network analysis (SNA) is a common method to study patterns of interactions among actors that make up complex networks. The graphical output of these networks, called sociograms, provide a visualization of that network. SNA also allows for quantitative metrics to be computed based on the ties connecting the actors (the links between them), to understand the different roles of the actors within that network. For example, seeing which actor is most connected to others in the network could be used as a proxy indicator for influence or impact. A network is defined by a finite set of nodes (i.e. individuals or groups) and by the links (i.e. "edges," relationships, or connections) that tie two or more individuals or groups to each other (Wasserman & Faust, 1994; Borgatti *et al*., 2009; Hafner-Burton *et al*., 2009; Ward *et al*., 2011; Maoz, 2012). Our study focuses on working groups and workshops as the "nodes," with mutual participation by attendees as the direct links, or connections (also called "edges"), between groups. In this SNA study, we considered individual attendance at one or more meetings to be an "interaction" to represent communication and collaboration among the ICES groups. It follows that more mutual members indicate stronger ties to transfer knowledge and information between the groups (Böhmelt & Spilker, 2016).

ICES data

We used an extraction of the ICES database for the years 2015–2019, which was provided to the authors by the ICES Secretariat. The information included lists of all attendees to all expert groups that took place within those five years, as well as metadata on each meeting (e.g. whether it was a working group or workshop). Personal or identifying information about each attendee was not included in the data provided to the authors. The original database of over 20 000 entries was intensively cleaned and filtered to exclude "non-attendees" (i.e. individuals who registered for meetings but did not physically attend) and irrelevant meeting types (see supplementary material for a full list of ICES meetings not included in the analysis). The year 2020 was not included in the analysis due to complications with COVID-19 travel restrictions, and uncertainty about meetings taking place during that time. The expert groups included in the final analysis were, in general, working groups and workshops that had physical meetings, and which were not considered supplementary (e.g. breakout group meetings) or preparatory (e.g. data preparation meetings) in their objectives.

The ICES database provided an array of information that included: a unique identifier, or code, for individuals who registered for the meeting; a unique identifier for each meeting; an acronym of the meeting; a Boolean value to indicate if the person attended the meeting (1) or not (0); and the type of meeting (e.g. ACOM, ADG, benchmark, expert group, etc.). Individual meeting records that provided details on dates and locations of the meetings were consulted from the ICES meeting repository, meeting reports (if available and published online), expert judgement of the authors with knowledge of the specific meeting, and, if necessary, direct contact with the meeting

Table 2. Definitions for the SNA analytical measures calculated in this study (table adapted from Oliveira & Gama, 2012).

SNA measures	Definition
Density	The number of connections observed in a network divided by the maximum number of possible connections, denoted as a value between 0.0–1.0 (De Laat *et al*., 2007).
Degree centrality	A measure of connectedness; the number of connections (i.e. shared attendees) each expert group has with other expert groups (Golbeck, 2013). Measures the importance and influence of a node in a social network (high degree = high importance).
Betweenness centrality	A measure of how important an expert group is to the shortest paths through the network (Golbeck, 2013).
Isolates	A node that is not connected to others within a network (Wasserman & Faust, 1994).

Chairs to verify details such as number of attendees, type of meeting, etc.

In line with our objectives, the data were refined by unique attendees and type of expert group (i.e. working groups or workshops). The analysis focused on the eight IEA-focused expert groups established before 2020 (see Table 1 for full titles): WGIAB, WGNARS, WGEAWESS, WGINOSE, WGINOR, WGCOMEDA, WGIBAR, and WGICA. The analysis also included the top three ranked expert group meetings by degree centrality, for comparison purposes. Data collection took place in January 2020 in collaboration with the ICES Secretariat.

Data analysis

All SNA centrality measures were calculated using the Software UCINET (Borgatti *et al*., 2002). Final network visualization was conducted using UCINET and *Gephi* (Bastian *et al*., 2009). Centrality measures direct attention to the potential importance of individual nodes based on how they are situated in the network. There are many ways to assess centrality (Wasserman & Faust, 1994; De Laat *et al*., 2007; Everett & Borgatti, 2010; Oliveira and Gama, 2012; Scott, 2017), but the most basic measure is degree centrality. In this study, the degree centrality measure calculates the number of connections (shared attendance) one expert group has with another. However, the number of shared connections is not equivalent to the number of participants in each group. A single individual could be responsible for more than one shared connection if they are also attending several other expert groups in the same year.

Another important aspect of centrality rests in a node's potential importance in connecting other nodes, i.e. being an intermediate (the betweenness measure). This aspect could be of particular importance in relatively sparse networks (low or medium density) since not that many nodes are directly connected with each other. Thus, the prominence of betweenness centrality builds on a different assumption of importance relative degree centrality—i.e. a node might be important not because it is connected to many others, but it connects many others (Freeman, 1979). Nodes with high betweenness scores are considered to be "gatekeepers" because they tend to control the flow of information between tightly-knit groups. We also looked at the number of isolates in each network as an indicator of general connectedness.

Although the are many ways to assess to what degree a network brings together its nodes, the perhaps most basic measure is density. It is widely used in network-centric studies across disciplines since the interpretation is intuitive but informative (Freeman, 1979; De Laat *et al*., 2007; Oliveira and Gama, 2012; Fischer, 2015; Scott, 2017; Bodin *et al*., 2020). In other words, are the nodes realizing their networking potential in the sense that they have formed links with the other nodes in the network? The more links a node have (and/or how strong these links), the more prominent it could be in relation to the other nodes based on its sheer number (and/or strength) of links.

The workshop analysis aimed to compare the two overall ICES networks: one including workshops and one excluding workshops. This was primarily to understand the relative importance of workshops, due to their *ad hoc* nature, and if their presence increased the number of connections in the network. The density measure is a general performance indicator for networks and provided a calculation of the number of connections observed within a network compared to the maximum number of possible connections. It reflects the general level of connectedness in a network via a value from 0.0 (a network with zero connections) to 1.0 (a perfectly and completely connected network). In other words, the more expert groups connected to one another through shared participation, the higher the density value for that network and the denser the network will be.

Analyzing these four values for each network (density, degree, betweenness, and the number of isolates) allows for a broad interpretation of the relative importance of expert groups in the overall network, and thus the relative influence those groups have on the dissemination of information to the overall body of knowledge in ICES. The measures included in this study are summarized in Table 2.

The analysis of the importance of workshops looked at the network as a whole and not into the role of individual groups (nodes) and on the role of workshops to connect the IEA groups. The latter analysis used links between the eight IEA-groups differentiated by shared connections *via* workshops and shared connections *via* working groups (Figure 2). Removing the workshop links from that sub-network revealed a composition of the IEA-groups without the influence of workshops.

To compare the network with and without workshops, we used weighted density values of the whole ICES network with and without workshops. We used the dataset from 2019 with all groups included and with all workshops removed and estimated the density of both networks. The two analyses could not be compared quantitatively because the smaller network, which excluded the workshops and included the working groups only, would have had a higher density value (due to fewer nodes in total). However, it still gave an indication of whether the workshops did play a large role, as we assumed they did.

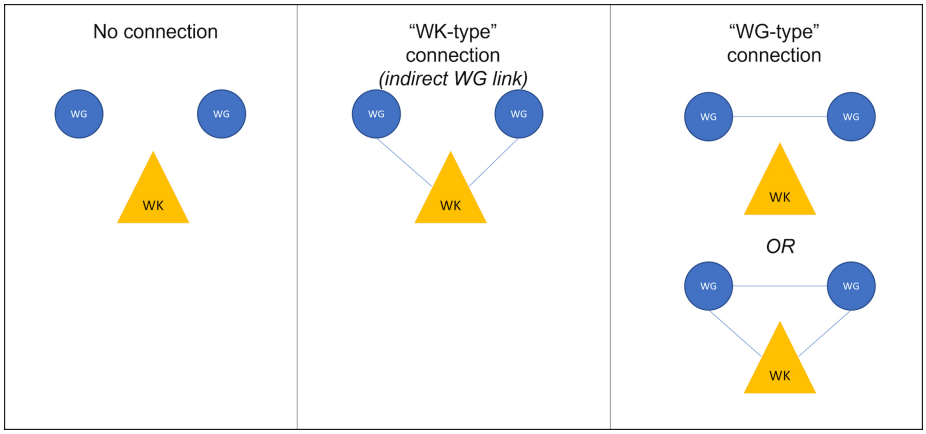

Figure 2. A visual explanation of connections (shared attendance; blue lines) determined for the workshop analysis. Blue circles denote working group nodes present in the network. Yellow triangles denote workshops present in the network. The connection type in the center column is considered a "workshop-type" connection because the two working groups are only linked via a workshop (i.e., shared attendance/link through a workshop). In the right-hand column, the connections are "working group-types" because the working groups are linked regardless of the presence of a workshop.

Table 3. Meta-summary statistics calculated for ICES expert groups from 2015 to 2019, using meeting attendance data provided by the ICES Secretariat.

	Total number EGs (WGs + WKs)	Number of WGs	Number of WKs	Unique attendees for the year (EGs)*	Cumulative attendances for the year (EGs)
2015	126	89	37	1 603	2 455
2016	135	86	49	1 821	2 681
2017	132	90	42	1 648	2 575
2018	145	99	46	2 148	3 236
2019	154	99	55	2 341	3 645

EGs = expert groups
WGs = working groups
WKs = workshops
*All attendees for the year filtered to remove "repeat attendances" (e.g. one person attending more than one meeting per year). This value indicates the core number of individuals who attended expert groups in one year. Obviously, an individual can attend more than one expert group meeting in a year, and this cumulative value is reflected in the last column on the right.

Results and discussion

Social network analysis of ICES IEA expert groups

ICES has been steadily growing over the last five years as indicated by the increasing number of working groups and workshops, and the increasing number of participants per year (Table 3).

This could be an indication that the workload within ICES is increasing, which requires more participation and individual scientific support to get the work done. In addition, an increasing number of workshops means more dedicated work on specific issues, and people outside the core membership of an ICES working group can be attracted to workshops because of their timely relevance and focus.

With an increasing number of individuals, we expected to see more nodes and ties within the network, and this is evident from the sociograms for each year from 2015–2019 (Figure 3), which suggests more shared connections between the nodes (as the sociogram networks become denser over time).

The study considered all the expert groups (working groups and workshops) for each year of analysis and provided a longitudinal comparison over five years. Tables 4, 5, 6, 7, and 8 provide an overview of the top three connected groups for each year based on the calculated centrality measures for degree and betweenness. Tables 4–8 also include the centrality measures for all eight IEA-focused groups, even though none of them (with one exception that we discuss further on) ranked in the top 10 for degree centrality. Complete tables with centrality measures for all expert groups, by year, can be found in Supplementary Material.

Shared links (i.e. one or more individuals attending both meetings) between expert groups can allow for the spread of information on working procedures, regulations, or performance in general and this then influences the performance of the expert groups. Accordingly, an "important" group would have a greater number of shared linkages (Böhmelt & Spilker, 2016), or a high degree centrality measure, and therefore two well-connected IEA groups are likely to contain similar scientific and knowledge profiles. While the results indicate a general trend where expert groups with a higher degree centrality measures also had high betweenness centrality measures (Tables 4–8), the authors did not systematically verify this.

Interpreting the centrality measures in Tables 4–8 shows that, in 2015, WGCOMEDA ranked the highest out of all IEA-focused groups for degree centrality, with a total of 15 shared connections with other expert groups that year. This means that there were 15 connections between WGCOMEDA and one or more expert groups that year. However, this does not indicate that 15 unique individuals attended other expert groups (22 individuals attended the 2015 WGCOMEDA

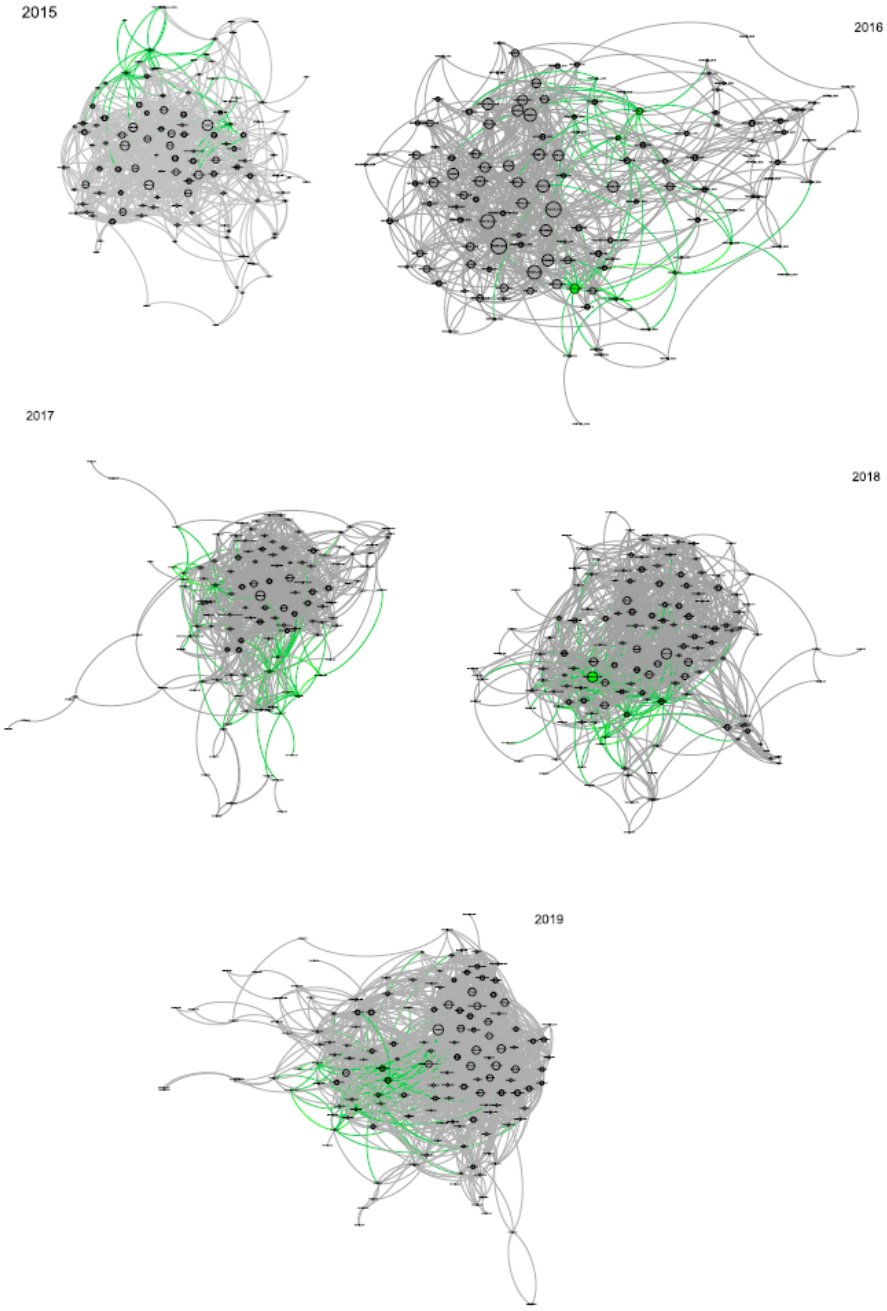

Figure 3. Sociograms created for 2015–2019 showing all ICES expert groups for each year, with IEA-focused Groups highlighted in Green (sociograms created with *Gephi*). Figures have been cropped to the network web, and full sociograms (including isolates) can be found in supplementary materials. Isolates for each year are noted in Tables 4–8 in this manuscript. The layout and node position in each of the sociograms is random, determined by *Gephi*. However, the graphs are usually laid out with "force-based" algorithms, where linked nodes attract each other, and non-linked nodes are pushed apart (*Gephi* tutorial).

Table 4. ICES expert groups convened in 2015 with associated social network analysis metrics. The table shows the top three expert groups ranked by degree centrality, and the IEA-focused groups. The *Ranking* score indicates the relative ranked position of each group according to its degree centrality measure, in relation to the total number of expert groups for that year. The analysis revealed seven (7) isolates (WGMRE, WGMS, WGBEC, MCWG, WGDAM, WGMABS, WGPDMO).

2015			
Ranking	Id	Degree measure	Betweenness measure
1	WGSAM	43	901.609
2	WGCATCH	37	287.926
3	WGWIDE	36	457.836
38	WGCOMEDA	15	123.585
43	WGINOR	14	202.13
51	WGIBAR	13	149.925
64	WGEAWESS	11	8.768
65	WGIAB	11	8.981
94	WKICA*	4	0
114	WGINOSE	2	4.426
121	WGNARS	1	0
127	**TOTAL EXPERT GROUPS ASSESSED FOR 2015**		

* In 2015 WGICA was recorded as the ICES/AMAP Workshop on Integrated Ecosystem Assessments for the Central Arctic Ocean (WKICA).

Table 5. ICES expert groups convened in 2016 with associated social network analysis metrics. The table shows the top three expert groups ranked by degree centrality, and the IEA-focused groups. The *Ranking* score indicates the relative ranked position of each group according to its degree centrality measure, in relation to the total number of expert groups for that year. The analysis revealed zero (0) isolates.

2016			
Ranking	Id	Degree measure	Betweenness measure
1	HAWG	34	452.914
2	WGBFAS	33	958.83
3	WGCATCH	30	282.681
23	WGINOR	19	412.963
39	WGIAB	13	176.099
75	WGCOMEDA	8	43.949
77	WGEAWESS	8	15.03
85	WGIBAR	7	34.666
86	WGICA	7	126.112
98	WGNARS	5	136.125
112	WGINOSE	4	3.646
135	**TOTAL EXPERT GROUPS ASSESSED FOR 2016**		

Table 6. ICES expert groups convened in 2017 with associated social network analysis metrics. The table shows the top three expert groups ranked by degree centrality, and the IEA-focused groups. The *Ranking* score indicates the relative ranked position of each group according to its degree centrality measure, in relation to the total number of expert groups for that year. The analysis revealed three (3) isolates (MCWG, WGEXT, WGPDMO).

2017			
Ranking	Id	Degree measure	Betweenness measure
1	WKWIDE	57	891.591
2	WGNSSK	39	430.452
3	HAWG	36	320.899
22	WGINOSE	21	610.449
26	WGINOR	20	459.505
51	WGIAB	13	225.73
60	WGEAWESS	11	56.67
82	WGIBAR	7	60.787
96	WGNARS	5	127
101	WGCOMEDA	4	19.23
110	WGICA	3	0
132	**TOTAL EXPERT GROUPS ASSESSED FOR 2017**		

Table 7. ICES expert groups convened in 2018 with associated social network analysis metrics. The table shows the top three expert groups ranked by degree centrality, and the IEA-focused groups. The *Ranking* score indicates the relative ranked position of each group according to its degree centrality measure, in relation to the total number of expert groups for that year. The analysis revealed one (1) isolate (WGPDMO).

2018			
Ranking	Id	Degree measure	Betweenness measure
1	WGINOSE-Skagerrak	50	922.376
2	WKPELA	50	459.339
3	WGMARS	37	575.94
17	WGINOR	26	319.624
29	WGIBAR	22	183.696
50	WGINOSE	16	30.854
57	WGEAWESS	15	29.666
94	WGIAB	8	12.423
103	WGNARS	7	146.66
115	WGCOMEDA	5	2.312
125	WGICA	4	5.289
145	**TOTAL EXPERT GROUPS ASSESSED FOR 2018**		

meeting in 2015; (ICES, 2015), but that possibly one person or several individuals comprised 15 total attendances to other meetings in the same year. However, WGCOMEDA ranks lower for betweenness measure (123.58) than for the two expert groups below it in Table 4: WGINOR (14 degree measure; 202.13 betweenness measure) and WGIBAR (13 degree measure; 149.92 betweenness measure). This indicates that although WGCOMEDA had 1–2 more shared connections than either WGINOR or WGIBAR, both of the latter groups (especially WGINOR) occupied a more critical position in the network structure with regards to acting as a "gatekeeper" or intermediary for information flow.

Except for 2018, none of the IEA groups were included in the top three ranking for degree centrality, indicating that none of these groups are very influential in ICES. The 2018 WGINOSE-Skagerrak meeting was the top-ranked for that year in terms of degree (Table 7; Figure 4), however, a closer inspection of the meeting itself revealed that it was a workshop attracting 21 attendees. The regular annual WGINOSE meeting later that year was attended by seven people. For further details on the case of the 2018 WGINOSE-Skagerrak meeting, please see supplementary materials.

Role and function of ICES expert groups

The results also reveal that the centrality measures of degree (number of shared attendees) and betweenness (the position of the node with regards to other nodes) are not necessarily correlated. This means that even if one group has many connections (a high degree measure), it does not necessarily follow that they have a high betweenness measure, which would indicate that the node occupies a critical role in the network structure and is therefore important for connections with other nodes. For example, in the 2015 analysis, WGSAM is ranked the highest with a degree of 43 (i.e. 43 shared connections) and has a betweenness value of 902. However, the

Table 8. ICES expert groups convened in 2019 with associated social network analysis metrics. The table shows the top three expert groups ranked by degree centrality, and the IEA-focused groups. The *Ranking* score indicates the relative ranked position of each group according to its degree centrality measure, in relation to the total number of expert groups for that year. The analysis revealed four (4) isolates (WGEUROBUS, WGHIST, WGBEC, WGECOA).

2019			
Ranking	Id	Degree measure	Betweenness measure
1	WKIrish6	61	578.959
2	WGCATCH	47	258.878
3	WGWIDE	47	263.071
19	WGEAWESS	32	175.467
21	WGIBAR	32	416.322
51	WGINOR	22	112.258
54	WGINOSE	21	73.605
107	WGIAB	8	11.358
117	WGNARS	6	1.594
120	WGCOMEDA	5	6.528
138	WGICA	2	0
154	**TOTAL EXPERT GROUPS ASSESSED FOR 2019**		

second-highest ranked group is WGCATCH with a degree of 37 (i.e. 37 shared connections) and a betweenness value of only 288. This is interesting because it indicates that although many WGCATCH members attended other meetings that year, these attendances did not serve much to connect WGCATCH with other expert groups. To understand this better, further analysis is needed to identify the type, or "quality," of connections between groups: who are the individuals that are making up these connections, and what is it about their background and qualifications that determines if they play critical roles as intermediaries or key connections?

The analysis looked at the variation of the degree centrality measure over time to see if this was correlated in any way with the size of the meetings (i.e. the number of participants). Figure 4 illustrates this and reveals that, over time, most IEA-focused expert groups (five out of eight in the analysis: WGINOR, WGIBAR, WGEAWESS, WGINOSE, and WGNARS) in our analysis have a generally increasing number of shared connections with other meetings (i.e. an increasing degree measure over time, as indicated by the increasing trendlines). On the other hand, WGIAB, WGCOMEDA, and WGICA have a decreasing number of shared connections with other groups over time, which suggests they are becoming less connected (more isolated). However, for all eight IEA-focused working groups there is somewhat poor fit of the line to the data. Therefore, we assume that most of the participants to the 2019 WGCOMEDA meeting are relative "outsiders" to the ICES network in general because they did not attend any other expert groups that year.

Figure 5 shows a similar graph for the betweenness centrality measure, however the trendline fit is very poor for five of the working groups (WGINOR, WGIAB, WGINOSE, WGICA, and WGNARS). The trendlines for WGIBAR, WGEAWESS, and WGCOMEDA fit moderately well, and show that WGIBAR and WGEAWESS both have increasing betweenness scores over time, indicating they are occupying an increasingly important role in the network, while WGCOMEDA is not.

Overall, some general indications can be made, for example, with WGINOR which has an *increasing trend for the degree measure over time* (indicating more shared connections over

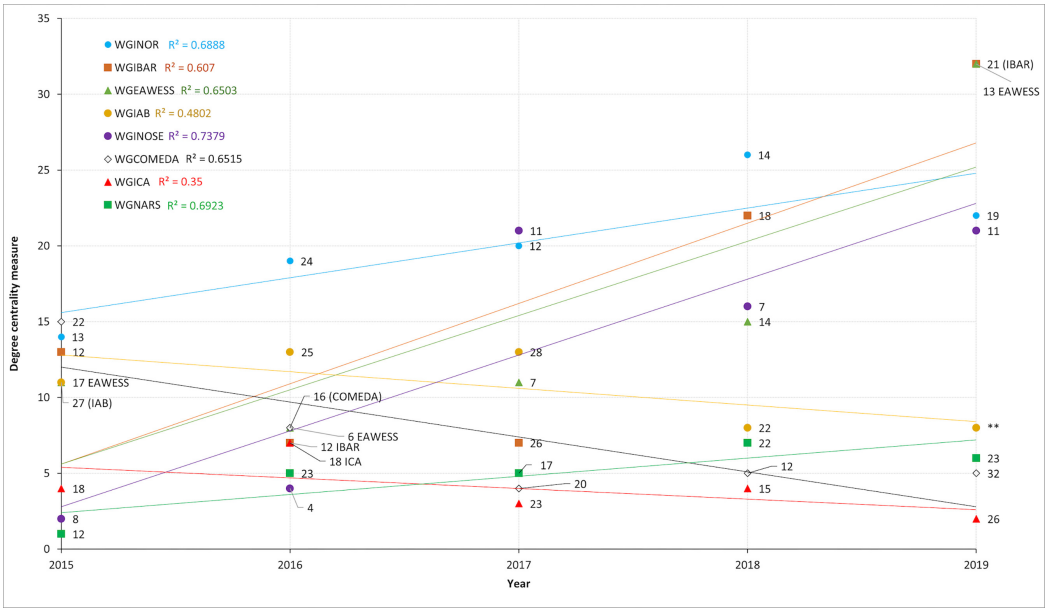

Figure 4. Graphical representation of the degree centrality measure over time (2015–2019) per IEA-focused group (data points). Lines represent the linear trendlines, with associated R^2 values in the legend. Values at each data point represent the number of participants for that meeting, taken from the meeting reports (** = no participant information available).

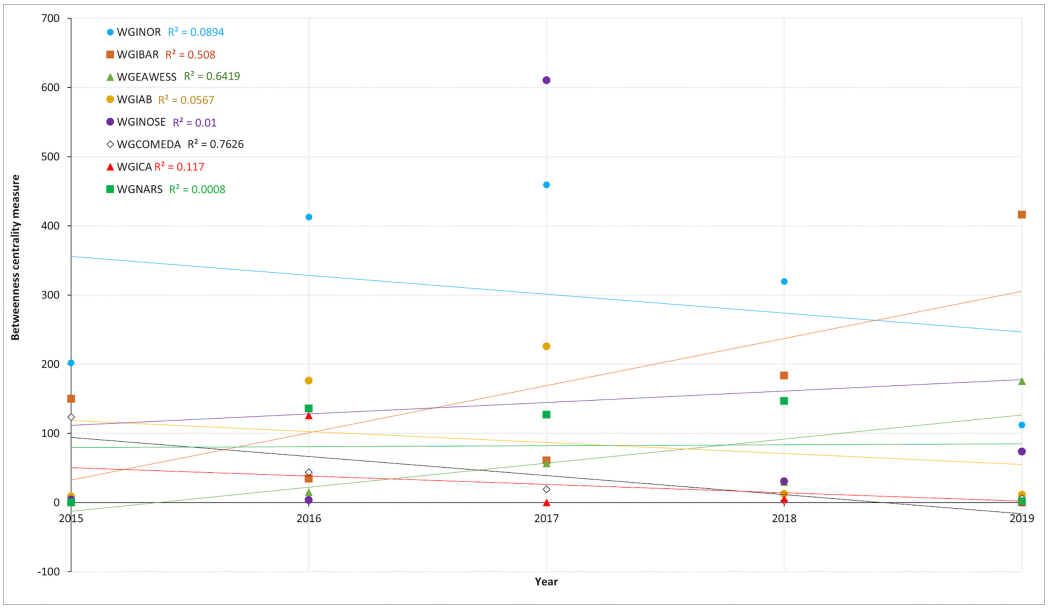

Figure 5. Graphical representation of the betweenness centrality measure over time (2015–2019) per IEA-focused group (data points). Lines represent linear trendlines, with associated R^2 values in the legend.

time), and a *decreasing trend for betweenness measure over time* (the working group is occupying a less critical role in the network over time). Thus, this indicates more connections between WGINOR and other groups, but these connections are becoming less influential.

Of the eight IEA-focused expert groups studied in this analysis, three diverged from our first hypothesis that over time these IEA-groups would become more connected to the rest of the ICES expert group network as they become more well-known and the IEA work more robust. Over time, WGIAB, WGCOMEDA, and WGICA had fewer connections (shown by the decreasing degree centrality measure, Figure 5) and decreasing influence (shown by the decreasing betweenness score, Figure 6). This result may be a reflection of the nature of the ecosystem areas covered by these expert groups. The sea basins of the Mediterranean (WGCOMEDA), the Baltic (WGIAB), and the central Arctic (WGICA) are more closed systems when compared with the other IEA areas (i.e. the North Sea, Norwegian Sea, Barents Sea, etc.). As such, the nature of these three ecosystems may limit the need for or relevance of outside-shared participation with other groups, hence the decreasing trends in degree and betweenness centrality. There is a risk that the IEA knowledge acquired in these ecoregions is developed in isolation and is isolated from the rest of the ICES network and therefore has no relevant influence on, for example, assessment working groups in these ecoregions. This offers an opportunity for ICES to consider enhancing support to these groups to advance IEA advice for these ecoregions.

The results support our hypothesis in general that while there is a plethora of IEA-knowledge within ICES, the sources of this knowledge are not generally well-connected to each other or to other expert groups in the network. All IEA-focused expert groups included in our analysis ranked low in terms of shared participation when compared with other expert groups in the network. This suggests that the individuals involved with the IEA-focused expert groups are specialized in their expertise and knowledge and rarely attended other expert groups. This circumstance could also be a sign for a more fundamental structural problem concerning intentional links between IEA-groups and, for example, assessment expert groups. In a situation where constituencies are developing a stronger demand for integrated ecosystem-based advice, it is essential that IEA and assessment expert groups are working together and agree on the data needed to support the scientific advice.

Role of workshops in ICES IEAs

We found strong support for our second hypothesis that workshops play an important role in ICES network connectivity. The workshop analysis revealed that the full ICES network, including both working groups and workshops, had a higher density of 0.144 (total nodes 154, edges 1345) compared to the full ICES network excluding workshops with a density of 0.101 (total nodes 99, edges 492). This result suggests that, in this case, workshops indeed play an important role in the overall connectivity of the network when they are present, compared to when they are excluded (Figure 6). This finding is even more pronounced, as a smaller network (the ICES network excluding workshops) should have a higher density, which we could not confirm. This result was supported by a more detailed analysis of the workshop's influence on a network comprising of the eight IEA-focused working groups. The density in the IEA subnetwork rose considerably when

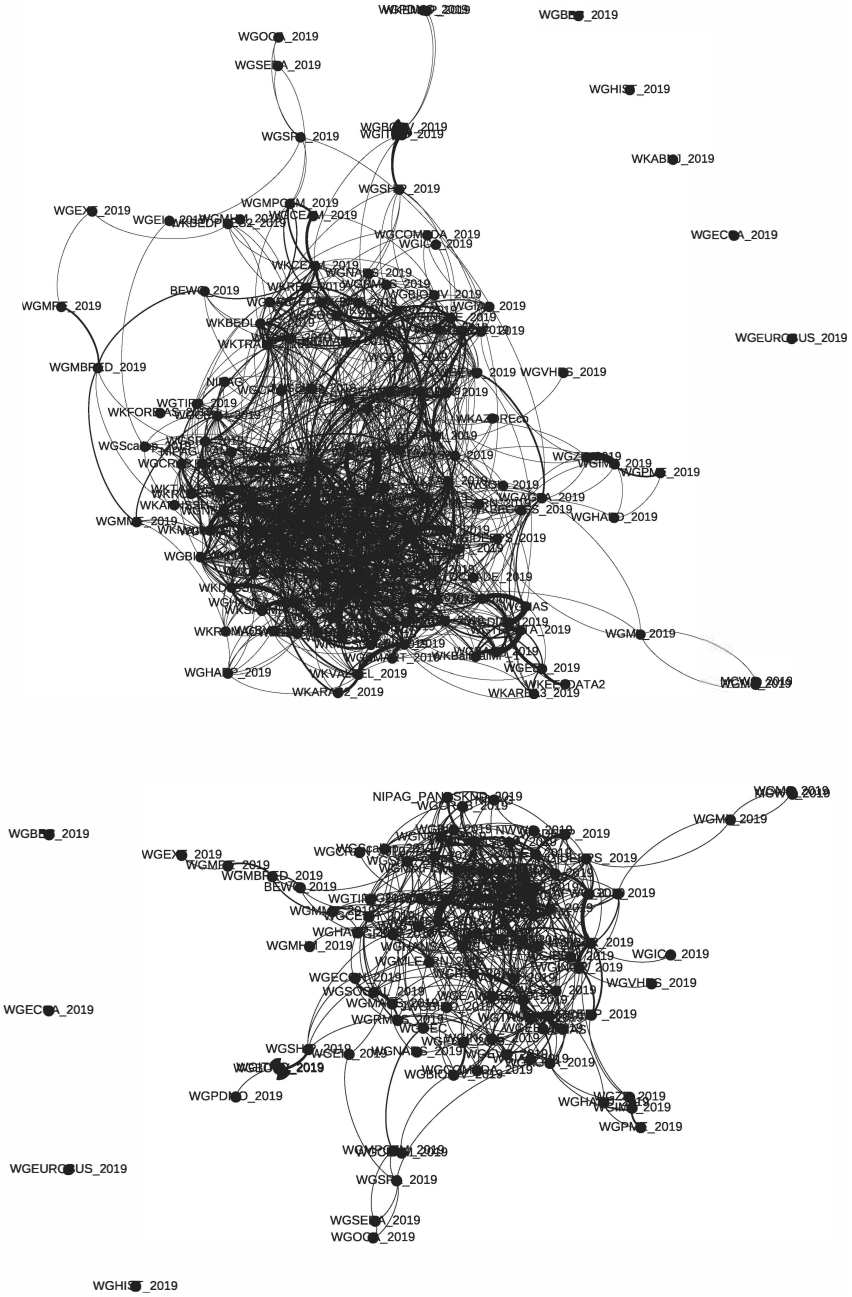

Figure 6. Network structure comparison of the ICES expert group network for 2019 including workshops (top figure) and excluding workshops (bottom figure). Graphs produced with *Gephi*.

including workshops into the analysis (Figure 7). Without workshops, WGNARS became isolated and was unconnected to the other working groups through shared participation. This result was supported by the density calculations for the sub-network with all connection types (0.786 density) and with connection types excluding Workshops (0.321 density).

Both workshop analyses show the fundamental structural role of workshops to connect otherwise disconnected

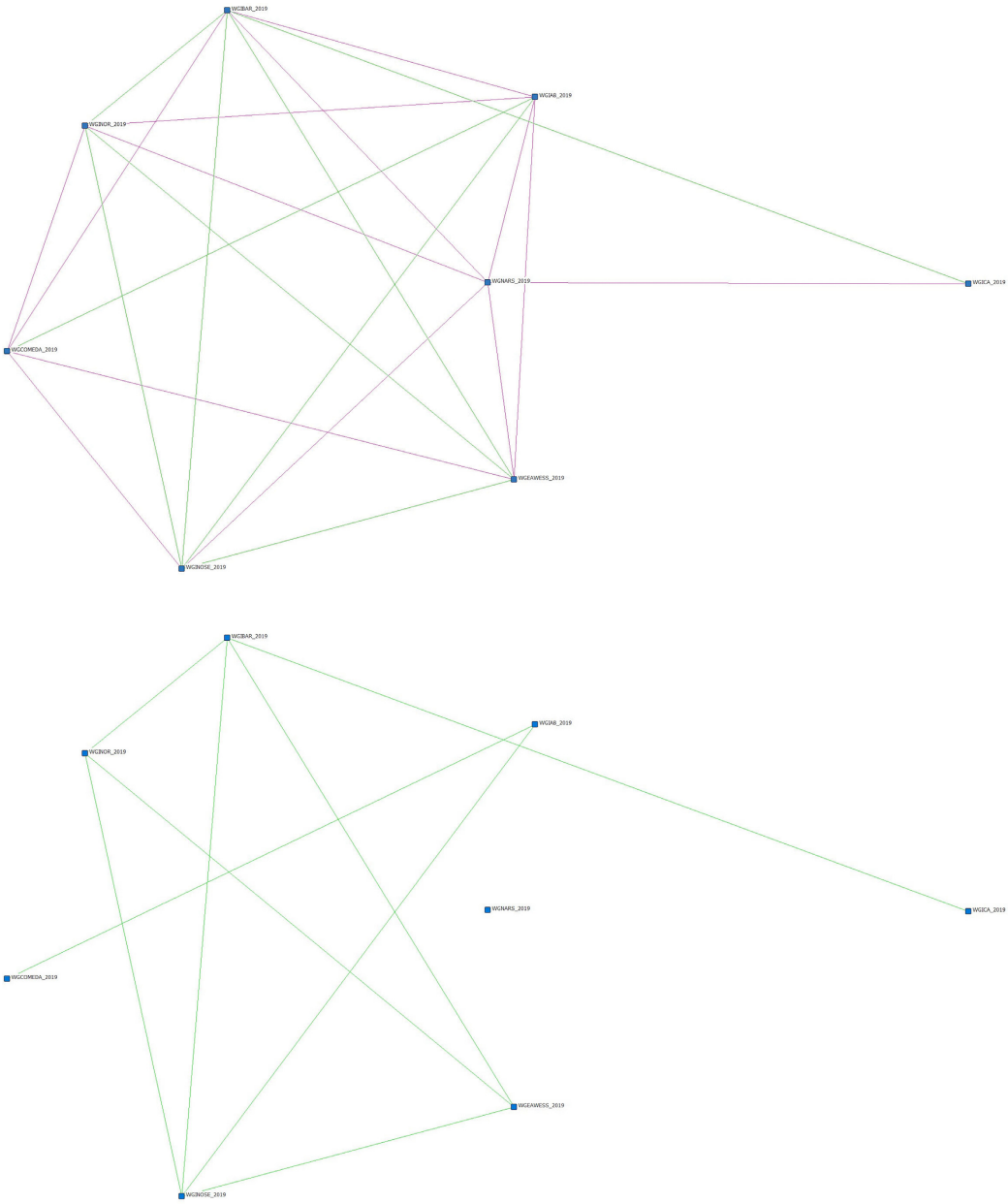

Figure 7. Sociograms for the sub-network of the eight IEA-focused working groups with green lines indicating *working group* connections and pink lines indicating *workshop* connections. Top image is the sub-network with both connection types, and the bottom image is the sub-network *excluding* workshops (i.e. only showing green links with working group connections).

working groups in the ICES network. Since workshops cover a wide range of topics, they are instrumental to facilitate and develop IEAs and more integrated approaches. Furthermore, the semi-permanent nature of working groups means the establishment of one can be a time-consuming process (to elect Chairs, identify members, and develop terms of references), thus workshops are essential to fulfill an immediate need, or to address specific and/or short-term issues.

Study limitations

SNAs are static, only represent a snapshot in time, and do not reflect the true dynamics of a network or their responsiveness to changes. The snapshots that the sociograms give us do not perfectly reflect the complexity of intra- and intergroup collaboration, and they change interannually. SNAs also do not say anything about the quality of the social interactions, or the disciplinary composition of the groups. This requires a more in-depth look at specific expert groups, or another SNA focusing on individuals rather than groups.

Conclusion and implications

The analysis and visualization of the ICES network using SNA gives a good overview of how groups are embedded in the network and which groups do contribute but are not well connected in the wider ICES network. The analysis further showed that most expert groups were better connected than IEA-focused expert groups. Future focus should lie on the question of whether there is a mismatch between the different sources of knowledge necessary to conduct IEA advice and the existing one from IEA-focused expert group attendees, and whether structural decision-making is required to bring in intentional links. The ICES strategic plan states that "*[ICES] will seek to increase the scope, impact, and efficiency of our science through innovation, integration, and increased interdisciplinary collaboration.*" (ICES, 2021). Collaboration can most efficiently be measured by joint outputs, but the organization can facilitate this collaboration by ensuring good connection between groups. SNA can help in tracking this process and identifying missing links and where topical workshops can bridge working groups. Workshops proved to be an important structural and strategic element within the ICES system to develop organizational change towards making IEAs operational. However, SNA only reflects the structure based on the used input variables, here participation in groups, and thus further content related analysis, e.g. interviews with chairs and members of groups, will help to identify in which areas collaboration is working successfully and where the structure needs to be supported by other activities. This first study of the social network of ICES could serve as a baseline for both ICES leadership and national research institutions of ICES member countries in at least three important ways: (i) for strategic structural decision-making to enhance uptake of IEA understanding; (ii) for cost-benefit decisions on who and where to fund expert group participation of the over 6 000 scientists in the ICES network; and (iii) to give insights on overall organizational integrity. Social network analysis can therefore be a new tool in the ICES toolbox to leverage the diverse capacities within its scientific network to advance ecosystem understanding for sustainable seas.

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Supplementary material

Supplementary material is available at the *ICESJMS* online version of the manuscript.

Conflict of interest

The authors have no conflicts of interest to declare.

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Author contributions

JLF, HVS, JOS, and DJD contributed to the design and theoretical background of the study. OJB provided expert guidance on the use of the methods and study approach, and interpretation of results. JLF and JOS conducted the analyses with UCINET and Gephi and generated the figures and images. All authors contributed to writing and editing the manuscripts and approval of the final draft.

Data availability

The data underlying this article were provided by the ICES Secretariat by permission. Data will be shared on request to the corresponding author with permission of the ICES Secretariat.

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9 Paper II

"Sustainability is not a vegan coffee shop." Eliciting citizen attitudes and perspectives to localize the UN sustainable development goals

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"Sustainability is not a vegan coffee shop." Eliciting citizen attitudes and perspectives to localize the UN sustainable development goals

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Integrating the United Nations Sustainable Development Goals (SDGs) into national legislation includes a need for their localization. The authors posit that this concept of localizing the SDGs is achieved if the goals are appended to an existing policy process with local implications, termed a "policy vehicle." For this study, Q-methodology was used to gather local perspectives on the legislative process for coastal planning in Norway (the "policy vehicle"), the "proxy" legislation through which the SDGs are localized for the case study municipality of Andøya, Norway. The overall aim of the study was to understand potential pathways for enabling approaches to societal transformations where focus is placed on fostering human agency and capacities. The authors demonstrate how Q-methodology can be applied for enhanced stakeholder engagement in local decision-making processes as a starting point to enable social transformations for sustainability in a social-ecological system.

Keywords: Q-methodology; social-ecological systems; UN sustainable development goals; sustainable coastal development; transformational change; citizen attitudes

1. Introduction

Our planet is experiencing relentless pressure on natural resources to provide food, energy, space, and materials for a growing human population. Besides the need for the sustainable use of natural resources, there is an equal need for social justice, equity and representation of individuals and their associated values. All United Nations countries have formally recognized these realities, which provided the impetus for the United Nation's 2030 Agenda on Sustainable Development (UNGA (United Nations General Assembly) 2015).

As a signatory to the 2030 Agenda, Norway is committed to achieving all seventeen sustainable development goals (SDGs) by 2030 and aims to "… contribute to getting the world back on track in achieving the SDGs, in a greener, fairer, and more

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resilient manner" (Ministry of Local Government and Modernisation 2021, 119). Norway has also determined that the implementation of the SDGs must include the *localization*[1] of these global Goals in a way that remains loyal to the fundamental values of prosperity and peace for the people and our planet noted in the 2030 Agenda (UNGA 2015; Gassen, Penje, and Slätmo 2018; Bardal *et al.* 2021; Ministry of Local Government and Modernisation 2021).

1.1. Theoretical framing

The 2030 Agenda explicitly mentions three key components of sustainability: society, economy, and the environment. Chiefly, this trifecta comprises three distinct, but interconnected, "pillars" (Basiago 1998; Pope, Annandale, and Morrison-Saunders 2004; Gibson 2006; Waas *et al.* 2011; Moldan, Janousková, and Hák 2012; Schoolman *et al.* 2012; Boyer *et al.* 2016; Purvis, Mao, and Robinson 2019), "dimensions" (Stirling 1999), or "components" (Du Pisani 2006). These three pillars of sustainability are founded on the idea that humans and nature are intricately connected (UN 1987). Altogether, these dynamic human-nature connections are organized by distinct boundaries and are conceptually known as social-ecological systems (SESs).

SESs are nested, multi-level systems that provide essential services to society such as the supply of food, water, and energy (Folke 2006; Ostrom 2009; Binder *et al.* 2013; Partelow 2018), as well as the non-material benefits people obtain from nature (e.g. cultural services) (Fish, Church, and Winter 2016). The study of these nested, multi-level systems conceptualizes our world as humans interacting with and relying on nature (Ostrom 2009; Partelow 2015). As a framework, SESs can support the development of sustainable policy, environmental management, and climate change adaptation that is relevant to decision-makers at all levels (Armatas, Venn, and Watson 2017; Dankel *et al.* 2022).

The study of SESs from both the social and natural sciences has illuminated the complexities and dynamic relationships of our human-natural world across multiple scales. Increasingly the focus has been on the micro-scale (individuals and small groups): the question of how society *sees itself* as part of nature. In other words, how the inner world (i.e. the emotions, thoughts, identities, and beliefs) of the people who make up social structures (Ives, Freeth, and Fischer 2020) impact and are influenced by social-ecological interdependencies. Understanding how changes in the inner world can affect transformation in the collective values of society is important for achieving sustainability (Westley *et al.* 2011, 2013; Stirling 2014; Pereira *et al.* 2015; 2018; Ives, Freeth, and Fischer 2020; Scoones *et al.* 2020). Social transformation requires fostering human agency at the individual or local level, enabling cross-sectoral cooperation and networking, and empowering individuals to take responsibility for change in their communities (Armatas, Venn, and Watson 2017; Avelino *et al.* 2019). Thus, identifying and extracting collectively-held values in society, and recognizing society *as part of* nature, is a first step to developing and implementing solutions to sustainability problems.

1.2. Enabling salient, credible, and legitimate social transformations for sustainable development in Norway

Knowledge of the individual preferences and perspectives (that could broadly comprise collectively-held values) can increase individual participation in problem-solving and stimulate the "transformational potential" of those individuals (Lang *et al.* 2012;

Ruppert-Winkel *et al.* 2015; Tschakert *et al.* 2016; Farrell, Carr, and Fahy 2017; Horcea-Milcu *et al.* 2019). The transformational potential thereof is strengthened when it fulfills three key attributes: *salience* (the relevance of information for an actor's decision choices), *credibility* (if actors perceive information as meeting the standards of scientific plausibility and technical adequacy), and *legitimacy* (if actors perceive the process in a system meets standards of political and procedural fairness) (Cash *et al.* 2003; Cash and Belloy 2020).

The transformational possibilities emerging from the type of localized knowledge obtained on individual attitudes and perspectives includes political, cultural, and institutional change that could be made in society to achieve a desired outcome. In the sustainability sciences, three transformational approaches have been theorized for sustainable development: *structural*, *systemic*, and *enabling* (Sachs *et al.* 2019). Structural approaches focus on the underlying foundations of politics, economy, and society (e.g. the ideologies of institutions). Systemic approaches focus on features of systems for targeted change (e.g. the elements and drivers of a social-ecological system). These two approaches view society as a unit that comprises the institutional formations and processes that need to be changed. Enabling approaches, on the other hand, target transforming society (and the individuals within) by fostering human agency and capacities to identify shared values to collectively enact pathways to desired futures (Scoones *et al.* 2020).

Norway has an imperative to localize the SDGs and a targeted way to do this is through empowering local individuals and municipalities to determine what sustainability means *for them* (i.e. enabling their agency), thus leading to social transformation. The result would be a localizing process for Norway that is meaningful and contextually relevant (salient), follows political and procedural standards (legitimate), and has generated mutual trust and credence between individuals, institutions, and the science (credibility) that forms the basis for sustainability policy.

1.3. Using existing national policy mechanisms to localize the SDGs for Norway: the Norwegian Planning and Building Act (2008)

Consensus in Norway is that SDG implementation relies heavily on existing policies and processes (Bardal *et al.* 2021). By localizing the SDGs through an existing policy, or "vehicle", that is already anchored to and implemented at the local level, the SDGs are forced to be adapted to the local context, which facilitates their integration. Norway has done much to jumpstart the localization process for the SDGs, including allocating monitoring and reporting responsibilities to relevant ministries and departments in the government, and providing some financial resources for regional and municipal collaborations (Bardal *et al.* 2021). However, a "lack of guidelines and support from national authorities are key barriers [to working with the SDGs] at the regional level" (Ministry of Local Government and Modernisation 2021, 96). Without clear guidance from the national government, local and regional authorities struggle to understand how to develop plans, processes, and activities that are relevant to their needs while also contributing to the SDGs. In other words, what is lacking is knowledge on local community grounding (or anchoring) of the SDGs (Rybråten *et al.* 2018). While the three transformational approaches are not mutually exclusive, in this study we consider *enabling approaches* as the focus for achieving salient, credible, and legitimate social transformation *at the local level*.

For this study, we explored how to overcome these barriers to SDG localization in Norway, by adapting a methodology to a local case using the legislative process for

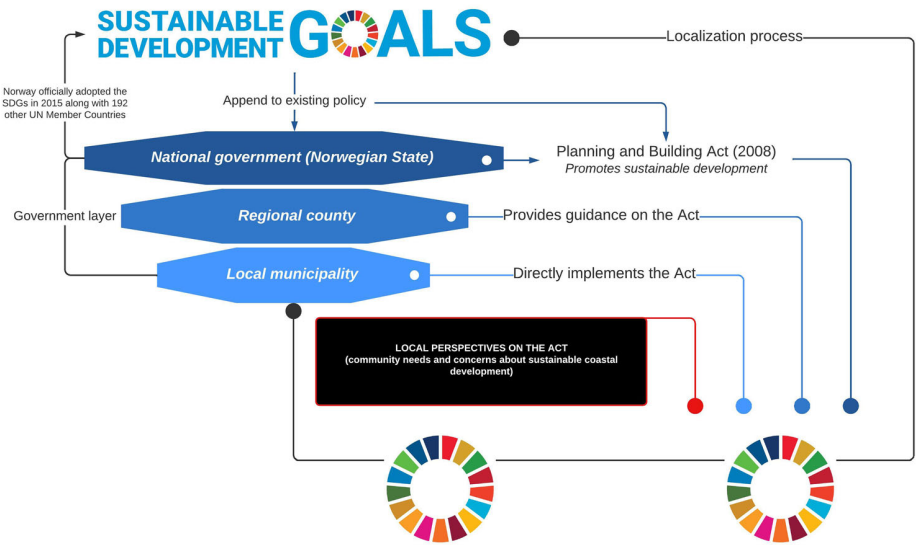

Figure 1. A conceptual illustration of how the Norwegian Planning and Building Act (2008) could be a "policy vehicle" to localize the SDGs. Relevant government levels are distinguished, alongside their specific connection to the Act. The black box indicates the knowledge gap on the local discourse about the topic of sustainable development that this study aims to illuminate using Q-methodology.

coastal planning as an example of a "policy vehicle." The coastal planning process is regulated by the Norwegian Planning and Building Act (Ministry of Local Government and Regional Development 2008), which is a concrete example of legislative planning for all governance levels and stakeholders, through which the SDGs could be anchored and localized *by proxy*. This study uses the Planning and Building Act as the "policy vehicle" for localizing the SDGs. The Act is significant for the local (municipal) governance levels in Norway because of its direct implementation *via* those management bodies. The explicit purpose of the Act is to promote sustainable development (Kvalvik and Robertsen 2017; Dankel *et al.* 2022) for the use and conservation of terrestrial and aquatic resources. It contains a clear mandate for municipalities to cooperate on projects that fall within the scope of the Act, such as building developments and physical alterations of the land or area (Ministry of Local Government and Regional Development 2008, Section 1-6). Figure 1 illustrates this policy vehicle concept alongside the Norwegian government layers related to the Planning and Building Act. It shows how on-the-ground knowledge of local needs and concerns can be used to contextualize the Act (and by proxy, the SDGs) for those needs, thus strengthening the attributes of legitimacy, salience, and credibility for that policy vehicle. This is done by applying Q-methodology to elucidate local shared and diverging perspectives on sustainable coastal development.

The research objective for this study is to identify and examine the various discourses on the coastal planning process and what sustainability means to individuals in this case. The study is framed within the social, economic, and environmental pillars of sustainability applied to key economic sectors in the local case study area. The overall aim was to understand how a coastal planning process (i.e. the Act or the "policy vehicle" for the SDGs), could include the varying perspectives held in the community on sustainable coastal development as a proxy topic for the SDGs.

2. Methodology

2.1. Our case study of Andøya, Norway

Our case study area is *Andøya* (Figure 2), the northernmost island of Vesterålen, situated 300 km inside the Arctic Circle. Andøya has a surface of around 500 km^2 and a total of 5,000 residents in 2022. *Andenes* is the largest town with 3,500 residents and is the administrative center of *Andøy Municipality*, which also encompasses a few neighboring areas on the mainland. The largest employment sectors are the fishing industry (fishing activities have been occurring on Andøya for centuries), the Norwegian Air Force station established in 1954, and Andøya Space (a research and rocket testing center on the island since 1962). See Figure 3 for a development timeline of key economic sectors on the island, important for local employment. Geographically, Andøya has mountains rising up to 700 m above sea level, while the innermost part of the island consists of bogs, marshes, and lakes.

From 2016 to 2022, the Norwegian Defense Ministry proposed a series of changes to its military presence on the island. Three major ongoing developments are: i) the addition of a new rocket launch site for the Andøya Space Center at Nordmela, ii) the development of a new land-based aquaculture facility on the mid-eastern coastline of the island, and iii) a new museum and cultural center in Andenes called "The Whale." During an in-person conversation with a co-author of this study on 11 June 2020, a member of the Andøy Municipality planning group commented that these developments are expected to provide significant positive impacts on employment and population growth for the municipality, as well as increased revenue from tourism.

2.2. Q-methodology

To understand the perspectives of local Andøya stakeholders on sustainable coastal development we used Q-methodology (Stephenson 1935). This approach can reveal social perspectives and allows for identifying similarities or commonalities among stakeholders. The advantage of using Q-methodology is that the participants' responses can be compared in a consistent manner because everyone is responding to the same set of Q-statements (Brown 1993; Webler, Danielson, and Tuler 2009, 5; Watts and Stenner 2012). Q-participants were selected to represent the breadth of opinion in a target population (i.e. all sectors impacted by coastal planning), thus it is about qualitative representativeness. Participants sorted Q-statements about sustainable development and planning according to their beliefs and understandings, i.e. whether they Agree or Disagree with those statements.

Q-sort results can reveal patterns by showing inter-subjective orderings of beliefs shared among people (Brown 1993; Webler, Danielson, and Tuler 2009, 7; Watts and Stenner 2012). These subjective patterns indicate the degree of (dis)similarity in individually-held perspectives. In the Q-sort analysis, unique viewpoints are reduced to a few concise and general perspectives, which are complemented and contextualized by qualitative information derived from interviews (Armatas, Venn, and Watson 2017). The analysis reveals patterns within and across individuals, but it does not measure the distribution of beliefs across a population (Webler, Danielson, and Tuler 2009, 7; Armatas, Venn, and Watson 2017) nor does it measure across traits or categories (Martin and Steelman 2004; Ockwell 2008; Curry, Barry, and McClenaghan 2013).

This study followed four main steps for Stephenson's Q-methodology, as elaborated in work by Brown (1993), and Watts and Stenner (2005, 2012). Figure 4 summarizes the key steps used in this study. Details on the Q-methodology steps are provided in the supplementary materials. Ethics approval for the study was granted by the Norwegian

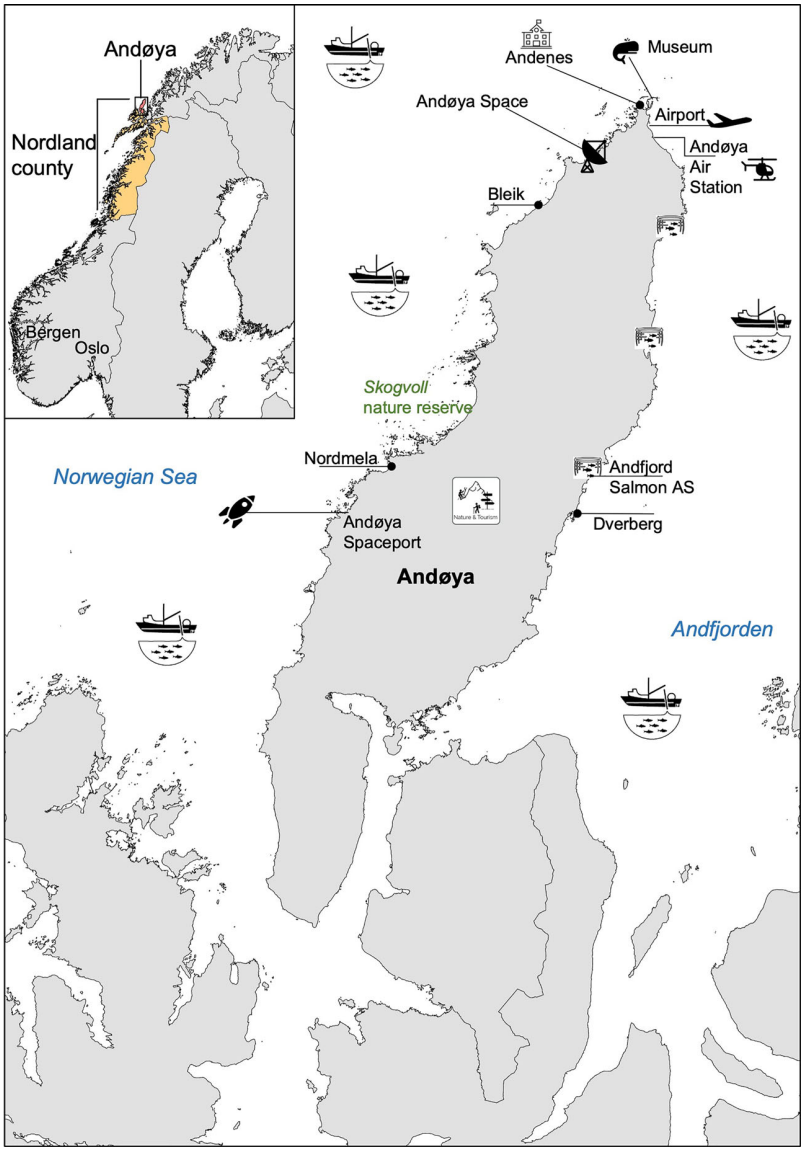

Figure 2. Map of Andøya (*basemap produced by* Per Arne Horneland, Norwegian Institute of Marine Research, 2022). Nordland County is denoted in orange and Andøya highlighted in red in the inset map. The map shows key townships (Andenes, Bleik, Nordmela, and Dverberg) and economic businesses (The Whale Museum, Andfjord Salmon AS, Andøya Space and Andøya Spaceport, the civilian airport, and the military air station). Key activities include active fisheries for Northeast cod (*skrei*), Norwegian spawning herring (*sild*), lumpsucker (*rognkjeks*), Northeast Atlantic Saithe (*sei*), halibut (*kveite*), Northeast Atlantic haddock (*hyseline*), mackerel, and anglerfish (*flabb*), among other species. These fisheries take place along the coastline and offshore in the Norwegian Sea and the Andfjorden fjord with several vessel sizes and different gear types such as Danish seine (*snurrevad*), jigging or by-hand weighted multi-hook (*juksa*), mixed nets, and longlines. There are active fishing ports in Andenes, Bleik, Nordmela, and Dverberg, and fish processing plants in Nordmela and Andenes. The size of the icons does not represent the size or importance of the enterprise it depicts.

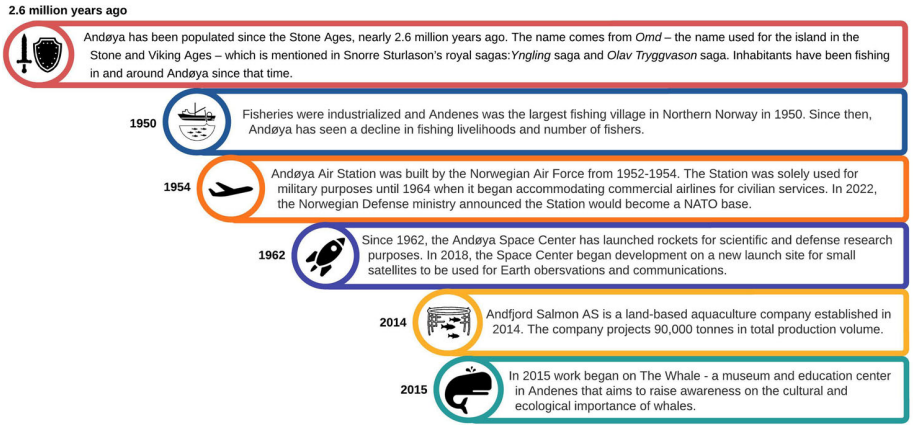

Figure 3. A generalized and stylized timeline illustrating key economic developments on Andøya. The subset shown here is a small selection relevant for this case and does not include all economic developments that mark the rich history and social, economic, and environmental diversity of Andøya. Icons created by Linley Kristofferson, with Microsoft Icons.

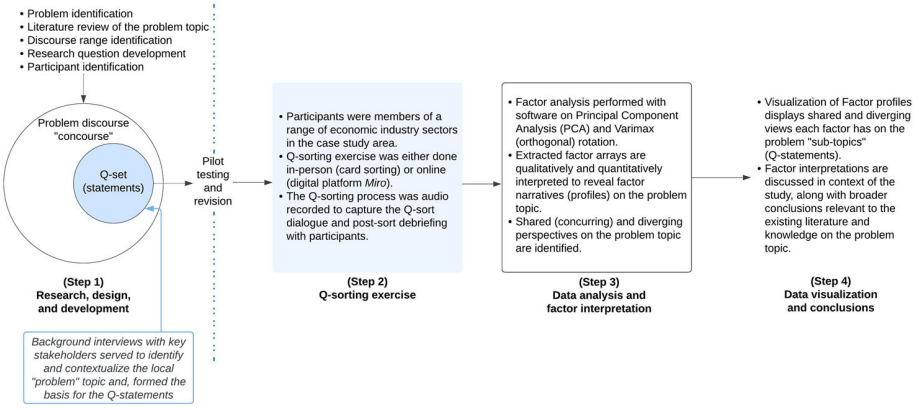

Figure 4. A summary of the Q-methodology steps utilized in this paper. Image adapted from Hai-Jew (2019).

Centre for Research Data (reference number 929315). All participants in the study were provided with an information note and consent form to sign prior to their participation, which included their right to withdraw from the study at any time and for any reason.

2.3. Step 1: Developing the concourse and identifying participants

The Q-set, or concourse, is a series of statements drawn from semi-structured scoping interviews held with key stakeholders from November to December 2020 (see supplementary materials for a list of interview questions). Twenty-five statements were developed from the interviews, of which 16 were direct quotes, and *post-hoc* categorized into the three sustainability pillars, with an additional "institution" category (Figure 5). A stakeholder analysis was done to establish a cross-section of local businesses located on the main island of Andøya with a direct impact on the coastal and/or marine space. Out

Numbered statement	Coded segment	SDG Link
1. When it comes to coastal development in Andøya, the majority of Andøyværing* are not listened to.	1 Unheard voices	
2. "Money talks" in Andøya (larger, wealthier businesses/investors influence coastal plans).	2 Money Talks	
3. At this moment, the commercial fishing sector in Andøya is losing to other sectors.	3 Fishing loss	
4. The Andøy Municipality and local policymakers have time, knowledge, and money to sustainably plan the Andøya coastline.	4 Municipal capacity	
5. New buildings and infrastructure development are destroying the Andøya coastline.	5 Coastline destruction	
6. People in Andøya have different definitions of sustainability, and this is what hampers sustainable coastal development.	6 Sustainability confusion	
7. Climate change is the most important reason to do sustainable coastal planning in Andøya.	7 Climate change	
8. Andøya is a "Mecca" for wildlife and nature.	8 Andøya Mecca	
9. The government is responsible for implementing sustainability in Andøya.	9 Government responsibility	
10. Businesses in Andøya need to decide if sustainable practices first make "business-sense", additional benefits are just side effects.	10 Business-sense	
11. Monetary incentives are the only way to get Andøya businesses to integrate the SDGs/sustainability into their business plans.	11 Monetary incentives	
12. Andøya doesn't need to be developed more, it just needs to be better organized.	12 Organize better	
13. If coastal development in Andøya is done sustainably, it is always acceptable.	13 Always acceptable	
14. Andøyværinger* need to see how global goals (e.g., the SDGs) are locally relevant if they are to accept the goals.	14 Locally relevant SDGs	
15. Real change in Andøya comes with integrating the SDGs into business plans and policies.	15 SDG integration	
16. The sustainability bar is set very low for Andøya businesses.	16 Low sustainability bar	
17. You can do good things for society with bad results for the environment, but if you are doing good things for the environment then it is really hard to screw up society.	17 Society vs environment	
18. In order to be sustainable, the Andøy Municipality needs to say "No" to development a lot more.	18 No to development	
19. The fishing industry in Andøya has always been thinking about sustainability, because if they harvest all the fish this year there won't be any for next year.	19 Sustainable fishing	
20. I live in nature, not outside of it (e.g., I don't separate myself from nature).	20 Live in nature	
21. It's a brute fact that Andøy Municipality needs money (e.g., from business growth and development in Andøya) to do its work, even if that means making hard (unpopular) choices.	21 Municipality needs money	
22. The government gives the minimum requirements for sustainability and then it's up to Andøya businesses and individuals to take it further.	22 Minimum requirements	
23. Many Andøya businesses struggle to understand how to incorporate sustainability into their business.	23 Sustainable businesses	
24. Planning for a small community like Andøya needs to involve everyone.	24 Planning involvement	
25. Andøy Municipality does not prioritize the environment enough.	25 Environment priority	

Figure 5. Q-concourse of 25 statements, color-coded by sustainability pillar with which each statement is most strongly associated: economy (blue), society (orange), environment (green), and institutional (yellow). Each statement is linked to a relevant SDG. Colour online.
* *Andøyværing* and *Andøyværinger*: Norwegian word for "people from Andøya."

of the 35 businesses contacted and/or found by snowball sampling, fifteen individuals responded to requests for interviews and completed Q-sorts between April and July 2021. Each business was then categorized into a sector type: government (2 participants), tourism (4 participants), fisheries (6 participants), and research and technology (3 participants). Two major business sectors were excluded from the Q-sort: agriculture (less relevant for coastal planning), and the military (the authors were unable to interview people from the military based in Andøya and/or had local knowledge of the case study area).

2.4. Step 2: Q-sorting exercise

The Q-sort was implemented using a standard distribution grid (Table 1) either in-person (using a poster and sticking cards) or online (using Miro and Zoom). During the Q-sort, participants were asked to "think aloud", so their reasoning behind the decisions could be recorded (sometimes after probing by the researcher). Participants could move the statements until they were satisfied, and the final Q-sort was saved.

2.5. Step 3: Q-analysis and factor extraction

The 15 completed Q-sorts were analyzed using Principal Component Analysis (PCA) and Varimax (orthogonal) rotation with PQMethod software (Schmolck 2014).

Table 1. Forced-choice quasi-normal distribution grid for the Q-sort, with a corresponding a Likert scale of −4 (Most Disagree) to 4 (Most Agree).

Most Disagree				Neutral			Most Agree	
-4	-3	-2	-1	0	1	2	3	4

Following a classic determination, the factors with eigenvalues greater than 1.00 were considered (Brown 1993; Watts and Stenner 2012; Rahma, Mardiatno, and Hizbaron 2020), and subsequently reduced using a series of tests (explained cumulative variance, Humphrey's Rule, Scree test, and a by-hand comparison of results for factors extracted) (Watts and Stenner 2012).

2.6. Step 4: Factor interpretation

The resulting factor arrays were qualitatively interpreted following the "crib sheet" method (Watts and Stenner 2012). The interpretative phase of the analysis was initially performed separately by four of the co-authors. The individual results were then discussed, and a collective interpretation was developed. These interpretations were based on the results from the statistical analysis, along with perspectives and field observations by the first author who conducted the fieldwork. The factor descriptions were drawn primarily using the distinguishing statements identified for each factor (statement for which one Factor had a significantly different viewpoint from the other Factors). Then a holistic interpretation for all three factors was accomplished using the diverging statements (statements upon which all Factors differed) and consensus statements (statements upon which all Factors concurred).

3. Results

A 3-factor solution explained 57% of the study variance, which is considered sound (Kline 1994; Peterson 2000); and did not yield any non-significant Q-sorts. The three factors were distinguished using statements unique to them (see step 4 above), concurring stances (or shared viewpoints, Table 2), and diverging viewpoints (Table 3). Complete results are summarized in Figure 6. See supplementary materials for the full factor arrays. The three perspectives were classified as "Fisheries are important" (Factor 1), "Development must be green" (Factor 2), and "Sustainability guidelines are crucial" (Factor 3). Six of the 15 Q-sort participants loaded onto Factors 1 and 3 each, and two respondents loaded on Factor 2. One remaining respondent loaded onto both Factor 2 and Factor 3. In the following results tables, high or very low (negative)

Table 2. Consensus statements for which all three factors concur (shared viewpoints).

Statement number and text		Result interpretation	Factor 1		Factor 2		Factor 3	
			Q-value	Z-score	Q-value	Z-score	Q-value	Z-score
8	Andøya is a "Mecca" for wildlife and nature.	All factors Agree	3	1.42	3	1.63	2	1.04
11	Monetary incentives are the only way to get Andøya businesses to integrate the SDGs/sustainability into their business plans.	All factors are Disagree	−1	−0.33	−1	−0.55	−1	−0.34
22	The government gives the minimum requirements for sustainability and then it's up to Andøya businesses and individuals to take it further.	All factors are Neutral	−1	−0.45	0	0.08	1	0.24
24	Planning for a small community like Andøya needs to involve everyone.	All factors are Neutral	0	−0.07	0	−0.05	−2	−0.53
25	Andøy Municipality does not prioritize the environment enough.	All factors Agree	2	1.14	1	0.65	1	0.72

Note: These are statements that do not distinguish between any pair of factors because there is no significant difference in how each factor ranked with that statement.

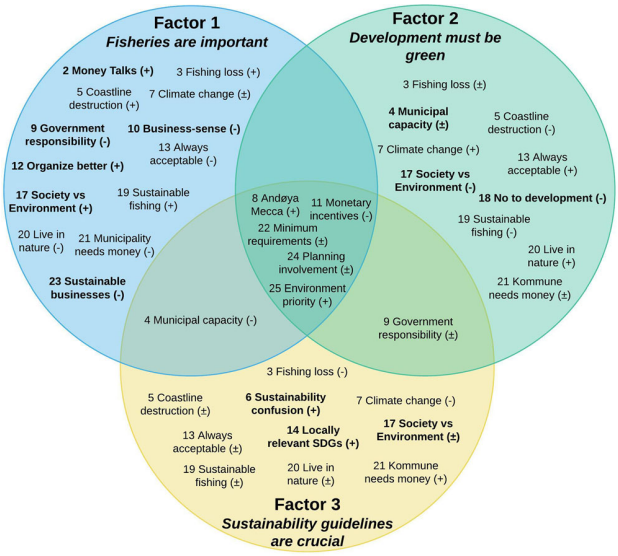

Figure 6. Venn diagram of each of the three factors extracted by Principal Component Analysis and rotated by Varimax with the PQMethod Software (see supplementary materials for complete results tables and factor arrays). Statements are indicated by coded segments (see Figure 5 for the key). The use of a symbol indicates whether that Factor "Agrees" (+), "Disagrees" (−), or is "Neutral" (±) to that statement. Statements placed in each circle denote those for which that Factor holds either a distinguishing/unique view (marked in **bold**) or diverging (different) view, compared to the other two factors. Statements placed in overlapping areas between two factors indicate the statement(s) for which those two factors *share a viewpoint* (two factors concur) in a way that is different from the third factor. The central overlapping area indicates viewpoints on statements that are "shared" between all factors (the consensus statements in Table 2). The extracted factors were not determined to have any viewpoints or stance on statements 1 (Unheard voices), 15 (SDG integration), and 16 (Low sustainability bar) so they are not included in this figure.

Z-scores are associated with small P-values in normally distributed distributions, upon which significant differences between variables can be determined.

The result interpretation column in Table 3 is based on the Q-value for each Factor *in relation* to the other two factors: so, there is one factor that Agrees most (+), one factor that Disagrees most (−), and a third that is Neutral (±). For example, Statement 13 shows a clear Disagreement for Factor 1 and a clear Agreement for Factor 2, while Factor 3 is more Neutral: i.e. more positive and more negative than Factors 1 and 2, respectively. For Statement 20, all three factors show a degree of agreement with the statement when viewed individually. When viewed in relation to each other, Factor 1 Agrees *less* with the statement than either Factor 2 or Factor 3.

3.1. Distinct perspectives on sustainable coastal development identified for Andøya

The three extracted factors comprise three distinct viewpoints about sustainable coastal development in Andøya (*Fisheries are important*, *Development must be green*, and

Table 3. Statements for which all three factors diverged strongly.

Statement number and text		Result interpretation	Factor 1		Factor 2		Factor 3	
			Q-value	Z-score	Q-value	Z-score	Q-value	Z-score
5	New buildings and infrastructure development are destroying the Andøya coastline.	Factor 1 (+) Factor 2 (−) Factor 3 (±)	1	0.62	−2	−0.64	0	0.05
7	Climate change is the most important reason to do sustainable coastal planning in Andøya.	Factor 1 (±) Factor 2 (+) Factor 3 (−)	0	0.09	3	1.50	−3	−1.61
13	If coastal development in Andøya is done sustainably, it is always acceptable.	Factor 1 (−) Factor 2 (+) Factor 3 (±)	−3	−1.20	2	1.00	−1	−0.30
19	The fishing industry in Andøya has always been thinking about sustainability, because if they harvest all the fish this year there won't be any for next year.	Factor 1 (+) Factor 2 (−) Factor 3 (±)	2	1.24	−4	−1.96	−1	−0.32
20	I live in nature, not outside of it (e.g. I don't separate myself from nature).	Factor 1 (−) Factor 2 (+) Factor 3 (±)	1	0.28	4	1.96	3	1.07
21	It's a brute fact that Andøy Kommune needs money (e.g. from business growth and development in Andøya) to do its work, even if that means making hard (unpopular) choices.	Factor 1 (−) Factor 2 (±) Factor 3 (+)	−1	−0.30	2	0.82	4	1.76

Note: Determined by the calculated significant difference (at the $p < 0.05$ or $p < 0.01$ levels) of the associated z-scores. The use of a symbol indicates if that Factor "Agrees" (+), "Disagrees" (−), or is "Neutral" (±) to that statement. The result interpretation column is based on the Q-value for each Factor *in relation* to the other two factors (not in isolation).

Sustainability guidelines are crucial). The labels for the three factors are descriptive and intended to reflect the predominant focus. The unique perspectives derived from the distinguishing statements are summarized in Boxes 1-3.

BOX 1: Fisheries are important

Factor 1 orients towards a pro-fishing perspective that believes the fishing business should be the primary consideration for coastal planning and emphasis is on the perspective that the fishing industry is losing out to other sectors on the island. This is connected to the perception that the smaller fishing businesses are being outcompeted and outvoiced by larger and wealthier industries aiming to use the same coastal and marine space. While this pro-fishing perspective is not necessarily anti-development or anti-growth for Andøya, it exhibits more skepticism towards the other sectoral developments for the area. This is connected to a general feeling of distrust towards the motivations behind these proposed developments, as they believe the competing industries are primarily motivated by profit and growth rather than for the benefit of the Andøya society and environment. Individuals loading on this factor perceive the national government as having much influence or power over what happens with Andøya businesses, and they are skeptical about the approach to coastal planning and development by the Andøy Municipality and whether the process is truly democratic or influenced by "Big Money." Given this attitude towards government institutions, this perspective places much responsibility and expectations on businesses themselves to do the right thing, rather than trust the government to mandate for the right action. Therefore, this attitude comes across as slightly contradictory because individuals see the necessity for coastal development in their area, but also mistrust the process behind it. These individuals believe that most businesses in Andøya can have a more altruistic motivation for society and the environment that it is not always about profit and growth. However, the perspective also places little trust in those same businesses to follow through with that altruism.

BOX 2: Development must be green

Factor 2 orients towards the viewpoint that protecting the environment and promoting development are not mutually exclusive. From this perspective, the idea of promoting environmentally friendly and sustainable businesses is dominant, and there is a strong sense of the environment being the foundation for a healthy society and robust economy, which connects with a holistic view of the human-nature relationship on Andøya. This view is not singularly pro-environment at the expense of society or the economy, but rather seeks to find the balance between environmental conservation and socioeconomic growth – which fits closely with the general approach of both pragmatism and realism in sustainable development. This perspective is also of the view that more environmentally focused social and economic development is needed for Andøya to be sustainable, and that even though Andøya businesses should have a self-imposed duty to be sustainable, the Andøy Municipality is the entity with the responsibility to pursue and advocate for sustainable development. This supports the viewpoint in this factor that despite being small and rural, the Andøy Municipality has sufficient time, knowledge, and money to undertake this.

BOX 3: Sustainability guidelines are crucial

Factor 3 orients towards the viewpoint that the social attitudes towards sustainability are the biggest challenge to address for coastal development in Andøya. A dominating view is that there is no clear or single definition or guideline on what sustainable coastal development is, either from research or from the national government, and this is what creates confusion and subsequent ambivalence towards the concept and prevents it from being fully implemented in Andøya. This perspective also sees how the localization aspect of sustainable coastal development is key for its success: unless the local relevance and consequences are made explicit to people living in Andøya, the implementation of sustainable coastal development will not be supported. This reveals a pragmatic point of view for this perspective, where an emphasis is placed on the task of operationalizing the sustainability concept, rather than thinking about it in abstract terms.

3.2. Shared and diverging perspectives on sustainable coastal development in Andøya

A closer examination of the contextual information (the dialogues recording during each Q-sort) alongside the Q-scores revealed several viewpoints where factors appear to concur or diverge according to the quantitative analysis but do the opposite when the qualitative substance is examined. The quotes shared below are from the transcribed Q-sorts and reference the relevant statement and the Factor on which the individual loads.

3.2.1. "To develop or not to develop" perspective

On inspection of the placement of the development-related statements (12, 13, and 18) in the factor distribution for the full array, it appears that individuals loading on Factors 1 and 2 disagreed with each other on this topic, while individuals associated with Factor 3 remained "neutral". However, a closer look at the qualitative information suggests that people within Factor 1 and Factor 2 might not have such different views. Principally, it appears that both factors value and support development "… in a healthy and sustainable way …" (Q-sort 5, statement 12, Factor 1), albeit with certain sustainability-oriented conditions. That is, new development should only be done *if* it is done responsibly and sustainably "… within a set of frameworks where we actually define ourselves closer to nature …" (Q-sort 1, statement 18, Factor 2).

Nevertheless, a sustainable approach will not automatically guarantee acceptance for that development. Factor 1 individuals showed reluctance towards new development because of their skepticism on whether current knowledge of sustainability is effective enough. Factor 2 individuals showed a general acceptance for development, but the contextual information reveals a similar skepticism on the current level of knowledge of sustainability and if it is fit-for-purpose: "… the measurements we now use for sustainability are not good enough … we don't [consider] everything when we measure [sustainability] …" (Q-sort 9, statement 13, Factor 2). Ultimately, it seems that sustainable development is acceptable for Andøya as long as current sustainability knowledge and monitoring is legitimate, salient, and credible.

3.2.1.1. "The "why" for sustainable coastal development in Andøya" perspective. A second viewpoint that emerges from the Q-study for all three factors comes from the motivations behind sustainable coastal development in Andøya. While the statements suggest two types of motivations: profit-focused incentives (e.g. statements 2, 11, and 21) or environment/society-focused altruism (e.g. statements 10 and 14) – individuals loading on different Factors communicate a combination of these motivations. The individuals acknowledge the realities of needing money to conduct business and manage a Municipality (e.g. statements 2 and 3): "… it helps to have a lot of money, because if you have a project and the Andøy [Municipality] is interested … it helps to be a big company and have big plans …" (Q-sort 6, statement 2, Factor 3).

Yet, the emerging perspectives from each Factor also include a sense of optimism that money is not always the sole motivator for integrating sustainability into business plans (e.g. statement 11): "… I do think we are planning ahead and thinking about the future and sustainability …" (Q-sort 5, statement 11, Factor 1). While they acknowledge that money is an important factor, a moral obligation also emerges – a sense of altruism: "… I don't think [money] is the only way … you can do something out of goodwill …" (Q-sort 14, statement 11, Factor 3).

However, a sense of realism still emerges as a strong perspective in each Factor: people may have altruistic motivations but ultimately profit generation is important for businesses and business and political leaders must make decisions accordingly: "… I think you cannot drive a business from altruism. You have to seek power and money if your business is actually going to survive … even charities and non-governmental organizations; they all have their business part of it because they have to make money somehow, even if they do have this altruistic objective … " (Q-sort 2, statement 10, Factor 3). Despite this realism, or perhaps because of it, some individuals distrust the way the authorities make decisions and believe the municipality is not so interested in what the community thinks: "… in this community there is a lot of corruption … " (Q-sort 11, statement 21, Factor 1).

Therefore, while the viewpoint has the opinion that profit is necessary in this world and money is needed for the continuation of social services to the Andøya community, the Andøya individuals loading onto this statement retain hope for a greener future. Both viewpoints are not harmonized (as they rarely are) but co-exist. This co-existence of hope for sectoral development and a greener future can be used to frame discussions on contextually relevant sustainable coastal development whereby global goals like the SDGs can be integrated. Even so, the study reveals the complexity of the sustainability debate and that motivations for sustainability are incredibly nuanced: "… it's so abstract. In Andøya there are poor people, but we don't have people on the streets. Even if people are poor, they still have a roof over their heads and a full belly and have money to go shop … we need to have a local [context] to accept them … " (Q-sort 2, statement 14, Factor 3).

3.2.1.2. The "nature connectedness of living in Andøya" perspective. The third and final viewpoint that emerges from the Q-study also reveals a strong appreciation for the Andøya nature, which at the same time is diluted by the economic and social realisms of the area (e.g. statements 7, 8, 20, and 25). Foremost, this viewpoint includes a strong awareness of the Andøya nature: "Whether I am onshore or offshore, I am in nature … " (Q-sort 10, statement 20, Factor 1), and that it serves as a primary motivation to live there: "… that's why I am living here and not Oslo" (Q-sort 4, statement 20, confounded on Factor 2 and 3). This viewpoint shows a responsibility to protect the preciousness of the Andøya nature: "… I'm trying to keep it sustainable and a bit secret … I want that Mecca to be protected" (Q-sort 5, statement 8, Factor 1). But at the same time, it also possesses a more realistic perspective: "We're not as close to nature … we can't say that we live in nature, because that would also mean that we know how to sustain ourselves … " (Q-sort 2, statement 20, Factor 3).

And there remains some skepticism about how much people in Andøya would be willing to sacrifice to address larger issues, such as climate change. It appears that climate change would only become a problem to the community "… when they feel it in the economy" (Q-sort 8, statement 7, Factor 3) because "… I don't think anyone in Andøya would be crying about the 2-degree Celsius increase – we're freezing … " (Q-sort 2, statement 7, Factor 3).

It's clear that the environment is an important consideration for these individuals in Andøya, but they struggle with its prioritization when faced with the economic and social realities of the Municipality. For example, how much confidence they have in the municipality with regards to the environment, from not prioritizing it at all to: "… they could do more" (Q-sort 9, statement 25, Factor 2).

4. Discussion

By appending the SDGs to an existing policy process, such as coastal planning (see Figure 1) the SDGs can be *localized.* Key to this is to ensure the SDGs are credible and relevant for the actors at the local level. By using Q-methodology, the variable perspectives and attitudes of local stakeholders to the coastal planning process were examined and the local discourses within and across all relevant economic sectors were identified. By framing these various perspectives within the social, economic, and environmental dimensions of sustainability, it becomes clear where the contention or synchronized discourses are, allowing for targeted interventions (for instance, by the local municipality). As such, the concept of sustainability is given a local and contextually relevant setting for the term.

This approach is also useful to guide the social transformation needed for sustainability as they rely on (a) the proposed change being anchored into practice, and (b) examining individual perspectives on the social, cultural, political, and ecological components of the proposed change (Westley *et al.* 2011, 2013; Pereira *et al.* 2015; Boström *et al.* 2018; Pereira *et al.* 2018; Zabala, Sandbrook, and Mukherjee 2018; Bardal *et al.* 2021; Orozco *et al.* 2021)). In this context, credibility is ensured if multiple perspectives have been heard and that it is a mutual learning process that involves the exchange of and respect for the knowledge and experiences of those involved (Staples *et al.* 2021).

4.1. Q-results for coastal planning in Andøya

The study revealed several viewpoints on sustainable coastal development in Andøya. The dominating perspective is that fisheries are economically and culturally important, which is typical for coastal areas of northern Norway (Engen *et al.* 2021). The local perspectives also reveal two distinct, but not mutually exclusive, motivations for coastal development: profit and sustainability. The third motivation underpinning coastal development is not as clearly defined, but generally encompasses the notion that there is a need to bring the community together on the topic of sustainability by using better information and knowledge.

There is a shared sense of skepticism about whether the government knows enough about sustainability. This skepticism about the adequacy of information can affect the credibility of sustainability efforts of the Andøy Municipality. This is further complicated by the seemingly different opinions among the stakeholders themselves of what sustainability is. This highlights the pluralistic view of the term: what is considered sustainable to one individual or group might be unsustainable to another (Engen *et al.* 2021). Therefore, the Andøy Municipality faces the challenge of having to clearly define *sustainability of what* and *for whom* to gain local support and acceptance for proposed coastal development. The varied viewpoints on what sustainable coastal planning is in Andøya can be used by Andøya Municipality in a positive way by building the definition of sustainability from the ground up.

The study revealed three shared perspectives (Factors) among the individual stakeholders: (1) an acceptance of coastal development on the condition it is sustainable (which requires defining it), (2) motivations for coastal development in Andøya balance hopes for a green future with expectations of economic and social development, and (3) nature prevails but is bound by local socioeconomic priorities and realities. Integrating and localizing the SDGs into local coastal policy plans ("policy vehicles") will subsequently strengthen the credibility and legitimacy of the SDG localization process.

If sustainability – and how it is being defined and considered at the local level – is part of the coastal development process, it could strengthen public support for the policy decisions, and enhance local trust in governing institutions.

4.2. *Practical applications for the Q-study to local decision-makers*

It does not serve to make assumptions about particular groups or their motivations for sustainability. In Andøya there seems to be a clear understanding that sustainability is important, as long as it can be specifically adapted to the local viewpoints and experiences. For instance, there is general agreement that coastal development is acceptable if it is sustainable for Andøya, implicitly showing support for the SDGs.

Q-methodology can be applied to sustainability questions in four broad ways: ascertaining management options, critical reflection, policy appraisal and acceptability, and addressing conflict (Zabala, Sandbrook, and Mukherjee 2018). It has been used to identify potential barriers to policy (Frantzi, Carter, and Lovett 2009; Kindermann and Gormally 2013; Curry, Barry, and McClenaghan 2013) by understanding how individuals perceive environmental issues (Barry and Proops 1999); improve public participation (Cuppen *et al.* 2010); offer a way to understand and resolve contentious issues (Durning 2005; Zabala, Sandbrook, and Mukherjee 2018); or understand the failure of solutions and point effort and resources in another direction for resolution (Bjørkan and Veland 2019). The integration of non-scientific information and social perspectives, or experiential knowledge, has a strong role to play in generating evidence-informed policy (Steins *et al.* 2022).

These shared perspectives that are unique for Andøya have direct implications for the localization of the SDGs through the policy vehicle of coastal planning. Identifying the shared perspectives among individuals in the local community (e.g. on concepts such as inclusivity, democracy, nature, and posterity) can assist the Andøy Municipality to frame discussions grounded in these shared values.

4.3. *Study limitations*

There are two limitations to the method used in this study. First, this study offers a snapshot in time of the various perspectives on sustainable coastal development for Andøya. Second, the study does not show the extent to which these discourses hold (Webler, Danielson, and Tuler 2009, 11) among the inhabitants on the island.

5. Conclusion

Discerning perspectives on sustainable coastal planning in Andøya suggest that any existing commonality among participants in this study comes from shared environmental and social values. The attitude of the local stakeholders included hopeful aspirations for their community, coupled with adherence to realism and the need for a practical application of the sustainability concept. This is illustrated by the sardonic observation of a local stakeholder interviewed for the study:

> "… you can't just do anything and if it's sustainable it's ok … because that's the way people are greenwashing things. They are just putting up **vegan coffee shops** 5 meters from the ocean and calling it sustainable. It's really not." – Q5 (statement 13, Factor 1).

The above "vegan coffee shop" quip is an example of a citizen attitude that is focused on a common understanding of sustainability, instead of a "green-washing" or copying urban à la mode businesses. The Q-method helps to identify these citizen insights to form and fuel salient, credible, and legitimate substance for policy such as local coastal management and planning. This can inform enabling approaches, such as participatory planning processes, and may offer more accessible pathways to social transformation for local communities. Anchoring citizen insights in local planning processes can be low cost and build on the capacities and capabilities already present by stimulating extended peer communities in the social-ecological system. Credible SDG localization, therefore, depends on enabling and empowering local communities to develop their agency and human capacity for change. Regional and local authorities can tap into existing potential (i.e. knowledge, skills, energy, motivations) and use that potential to guide solution-oriented discussions and craft ways forward for implementing the SDGs at the local level. The citizen attitudes on local sustainability topics should be considered and integrated in the important SDG localization work, to promote shared sustainability ideals that go deeper than a spontaneous "vegan coffee shop."

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Disclosure statement

No potential conflict of interest was reported by the authors.

Supplemental data

Supplemental data for this article can be accessed here.

Note

1. There is no single definition for 'localization'. In the context of this paper, localization refers to the integration and implementation of the SDGs into policy at the regional and municipal government levels that is accomplished alongside local community engagement and stakeholder inclusion (Orozco *et al.* 2021)).

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10 Paper III

Ethical approaches for engaging extended peer communities: insight into responsible workshopping with citizens

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