Háskólasetur Vestfjarða
University Centre of the Westfjords

Integrating local knowledge and data in marine spatial planning and management- challenges and opportunities in the North Atlantic Region.

Workshop Report

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BACKGROUND

On the 20-21th of January 2025, the workshop *Integrating Local Knowledge and Data in Marine Spatial Planning and Management – Challenges and Opportunities in the North Atlantic Region* was held at the Scottish Government offices in Victoria Quays, Edinburgh, Scotland. The event was hosted by the Scottish Government and organised by the University of Highlands and Islands Shetland, the University Centre of the Westfjords and Nordregio, and funded by the Nordic Council of Ministers' AG-Fisk working group.

With the aim of exchanging knowledge between North Atlantic countries, the workshop brought together planners, practitioners, technical experts, researchers and community representatives. The two-day programme combined presentations, panel sessions and group discussions.

The workshop focused on marine spatial planning and management approaches in the North Atlantic region, the opportunities and challenges associated with integrating Indigenous and local knowledge into these processes and the ways in which digital tools and data use influence this integration. This report summarises the background information shared with participants prior to the event and provides an overview of the key themes and insights that emerged during the discussions.

INTRODUCTION

Since the mid-20th Century, there has been a rapid expansion of marine and maritime activities, including oil and gas exploration, electricity and telecommunication cables, sand and gravel extraction, aquaculture, seaweed farming, and marine renewables, as well as the creation of marine protected areas (MPAs). This expansion has, in part, been facilitated by the extension of state jurisdiction over the sea, with states increasingly claiming control over areas of the continental shelf adjacent to their coasts. This is in stark contrast to the relatively limited use during the preceding millennium, when marine activities were largely confined to fisheries and seafaring.

The change in marine use and prioritisation, including conservation, can lead to conflict between new and existing users through competition for space and resources, as well as a range of environmental impacts [1,2,3,4,5]. These conflicts and impacts have generally been more acute in coastal areas [6,7,8]. However, development is increasingly occurring further offshore, through emerging sectors such as floating offshore wind, and deep-sea drilling for oil and gas [9,10].

To help mediate conflicts, balance multiple objectives and move towards more sustainable decision-making, marine spatial planning or maritime spatial planning (herein MSP), has emerged as a key management tool [4]. Within Europe, the first nations to develop MSPs in the mid-2000s were

Belgium [11], Germany [12], and the Netherlands [13]. Within the EU the role out of MSP became mandatory for member states through the EU Maritime Spatial Planning Directive 2014/89/EU (MSPD) in 2014. Subsequently, Sweden and Denmark adopted MSP in 2022 and 2021. While Norway has a multi-tiered marine planning approach, Iceland has opted to develop marine plans only in areas where there is a specific need. Iceland, Faroe Islands, Greenland and Norway are not bound by the EU Directive as non-member countries, and while the UK has left the EU it chose to retain the Directive requirement in legislation. In Scotland, pilot projects were also developed in 2006 [14], and Scotland adopted its first national marine plan in 2015.

MSP has been seen as a management tool that could align disparate governance structures, provide a 'public' forum and deliver blue economic growth. However, translating theoretical MSP ideals into practice poses several challenges, including overcoming existing power imbalances, differences in values, interests and priorities between stakeholders, knowledge gaps, data accessibility and quality, disparate data types and balancing competing needs [15,16,17,18,19,20,21].

To overcome some of these challenges, stakeholder and public participation is increasingly being recognised as a way to integrate local perspectives into marine planning. Participation in MSP is intended to respond to a range of objectives, including improving understanding of the marine environment, resolving conflicts over use, incorporating social dimensions and strengthening the acceptability of decisions in the eyes of users and communities [22]. This can be achieved through participatory methods including consultation, where stakeholders and knowledge holders become sources of data for researchers, or through the co-production of knowledge, where:

"iterative and collaborative processes involving diverse types of expertise, knowledge and actors to produce context-specific knowledge and pathways towards a sustainable future" [23, p.183].

The inclusion of stakeholder knowledge through participative methods emerged to challenge existing approaches that can exclude a range of knowledge types, particularly Indigenous and local knowledge (ILK) [24,25]. Hence, despite attempts to establish participatory methods and integrate local voices in MSP, concern has been expressed by existing marine users and communities that traditional users are being pushed aside by new development activities [26], transitioning from Mare Liberum [27] to spaces subject to rigorous state control [28]. Indeed, despite efforts, ILK is rarely fully included in the entire MSP process, leading to a range of challenges, including (but not limited to) enforcing rather than overcoming existing power imbalances, tokenistic inclusion, creating 'talking shops' that delay decisive action, creating consultation fatigue and being compounded by non-negotiable positions or actors with veto power [29].

The advancements of new technologies and digital transformation in a rapidly changing world have extended this gap further. Driven by the demand for more efficient processes and intensifying ocean resource use, the majority of today's MSP processes incorporate various types of digital tools to aid decision-making and assessments. Such digital tools are commonly described as enhancing MSP processes through their abilities to analyse vast datasets, use digital mapping tools and create comprehensive assessments. However, while a digital transformation could act as an enabler for MSP, a rapid digital transformation may also increase the divide between who can participate in MSP processes and decision-making, especially due to differences in access to technical tools, resources and expertise, coupled with fundamental divergence in value systems and beliefs and social considerations [30].

INTRODUCTION TO THE WORKSHOP

This workshop explored the role of ILK in MSP for a just green transition in times of digital transformation and climate change. It aimed to identify lessons and best practices that could be shared across the region, how cross-country exchange and collaboration can address challenges and seize opportunities. The workshop welcomed participants from Denmark, Faroe Islands, Greenland, Iceland, Norway, Scotland and Sweden.

The workshop focused on three key questions:

(1) How has Indigenous, local or users' knowledge been integrated into MSP and management processes in the North Atlantic region, and what challenges have countries in the region faced to integrate diverse knowledge types into these processes?

(2) What challenges and opportunities do the fast digital transformation pose for the inclusion of diverse Indigenous and local knowledge and data sources in MSP and management in the region?

(3) What opportunities can digital tools contribute to facilitate the integration of diverse Indigenous and local knowledge sources in MSP and management?

Based on an earlier desktop study and systematic literature review in Autumn 2024, this report was created to inform the project and provide participants with relevant background information ahead of the event. The following sections presents the background material used in the workshop.

MARINE MANAGEMENT AND MSP IN THE NORTH ATLANTIC REGION

The workshop opened with presentations on national approaches to MSP and marine management. To provide context for these discussions, the following section offers an overview of how countries in the North Atlantic region have structured their marine management and planning.

DENMARK

Denmark adopted its first Act on MSP in 2016, the Danish Maritime Spatial Planning Act, encouraged by the EU MSPD. The Act establishes a framework for implementing a Maritime Spatial Plan for the Danish marine area and promotes sustainable development of the maritime energy sector, maritime transport, fisheries and aquaculture, extraction of raw materials, environmental preservation and protection, and tourism and recreation.

Following the Danish MSP Act, a comprehensive Maritime Spatial Plan was developed through a coordinated and collaborative process between the Danish Maritime Authority under the Ministry of Industry, Business and Financial Affairs, various other ministries (for example, the Ministry of Environment, the Ministry of Climate and Energy, the Ministry of Food, Agriculture and Fisheries), stakeholders (e.g., fisheries, energy industries, transport), and interested parties. The Danish Maritime Spatial Plan was adopted in 2021 as the first legally binding plan for Danish waters.

The Danish Maritime Spatial Plan covers the entirety of the Danish Exclusive Economic Zone and territorial sea and therefore plays an essential role as a tool for enhancing collaboration between the many interests and actors in the Danish marine areas. To further ensure transparency of the content and development of the Danish Maritime Spatial Plan, it has been digitalised and made available to the public at https://havplan.dk.

Read more:

Danish Maritime Authority. (n.d.). Danmarks Havplan. https://havplan.dk/en/page/info

FAROE ISLANDS

Similar to the other island nations in the North Atlantic, the Faroe Islands have a long history as a seafaring country, relying on the oceans to support the livelihoods of their local communities. Today, marine resources still hold great significance for the country with the Faroe Islands having one of the largest fisheries and recently aquaculture per capita, with marine resources accounting for about 95 percent of Faroese goods exports.

However, despite the growth of marine industries, the Faroe Islands have not yet developed a marine spatial plan for their coastal and marine areas. Instead, marine activities are regulated and managed through the distribution of licences, for example, fishing quotas and licences for fish farming. Thus, marine activities are evaluated and assessed on a case-by-case basis under the respective ministries responsible. Moreover, fisheries management is carried out under the Faroese fisheries management regime, which uses area closures based on gear, season and effort.

Read more:

Government of the Faroe Islands. (n.d.). Oceans, fisheries and maritime affairs. https://www.government.fo/en/foreign-relations/oceans-fisheries-and-maritime-affairs

FaroeseSeafood.com. (n.d.). Fishery legislation and management. https://www.faroeseseafood.com/fishery-aquaculture/fishery-legislation-and-management/

GREENLAND

MSP has not yet been developed within the waters around Greenland. As Greenland withdrew from the European Union in 1985, MSP legislation such as the EU MSPD (2014/89/EU) does not directly apply. However, through its close connection to Denmark as an autonomous territory within the Kingdom of Denmark, Greenland has set out to apply an ecosystem-based approach to management, initiating the process with several pilot projects. These have been largely initiated due to the increasing environmental degradation and pressures from marine traffic, for example shipping and tourism. With rising pressures on the environment and on Indigenous and local communities, the pilot projects aim to identify areas of higher ecological significance for biodiversity, birds, wildlife and marine ecosystems. Accordingly, plans for protected areas are given high priority.

Additionally, it is important to note that manpower and resources are relatively scarce compared with the vast area of Greenland. As a result, questions remain about how larger coastal and marine management initiatives can be effectively implemented. There is also a need to understand the potential effects of such plans on the livelihoods of communities along the Greenlandic coast.

Read more:

Morf, A., Perus, J., Steingrímsson, S. A., Ekenger, M., Evans, S., Mayer, I. & Zhou, Q. (2014). Results of the 2nd Nordic workshop on marine spatial planning: Use and management of Nordic marine areas – today and tomorrow (Nordiske arbejdspapirer 2014:932). Nordic Council of Ministers. https://doi.org/10.6027/na2014-932

Christensen, T., Falk, K., Boye, T., Ugarte, F., Boertmann, D. & Mosbech, A. (2012). Identifikation af sårbare marine områder i den grønlandske/danske del af Arktis (Identification of vulnerable marine areas in the Greenlandic/Danish part of the Arctic) (Scientific Report No. 43). Danish Centre for Environment and Energy, Aarhus University.

Schütz, S. E. (2018). Marine spatial planning: Prospects for the Arctic. Arctic Review on Law and Politics, 9, 44–66. https://doi.org/10.23865/arctic.v9.899

ICELAND

In Iceland, the first law on MSP was established in 2018, requiring the many fjords and coastal areas to undergo the process of developing coastal zone plans. Whereas the oceans in and around Iceland have been predominantly used for fisheries, growth in new industries such as aquaculture and tourism has created the need for more complex planning and prioritisation of space. As a result, the fjords in the West and East were the first to undergo the process of developing coastal zone plans, with Skjalfandi Bay in the north of Iceland currently in progress, and with the Skipulagstofnun (National Planning Agency) as the lead organiser. In each location, a regional council was appointed with the intention of preparing the plans with the aid of the municipalities, various research institutes, and a consulting group consisting of local businesses and other actors. Regulations of commercial fisheries are excluded from the Icelandic MSP Act.

Once the coastal zoning plan for an area has been submitted, it is open to the public and any interested parties can make comments, which will be taken into consideration by the Regional Council. The development of MSP in Iceland is still relatively new, but with increasing activities in the oceans, the importance of planning and developing MSP for a sustainable future is becoming apparent.

Read more:

National Planning Agency (Skipulagsstofnun). (n.d.). Maritime spatial planning. Ísland.is. https://island.is/en/o/national-plannig-agency/about-maritime-spatial-planning

National Planning Agency (Skipulagsstofnun). (n.d.). Stefna um skipulag haf og strandsvæða. Ísland.is. https://island.is/v/hafskipulag/stefna-um-skipulag-haf-og-strandsvaeda

Kokorsch, M., & Benediktsson, K. (2018). Prosper or perish? The development of Icelandic fishing villages after the privatisation of fishing rights. MAST: Maritime Studies, 17(1), 69–83. https://doi.org/10.1007/s40152-018-0089-5

Wilke, M. (2023). Public participation in marine spatial planning in Iceland. Frontiers in Marine Science, 10, 1154645. https://doi.org/10.3389/fmars.2023.1154645

NORWAY

The purpose of Norway's integrated management plans is to ensure the sustainable use of marine resources while preserving the ecosystem. Each sector, including shipping, fisheries and energy, is managed separately under specific legislation and ministries. Regional integrated management plans for the Barents Sea, Norwegian Sea and North Sea aim to coordinate across sectors.

MSP in Norway is combined with a marine strategy into integrated marine management plans. At the largest scale, a national marine plan exists: 'The integrated marine management plan. Barents Sea–Lofoten area, the Norwegian Sea and the North Sea and Skagerrak (2020)'. This plan aims to achieve holistic and ecosystem-based management for Norway's marine areas. It provides guidance for the public management of different marine sectors through more detailed, sector-specific management laws and processes.

At a more localised level, Norway has two levels of local government: 15 counties and 357 municipalities, of which around 280 are coastal municipalities. The Planning and Building Act 2008 (PBA) regulates regional and municipal planning. County councils and municipal councils have competence under the PBA to adopt both municipal and county plans landward of the baseline and out to 1 nautical mile.

Read more:

UNESCO's Intergovernmental Oceanographic Commission & Directorate General for Maritime Affairs and Fisheries. (n.d.). Norway: Marine spatial planning status and integrated ocean management (MSP around the world). MSPglobal2030. https://www.mspglobal2030.org/msp-roadmap/msp-around-the-world/europe/norway/

Meld. St. 20 (2019–2020). Norway's integrated ocean management plans — Barents Sea–Lofoten area; the Norwegian Sea; and the North Sea and Skagerrak (Report to the Storting). Ministry of Climate and Environment. https://www.regjeringen.no/en/documents/meld.-st.-20-20192020/id2699370/

SCOTLAND

The UK established an integrated planning system for the UK's marine environment via the Marine and Coastal Access Act 2009. The four administrations in the UK (England, Scotland, Wales and Northern Ireland) developed separate marine planning processes and legislation, with the 2009 Act remaining the overarching legislation. Despite the same base legislation, England and Scotland have taken different approaches to MSP with Scotland choosing to legislate, via the Marine (Scotland) Act 2010, for a national marine plan with eleven subordinate regional marine plans.

In Scotland, the National Marine Plan has been developed by the Scottish Government's Marine Directorate (previously known as Marine Scotland), while regional marine plans are developed by local 'delegates', also referred to as marine planning partnerships (MPP). In Scotland, trials of MSP began with the Sustainable Marine Environment Initiative (SSMEI) which ran from 2006-2010 [14], followed by a pilot in the Pentland Firth which ran from 2012- 2016 [31]. It was intended that the SSMEI pilots would both inform the development of the National Marine Plan, and uniquely to Scotland in the UK context, future regional (sub-national) marine plans.

Scotland adopted its first National Marine Plan in 2015 [32] and opted for a policy framework without the use of hard zoning, although sectoral plans for marine renewables were established which identified priority areas for development. Marine regions were formally defined in 2015 via the Scottish Marine Regions Order [33]. In 2016, the Scottish Government gave direction to the NAFC Marine Centre UHI (now UHI Shetland) and the Shetland Islands Council to form a MPP for the Shetland Marine Region, with a marine plan for the region subject to public consultation in 2019. The development of regional marine plans was intended to provide a pathway for local knowledge and values into MSP in Scotland. In 2022, the Scottish Government initiated the development of an updated National Marine Plan, 'NMP2'.

Read more:

Scottish Government. (2015). Scotland's national marine plan. https://www.gov.scot/publications/scotlands-national-marine-plan/

Shetland Islands Marine Planning Partnership. (n.d.). Shetland Islands Regional Marine Plan. Shetland UHI. https://www.shetland.uhi.ac.uk/research/marine-spatial-planning/shetland-islands-regional-marine-plan/

SWEDEN

The Swedish Environmental Code (1998:808) and the Planning and Building Act (2010:900) constitute the legal basis for MSP in Sweden. The EU MSPD (2014/89/EU) has been incorporated into national legislation through the Marine Spatial Planning Ordinance (2015:400).

In 2002, under this legislation and in line with the EU MSPD, Sweden adopted three marine spatial plans, one for the Gulf of Bothnia, one for the Baltic Sea and one for the Skagerrak/Kattegat. The Swedish Agency for Marine and Water Management is responsible for drafting proposals for the plans including the consultation process and submit these to the Government. The adopted plans are currently under revision, and the Agency is required to submit proposals for the revised plans to the government no later than January 2025.

National marine plans are complemented by comprehensive plans for inland territorial waters developed by municipalities, under the Planning and Building Act (2010:900). In areas of territorial waters where national and municipal plans overlap, both plans apply, while the MSP alone applies in the outermost marine area, and the comprehensive plan alone applies in the coastal area.

The Swedish planning approach requires careful consideration of the interaction between MSPs and comprehensive municipality plans for the connection between sea and land to function effectively. Comprehensive municipality plans are important for indicating local and regional considerations and claims that may be relevant to MSP.

Read more:

Swedish Agency for Marine and Water Management. (2019). Marine spatial plans. https://www.havochvatten.se/en/eu-and-international/marine-spatial-planning/marine-spatial-plans.html

TOWARS UNDERSTANDING INDIGENOUS & LOCAL KNOWLEDGE

Local Knowledge (LK) is diverse. There is therefore not a singular definition that explains what is understood as LK, instead it may vary greatly in meaning between countries and contexts [34,35]. In general terms, LK is often described as the wisdom, skills and understandings that people living in a specific community have developed over time through direct interaction with the environment around them [36]. LK is therefore explained to include spatially specific information about the local context, such as the culture, local demands and needs, politics and functions of the economy.

While the existing literature on LK often defines it in terms of Indigenous communities, it is important to note that LK also encompasses local communities that do not fall under Indigenous legal frameworks. Thus, communities that do not identify as Indigenous or assert certain rights are still recognised as LK holders. In a Nordic context, the term LK therefore includes both Indigenous peoples (e.g., Sami and Inuit communities) and local communities (e.g., local fishermen, local citizens) who possess specific knowledge of the local environment and practices.

To add to the complexity, over the years, LK has been divided into several different subcategories, reflecting the fact that LK is viewed differently across fields of research, countries and communities themselves. Frequently used terms are Indigenous and Local Knowledge (ILK), Traditional Ecological Knowledge (TEK), Local Ecological Knowledge (LEK), Fishers' Knowledge (FK) and Traditional Knowledge (TK) [37].

While they all possess the same characteristic of generational and cultural transmission, variation is seen in terms of what knowledge is transmitted. For instance, fishers' and farmers' knowledge shows a transfer of experience-based knowledge, LEK and TEK focus specifically on local ecosystems and ecological knowledge, and ILK takes a holistic approach, encompassing all practices, beliefs and knowledge. Although existing literature tends to view LK through an Indigenous lens, recommendations by the United Nations (UN) and UNESCO suggest that LK should be referred to as Indigenous and Local Knowledge [37]. This is recommended as ILK acknowledges the heterogeneous nature of LK by including both Indigenous peoples and local communities that share many characteristics but separates the groups according to rights and laws. Hence, the term reinforces that Indigenous peoples are recognised and granted rights according to the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) yet broadens the scope to include local communities that are not recognised as Indigenous [37,38].

Regardless of the diversity of definitions and views of LK, research identifies a central challenge in recognising its value

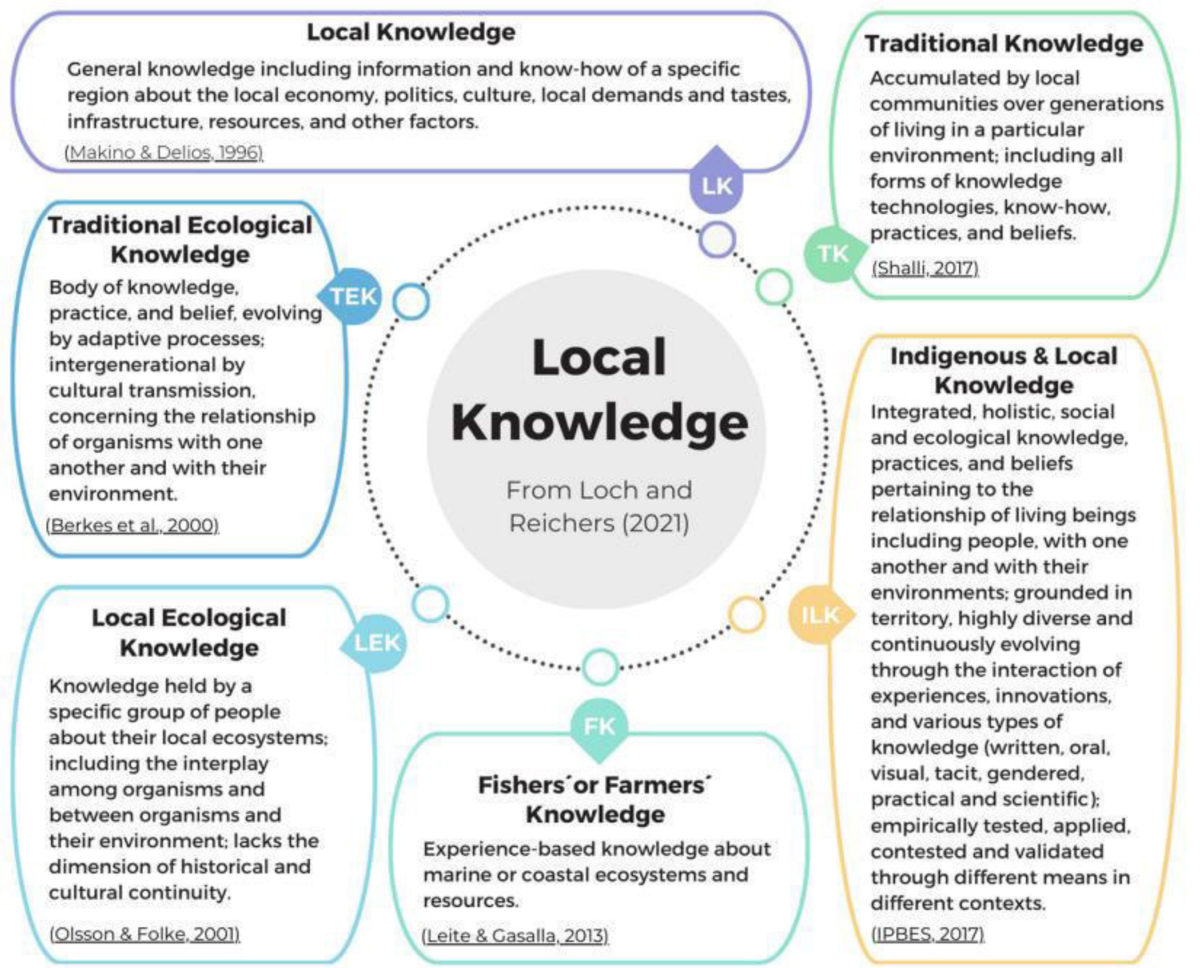

Figure 1Conceptual overview of different knowledge types related to local knowledge (adapted from [65]).

within contexts dominated by scientific approaches and technocratic processes, particularly in ensuring ILK is respected and integrated into global discussions about climate change, conservation and economic development [39]. Despite increasing recognition of its importance in MSP processes, studies show that local communities report their knowledge is often overlooked or undervalued in favour of scientific "expert" opinions [40]. Research suggests this perception of misrepresentation stems partly from uncertainty about what ILK entails and the lack of a shared understanding of local values. Consequently, scholars argue there is a need to develop a deeper understanding of how ILK is viewed and acknowledged across different countries and contexts, while recognising that the heterogeneity and evolving nature of ILK may further aid its incorporation into MSP processes.

In the second session, participants heard examples from across the North Atlantic region of the challenges and opportunities of incorporating ILK into marine management and planning. The session explored how ILK is collected, analysed and incorporated, and what challenges countries in the region have faced with the integration of diverse knowledge into these processes.

The workshop addressed the following questions:

- How do the way we define and view Indigenous and local knowledge across the different countries affect the ability to identify and integrate such knowledge into MSP and management processes?
- What type of Indigenous and local knowledge can be difficult to integrate into MSP and why?
- Do the countries see any particular type of Indigenous and local knowledge or values that is often missing?

MARINE SPATIAL PLANNING AND MARINE MANAGEMENT IN A DIGITAL ERA

A digital transformation is reshaping business, policy and everyday life, with new opportunities presenting themselves through the development of technological tools and innovations [41]. While novel in MSP and marine management, the emergence of tools for decision-making, spatial planning, forecasting and processing data has changed the way current planning processes are approached. Traditional methods, such as mapping with pen and paper, have been replaced or combined with tools like geographical information systems (GIS) for spatial analysis and decision support systems (DSS) for cumulative impact assessments, while Artificial Intelligence (AI) has emerged as the newest addition to the planning toolbox [42,43]. As such, we find ourselves in the middle of a digital transformation and a race for data. Driven by an effort to enhance efficiency, digital transformation is predominantly a term used within the spheres of business, economics and information systems, where it is often defined as:

"transformation concerned with the changes digital technologies can bring about in a company's business model, products or organisational structures" [44, p.124].

Digital transformation is often discussed in business and economic contexts, where it refers to organisational changes driven by technological innovation [44]. However, similar trends towards digitalisation are observable in public sector marine management and planning. As demand for ocean resources increases, governments, institutions and planning agencies have adopted digital tools to enhance efficiency and analyse larger quantities of data. As a result, MSP and marine management processes increasingly rely on these tools and the quality, accessibility and usage of data have become important factors in MSP development [64]. As MSP is rolled out globally, the need for data collection relevant to marine planning and management needs and objectives has become apparent, as has the diversity of data types involved. These data normally include environmental and biological variables, economic activities and social and cultural uses. However, while academics present various approaches to utilising such data, practical examples of implementation remain limited in published literature. This highlights the need to better understand how to integrate diverse data sources and knowledge in marine management and planning [45, 64].

The third session facilitated a discussion on what increasingly digitalised processes mean for MSP and marine management and planning, and how this affects the integration of diverse ILK. Participants heard examples of technologies currently used in the field and discussed future barriers and opportunities for integrating data and ILK in a digital context.

In this workshop we therefore pose the questions:

- What challenges and opportunities do the ongoing fast digital transformation pose for the inclusion of diverse local knowledge and data sources in marine spatial planning and management in the Region?
- What opportunities can digital tools contribute to facilitate the integration of diverse local knowledge sources in marine spatial planning and management?
- What digital tools are mainly used today?
- What developments are seen (both positive and negative) in the field.

CURRENT USES OF DIGITAL TOOLS IN MSP AND MARINE MANAGEMENT

MAPPING

To support this workshop, a comprehensive literature review was undertaken to explore the effects of digital transformation in MSP and marine management, with the aim of identifying current practices and usage of digital tools. The resulting literature demonstrates widespread use of various digital tools in the North Atlantic region and globally. Out of the articles analysed in this research, nearly all employed some form of digital tools, with a large portion focusing on mapping through geographical information systems (GIS). GIS tools were applied to both primary and secondary data, synthesising and analysing diverse datasets to create comprehensive overviews of the intended area [43]. Studies based primarily on pre-existing datasets often layered information on environmental conditions and species distribution [46], tourist densities and human activities [47], infrastructure locations and fisheries routes [35]. These data were used to inform MSP processes, including identifying space for renewable energies and new maritime industries.

The use of secondary data is frequent in recent MSP initiatives, with most relying primarily on pre-existing quantitative datasets, though some supplement these with primary, qualitative data. In an effort to apply ecosystem-based management and include local voices in planning, recent MSP literature advocates using participatory mapping approaches to capture human dimensions and social values [43]. This often involves workshops with Indigenous peoples and local communities to conduct participatory geographic information systems (PGIS) mapping or interviews, where collected data are converted to digital maps [48,49]. These approaches help to capture cultural values of a local place, values that are often communicated in an intangible and holistic manner [49]. Additionally, participatory mapping has been shown to support trust-building, enhance acceptance and enable the co-creation of MSP plans and processes [50].

While participatory mapping can be conducted with pen and paper, PGIS enable more systematic spatial data collection and analysis [51]. Digital tools such as SeaSketch exemplify this technological integration by creating online spaces for collaborative mapping [49]. These participatory approaches democratise spatial planning by enabling Indigenous and local communities to contribute knowledge for understanding the marine environment and create data in otherwise data-scarce areas.

Data portals for mapping

To ensure accessibility of data and facilitate mapping processes, the creation of online data portals to hold data has become increasingly common, and marine planning needs are often pivotal in driving national data collection programmes [54]. Examples of data portals within the North Atlantic region include Scotland, where the national data platform is called 'National Marine Planning Interactive (NMPI)', and Landmælinga Ìslands – the National Land Survey database in Iceland.

DECISION SUPPORT SYSTEMS

Marine management and MSP have increasingly looked to decision support systems (DSS) to negotiate the complex and competing demands placed on marine space. This digitalisation includes data mapping, which provides an opportunity for a range of activities, users and uses to be considered early in the decision-making process, including their consideration in more detailed strategic spatial guidance. DSS are regarded as important intermediaries to assist in management plan development in an objective, efficient and fast manner [52]. Output data become information when they are relevant and utilised by decision-makers [56] and should assist problem-solving and decision-making [57]. While a marine plan itself might be considered a DSS, the use of computerised models has the potential to assist the planning and management process where decision-making is complex. Globally, the development of MSP has led to a proliferation of DSS, with assessments of tools indicating that over 100 are available for the North Sea alone [58]. However, DSS are frequently unsuccessful in terms of uptake in decision-making [59]. The development of DSS and their application in management to inform complex issues can be hindered by a range of factors, even where challenges may be considered quantitative in nature. These include the suitability of DSS to resolve the specific management issue, data requirements (including data sparsity), time and costs for development and maintenance, complexity of the system, uncertainty of the output or the limited involvement of end users in the development phase of the model [60,18,61,62].

Decision support tools have frequently been criticised for failing to consider policy in their development [62]. Learning between marine areas therefore frequently generates knowledge, which is transferable, but not necessarily directly reproducible in other regions. This contributes to the challenge of utilising a DSS developed in one region or area to another.

The use of DSS is evident in marine planning process in the North Atlantic region, including marine renewables and ecosystem-based planning tools. We hope to explore the use of these tools in MSP within the workshop.

ARTIFICIAL INTELLIGENCE

While the use of Artificial Intelligence (AI) in marine management and planning is novel, new AI technologies are slowly being developed. Due to their ability to understand complex functions, collect and analyse various datasets, and identify patterns to support informed decision-making, AI technologies are identified as presenting new opportunities within planning [42]. Novel studies such as those presented by Spalding et al. (2023) [47] allude towards its potential, where machine learning is used to model and map ecosystem values significant to tourism. In this study, user-generated content (UGC), for example reviews on Tripadvisor, are combined with local datasets and participatory mapping data collected through a workshop. The combination of big data and local knowledge then led to the development of use-intensity maps, showing how nature influences tourism in the planning area, spanning from ocean activities to coastal recreational use. This may be one of the few examples of AI technologies being used in planning currently. However, as a significant portion of marine planning relies on data, it can be argued that AI technologies may hold vast opportunities in the future. Thus, while AI technologies are in their infancy, a discussion about how AI and new technologies may affect the planning field is needed.

DIGITISATION CHALLENGES

A digital transformation poses many challenges for ILK. For example, where rigid regulatory processes exist and the methods developed to digitise, map and use data have to align with norms of legal and regulatory systems, stakeholders can find they often have minimal agency over how data is used. In this way, MSP might be classified as “planner centred”, with participation that is focused on outcomes in contrast to “people-centred” participation, which builds capacity and empowers stakeholders to define and meet their own need [63]. If collection and representation of knowledge and data do not comply with existing norms including data collection or representation methods, there is the risk that data gathered may not be included within decision-making processes [22].

So, whilst MSP and digitalisation has a clear potential to bring a greater range of uses and values to the fore, there is a risk of amplifying real or perceived injustices, where closely held values are difficult or impossible to represent in static maps, processes fail to adequately engage all parties during mapping and policy development; or processes fail to consider existing power imbalances [53]. This could be particularly problematic if these data and policies are used to develop decision support tools.

To avoid exacerbating this risk of creating injustices, transparency throughout the planning process is essential. Evidently, as the data and tools used will influence the outcome of the planning process, clarity on what data has been used and how it was collected will determine the acceptability of plans. Who was involved in the planning process will also have greater significance as the divide between who has the access, skills and resources required to partake in the process may grow.

WORKSHOP SUMMARY

What role does ILK have in marine management and planning in times of digital transformation and climate change? How can we learn from each other and foster cross-country collaboration within the North Atlantic region to address the challenges and opportunities ahead? This was the focus of the workshop “Integrating Local Knowledge and Data in Marine Spatial Planning and Management – Challenges and Opportunities in the North Atlantic Region”, held in Victoria Quays, Edinburgh. By bringing together a diverse group of participants from across the North Atlantic, the two-day workshop aimed to explore how rapid digital transformation affects marine management and planning processes and how the increasing use of digital tools influences the integration of ILK and data. Divided into three sessions, the workshop included examples from Scotland, Sweden, Iceland, Norway, Denmark, Greenland and the Faroe Islands, illustrating different approaches to integrating diverse information into marine management and MSP.

The first session discussed the status quo of marine management and planning in the North Atlantic region, highlighting current challenges the countries have faced in integrating various information, and the influence of policy objectives and institutional barriers. A key focus was the influence of governance scale on planning effectiveness, particularly how different levels shape the balance between national and local priorities. Differences in scale were also seen to affect the availability of time and resources, directly influencing the extent to which stakeholders and communities can be meaningfully engaged in management and planning processes. As a result, ILK integration was seen as limited, often reduced to public participation where communities act as consultants rather than partners. The reasons identified for this were several, including short planning timeframes and consultation schedules, and the need for more detailed guidelines to support the identification and involvement of Indigenous and local communities and stakeholders. These challenges highlight that, while ILK was seen as crucial for creating sustainable, inclusive and equitable planning, uncertainty remains on how to properly integrate it into marine management and planning processes.

In response to the identified institutional barriers, the remaining discussions focused on how a rapid digital transformation and increasing reliance on digital tools can facilitate or hinder the integration of ILK in marine management and planning processes. The conversations highlighted emerging opportunities, such as the use of geospatial technologies, data-sharing platforms and AI to enhance processes. The growing use of digital tools in marine management and planning was identified as a way to speed up workflows and incorporate a broader range of data types. Digital tools could further support planners, stakeholders, and Indigenous and local communities in multiple tasks, for instance, translation between different languages and industry jargon, stakeholder engagement, streamlining of routine tasks, creating adaptive planning processes and developing feedback loops.

At the same time, while technological solutions offer opportunities for marine management and planning processes, an over-reliance on digital tools and data-driven approaches may lead to sub-optimal outcomes that could be unjust to certain communities and sectors. This was particularly emphasised in the case of communities that have historically been overlooked or have experienced injustices in management and planning processes, often in favour of Western scientific approaches. With this in mind, questions arose about whom current management and planning processes are for and whether ILK should and could be converted into digital formats to fit digitalised processes, or if this risks exacerbating power imbalances and disparities. As current practices of integrating ILK were explained to mainly utilise mapping tools to “translate” knowledge into digital formats, ambiguity remained as to whether digitalising it will affect its use, for example through loss of context, detail and value. This becomes critical as ILK is understood as an intrinsic part of communities’ identities, reflecting their values, social structures, practices and beliefs. Hence, although digitalising ILK was seen as important for documentation, preservation purposes and ensuring that local perspectives are accounted for, digitalising it was seen to be a question of justice and equity.

In light of this, accelerating digital transformation in marine management and planning highlights the need to address data ownership, quality, accessibility and harmonisation. This becomes increasingly important as AI evolves, necessitating stronger control mechanisms to ensure responsible and ethical use. Within these discussions, AI presented both risks and opportunities. In one respect, AI was seen as an augmenter with the ability to expand the gap between data-driven scientific processes and ILK. Effectively using digital tools and AI therefore requires an awareness of their functions and strengthening of technical skills. Alternatively, digital tools and AI solutions could be designed to fit their intended users, requiring lower technical skills. Additionally, ensuring responsible and transparent use of digital tools and AI necessitates a controlled environment, strategies for ensuring data quality and fostering harmonisation across datasets and systems. Grounding planning in the local environment was also seen as essential, where processes prioritise local needs, conditions and existing data, and develop planning that suits these conditions. Building on this foundation, digital tools and AI can help overcome barriers, reduce time and resource constraints and accelerate planning by integrating diverse data sources and enabling dynamic, feedback-driven processes and locally grounded processes. However, whether these technologies support more inclusive and holistic marine management depends on prioritising justice and equity throughout their design, implementation and use, ensuring Indigenous and local communities retain agency over their knowledge and participation in planning and management processes.

WORKSHOP TEAM

Matthias Kokorsch - *I am the academic director of the master's program Coastal Communities and Regional Development. My research interests include community resilience, regional development, particularly in sparsely populated regions, structural changes of old-industrial areas, and resource management in combination with aspects of justice and decision-making processes. In this project I am particularly interested in the aspect of knowledge integration and whether AI is a curse or a blessing in this regard.*

Rebecca Eriksson - *I am a research assistant and a master's student at the University Center of the Westfjords, pursuing an interdisciplinary program in Coastal Communities and Regional Development. Currently, I am writing my master´s thesis aiming to explore how diverse knowledge systems are influenced by the development of digital tools and artificial intelligence, and how these technologies can be utilised to support the inclusion of local voices in marine planning processes. I am therefore particularly interested in human-technology interactions, justice, equity, and the challenges and opportunities faced by coastal communities and marine life. I am very excited to meet you all!*

Rachel Shucksmith – *I am researcher at the University of Highlands and Islands Shetland. I also lead the delivery on Shetland Islands Regional Marine Plan in partnership with the local authority. My research seeks to address marine management and governance challenges through applied interdisciplinary projects, addressing real world challenges. Through place-based research I seek to explore how management and governance processes can be adapted to facilitate decision-making which is inclusive of different values and knowledge types, to achieve sustainable outcomes.*

Tabea Jacob - *As a research assistant and master's student at the University Centre of the Westfjords in Ísafjörður, Iceland, I am enrolled in the interdisciplinary program focused on Coastal and Marine Management. My research pursuits encompass fisheries management, ocean governance, the Blue Economy, and the critical aspects of social justice and equity for local communities. Through my Master's Thesis, I aim to explore social justice challenges faced by small-scale fishing communities in Greenland, specifically on integrating local knowledge and the cooperation between politics and communities in decision-making processes.*

Myriam Chilvers – *I am a research fellow at Nordregio, a Nordic research institute established by the Nordic Council of Ministers. I am a political scientist specialised in local democratic governance and citizen participation. My interests lie in developing timely research and tools that support civil servants and politicians to practically understand and address complex problems democratically. Currently, I work with Kerstin on several projects related to marine and maritime spatial planning in the Nordic region and Europe.*

Kerstin Bly Joyce – *I am a research advisor at Nordregio, a Nordic research institute established by the Nordic Council of*

Ministers. Currently, I work on several projects related to marine and maritime spatial planning in the Nordic region and Europe. My background is in environmental economics and policy design, focusing on water and marine management. I am particularly interested in integrating diverse values into evidence-based policy and understanding actors' interests to contribute to designing sustainable, fair, and inclusive policy processes. In this project, I am particularly interested in the challenges and opportunities of integrating diverse knowledge and values in relation to stakeholder involvement on equal terms within countries' marine and maritime spatial planning.

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