



Stakeholder Perceptions in Offshore Wind Development and Multi-Use in Rhode Island (United States)



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Summary

Offshore wind farms (OWF) are located in countries with densely populated coasts with numerous marine environment users, creating difficulties in organizing marine space. Fishing activities are among the most affected by offshore wind development (OWD). This situation is leading to problems and conflicts between stakeholders. In addition, spatial limitations such as exclusion zones are expected to be placed on numerous ongoing activities with increasing claims of competing uses.

The development of OWF involves multiple actors who are commonly organized in networks rather than a hierarchy, so cooperation between stakeholders is needed to find a better location for OWF and to minimize conflict among actors. Multi-use activities in OWD are a challenge and an opportunity to coordinate and agree among different actors in the future of offshore wind (OW).

Multi-use (MU) policies have yet to be developed enough, and they are in their first stages on the East Coast of the USA. Therefore, this thesis will analyze the perspectives, primary interests, and interdependences of the key stakeholders involved in OWD and how multi-use can be an integral part of the early stages of the permitting process to develop OW.

The thesis explores the integration of MU activities in OWD in RI, USA, and the benefits it can bring. The report uses actor models and comparative cognitive mapping (CCM) as a model to analyze stakeholder perspectives and identify potential conflicts and synergies in OWD.

Several strategies are suggested for addressing conflicts in OWD, including promoting collaboration and guidance that aligns with the goals of state agencies and other stakeholders, streamlining policies that support processes such as interconnection, grid integration of OWD, and permitting and policies. Moreover, it is essential to continue with assessments and research, engage the public and other stakeholders, and educate the general public about the benefits and risks associated with offshore wind energy (OWE) and the potential activities of MU.

Overall, the thesis emphasizes the importance of stakeholder collaboration and an integrated approach to governance and power distribution in addressing conflicts and promoting sustainable OWD in Rhode Island and the United States. These actions enable the sustainability and responsibility of this new industry operating in federal waters, enhancing coastal economies, minimizing conflicts, and maintaining ocean ecosystem services.

The findings of this thesis can aid in decision-making for issues in OWD and provide suggestions for developing new policies that can be integrated into the implementation of Marine Spatial Planning (MSP) for MU sites, allowing various users to utilize marine space sustainably.

Keywords

Actor models, cognitive mapping, stakeholders, actors, multi-use, offshore wind development, Marine Spatial Planning, offshore wind energy, marine governance, perceptions.

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List of Abbreviations and Acronyms

Acronym	Meaning
AMI	Area of Mutual Interest
BI	Block Island
BOEM	Bureau of Ocean Energy Management
CCM	Comparative Cognitive Mapping
CMA	Coastal Management Act
COP	Community of Practice
COP	Consturction Operation Plan
COPNS	Community of Practice North Sea (
CRMC	Coastal Resources Management Council
DEM	Department Environmental Management
FAB	Fishery Advisory Board
FABRI	Fisheries Advisory Board Rhode Island
MSP	Marine Spatial Planning
MPAs	Marine Protected Areas
MRE	Marine Renewable Energy
MU	Multi-Use framework
MUPS	Multi-use platforms at sea
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
ORE	Offshore renewable energy
OW	Offshore wind
OWE	Offshore wind energy
OWI	Offshore wind industry
OWF	Offshore wind farms
OWD	Offshore wind development
RI	Rhode Island
ROSA	Responsible Offshore Science Alliance
Ocean SAMP	Ocean Special Area Management Plan

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Introduction

Chapter Summary

Offshore wind farms (OWF) have gained global attention, particularly in the UK, Europe, and China. Europe has set ambitious renewable energy goals, and offshore wind energy significantly contributes to achieving these targets. However, the expansion of OWF raises concerns about conflicts with other ocean users, such as commercial and recreational fisheries. The interaction between OWF and other activities increases the need for spatial planning and managing multiple ocean uses. To address these challenges, Marine Spatial Planning (MSP) is a useful tool for managing competing uses and minimizing conflicts. However, it can be challenging to implement due to the urgency of the energy transition.

This research explores stakeholders' perspectives, interests, and interdependencies in offshore wind development (OWD) in Rhode Island, USA, and how the multi-use concept can be integrated into the industry. Understanding the different actor perceptions and interdependencies can help in the integration of marine governance and the utilization of tools like MSP. Conflicts between OWD and other ocean users, such as the fishing industry, are a global concern, and understanding stakeholder perspectives can contribute to finding adequate solutions that ensure the sustainable coexistence of different activities in the marine environment. Additionally, industrial ecology plays a role in understanding how the environmental impacts of industrial processes and ocean use can be improved for sustainability and circularity in the expanding blue economy.

1. Introduction

Offshore wind farms (OWF) have gained increasing attention globally, with the UK, Europe, and China leading offshore wind energy (T. Smythe et al., 2021). The European Commission published the EU strategy on offshore renewable energy (European Commission, 2020) and has set a target of 60 GW of offshore wind capacity by 2030. As of March 2023, 126 offshore wind farms in 13 European countries have a total capacity of 30,266 MW (GWEC, 2022).

The uncertainties about energy security and global climate change (Alexander et al., 2013) have driven the international ambition towards generating renewable energy in our oceans. As a result, OWF deployments are becoming more common in marine environments, requiring large oceanic areas to operate with exclusive access (Schupp et al., 2021). This exclusivity often excludes other users, such as commercial and recreational fishers, leading to challenges in allocating space for nature conservation and reduce operating space for fishing (van Hoof et al., 2020). The interaction between OWF and other users increases concerns about establishing marine spatial planning and impacts on human activities, but mainly commercial fisheries (Berkenhagen et al., 2010).

The United States is starting offshore wind development (OWD) in federal waters, with the East Coast leading the way. Rhode Island (RI) installed the first pilot OWF in the country in state waters of Block Island (BI), which facilitated the current developments in federal waters of Massachusetts, Rhode Island, and New York. However, offshore wind projects in the United States have faced opposition, mainly from commercial fishermen and coastal landowners (Christopher T. R. et al., 2022). Some commercial fishermen are worried about how their businesses will be affected economically, while others are concerned about the negative impact on fisheries and the environment. Landowners in coastal communities have raised concerns about visual effects and property prices. There are also other stakeholders who worry about navigation, effects on tourism, military operations, and the endangerment of species such as the North Atlantic right whale and its critical habitat. (Christopher T. R. et al., 2022). Nevertheless, renewable energy goals and offshore wind targets dictate the rush toward OWD in the United States. Eight East Coast states have targets higher than 37 GW, which will require coordinated planning and collaboration with stakeholders to address issues prior to OWD happens (Christopher T. R. et al., 2022).

Marine Spatial Planning (MSP) is a public process that involves analyzing and allocating the spatial and temporal distribution of human activities in marine areas (UNESCO, 2022) to achieve ecological, economic, and social objectives established through a political process. MSP can be a useful tool for OWD, as it recognizes several dimensions to address sectoral approaches and manage multiple uses offshore while balancing competing uses and minimizing conflicts. However, using MSP to plan OWD can be challenging when multiple users compete for ocean space. Moreover, the urgency of the energy transition often takes priority over MSP practices. Therefore, coordination and cooperation between various stakeholders are essential to balance the energy transition and other ocean uses (Spijkerboer, 2021).

Kyriazi et al., (2016) discuss marine spatial planning (MSP) in the context of coexistence dilemmas between marine renewable energy (MRE) and marine protected areas (MPAs). They explain that MSP is a process that aims to balance the different uses of the marine environment, including MRE and MPAs, and to minimize conflicts between them. The authors note that MSP involves the identification of areas that are suitable for different types of uses, based on ecological, social, and economic criteria, and the development of management plans that take into account the needs and interests of different stakeholders.

1.1 The problem statement

The fisheries sector has been under international pressure since OWD projects worldwide excluded fisheries activities, resulting in negative direct and indirect impacts on the fishing industry and coastal communities (Schupp, Kafas, et al., 2021). Furthermore, new marine activities in the same area, such as aquaculture, mariculture, recreational fisheries, and tourism, seek opportunities to operate in areas where OWF are already in operation.

MSP, involves a public process that examines and assigns human activities in marine areas, provides mechanisms for different users to access marine space sustainably (UNESCO-IOC/European Commission, 2021) and promotes the development of a sustainable Blue Economy by identifying sites for new and emerging uses (UNESCO-IOC/European Commission, 2021).

Hooper et al. (2015) state that MSP is recognized internationally as a means to promote sustainable co-existence of users to reduce conflicts and maximize opportunities. The EU Directive establishing a Framework for Marine Spatial Planning (2014/89/EU) and the US Government National Ocean Policy Implementation Plan are as examples of MSP policy frameworks. .

Despite its potential benefits, MSP often fails to create multi-use (MU) opportunities (Steins et al., 2021). According to Jones et al., 2016, MSP practice is more top-down and ad-hoc, resulting in incomplete stakeholder participation often leading to indifference, discontent, and frustration among stakeholders. Pennino et al. (2021) identify several challenges in implementing MSP. One of the main challenges is the lack of representativity in marine spatial data, which makes it difficult to incorporate sociocultural dimensions into MSP. Another challenge identified by Pennino et al. (2021) is the lack of balance among economic, social, political, and ecological objectives, leading to conflicts and trade-offs between different goals. Therefore, exploring opportunities that could support MU activities, such as fisheries or aquaculture, with the coexistence of OWD is key.

1.2 Research Questions and Hypothesis

Planning for the long-term deployment of OWD requires finding adequate solutions for all users involved (UNESCO-IOC, 2021). Commercial fisheries, aquaculture, and other users should be involved in the decision-making process to establish cooperation among users and OWD. Cooperation potentially increases social acceptance and supports the coexistence of other

activities and MU possibilities. The coexistence of activities can motivate the public and stakeholders to approve and accept OWD (UNESCO-IOC, 2021).

Offshore wind (OW) in Rhode Island is experiencing a gold rush moment due to a recent auction of federal leases driven by the US federal government. Therefore, ambitious environmental goals to reduce the impacts of climate change and fossil fuels pose challenges and opportunities for stakeholders involved in developing and ensuring the offshore wind industry's (OWI) success in the USA.

In Europe, OWE is accelerating, though with challenges, as neighboring countries of the North Sea- Netherlands, Denmark, Germany, and Belgium- conceive their new developments in OW in a symbiotic or synergetic design. They aim to use the North Sea sustainably and efficiently by combining different ocean uses in the same location, proving the concept of ocean multi-use. This represents a change from the exclusive resource rights concept to the inclusive sharing of resources by one or more users.

The Multi-use framework (MU) was introduced by the MUSES project (Schultz-Zehden & Lukic, 2018) to promote the sustainable exploitation of ocean resources and shared ocean space. MU is the combination of various industries and technologies in the ocean. The H2020 United website (United, n.d) defined MU as an intentional joint use of resources in close geographical proximity. Schupp et al., 2019, refer to combining multiple marine activities in the same area by single or multiple users. Therefore, in the European setting and specifically in the North Sea, shifting from the traditional sector-by-sector approach to ocean access to a holistic or integrated approach is needed to minimize conflicts and maximize synergies between marine uses.

Ocean users in federal waters of Rhode Island and Massachusetts face the development of a new industry that presents challenges and opportunities. Figure 1 shows the current active leases that belong to energy companies; some are in the phase of approval, and others are already in construction.

While reducing greenhouse emissions and implementing renewable energy are common interests among stakeholders, their perceptions seem to differ (Christopher et al., n.d.). Understanding the different actor's perceptions can facilitate agreements on different actions. For instance, MU is viewed by numerous actors in the North Sea as a way of minimizing conflicts and maximizing synergies (Stuiver et al., 2016), while for others.... Modeling actor perceptions could be critical and valuable in early stages of OWD in Rhode Island or other US east coast states. Moreover, introducing policies and guidelines that can minimize conflicts and maximize synergies can be positive in cases where OWD is projected to happen.

The Comparative Cognitive Mapping (CCM) model is useful for mapping out how different actors perceive and understand a policy problem. It helps to explain how actors view factors such as goals, instruments, and actions, and how they see causality in relation to the problem. CCM can be used for groups ranging from 3 to 15 actors, and allows for a deeper understanding of why some actors support or oppose certain ideas (Hermans and Cunningham, 2018).

This research is based on the idea that individual actors in OWD in Rhode Island hold their own beliefs about the opportunities and challenges presented by this new industry for the state. It also explores the actions taken by individuals to make OWD possible and the positive and negative impacts that may affect their objectives. OWD is a relatively new industry in the US East Coast and has sparked controversy and debate in Rhode Island. This research employs the conceptual framework of CCM as an actor model to clarify different positions, identify societal coalitions and their views, and uncover potential obstacles to cooperation among willing partners.

CCM may assist OWD during the initial stages and enhance the utilization of tools like MSP in federal waters. This could help prevent interdependencies and conflicts, as observed by Spijkerboer et al. (2020). Moreover, this study aims to comprehend the varying viewpoints of stakeholders regarding the potential of implementing diverse Multi-use experiences.

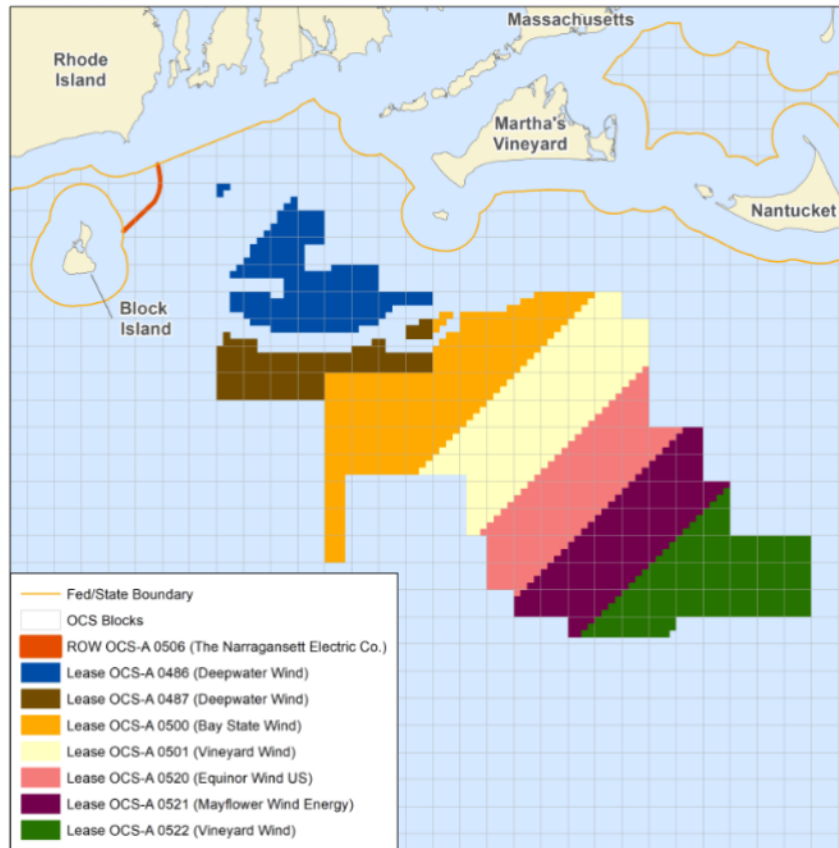


Figure 1: BOEM, Commercial Leases for offshore wind farms (Rhode Island and Massachusetts).

Therefore in this scenario, this research has the following overarching question:

To what extent do stakeholders' perspectives, interests, and interdependencies impact or modify processes in offshore wind and the implementation of policies that guide how offshore wind development is carried out in Rhode Island? What role can the framework of Multi-Use play in this industry?

To give an answer to the main question, previously these questions will be answered:

1. How do stakeholder perspectives connect to their actions and objectives to OWD in Rhode Island?
2. What are the stakeholders' primary interests in OWD in Rhode Island?
3. What are the interdependencies between stakeholders in OWD in Rhode Island?
4. What role can a Multi-Use framework play in OWD in Rhode Island?

1.3 The societal relevance of the research

In the overexploited marine environment, new socio-economic pressures and technological advancements are increasing the demand for marine space, resulting in additional burdens in the marine environment ecosystem (Kyriazi et al., 2016). The expansion of OWD is increasing worldwide and many of these projects are located in or near areas that are designated as Marine Protected Areas (MPAs) or that have high biodiversity value. This situation raises concerns about conflicts with other ocean users. Despite the exclusive access in some cases granted for OWD, pressure for other traditional marine uses, such as the fishing sector, persists. Unfortunately, commercial fishers are often left behind in the discussions and decision-making processes of where and how to implement OWD (Schupp et al., 2021). This is due to a variety of reasons, including the fact that the offshore wind sector is driven by legal requirements, cost savings, and positive reputation, while the fishing sector is driven by avoiding interferences and minimizing threat to livelihoods (Schupp et al., 2021). This situation is leading to differences and conflicts between stakeholders. In addition, spatial limitations such as exclusion zones are expected to occur in many ongoing activities with increasing petitions from competing uses of ocean space (Alexander et al., 2013). As a result, the fishing industry is affected, and fishing access has already been reduced due to extensive regulations.

Examples of conflicts associated with OWD are happening globally. For instance, South Korea has gradually increased its investment in developing technology from renewable sources, with plans for significant construction of OWF. However, most projects are on hold because local fishing cooperatives and residents oppose them (Kim et al., 2016). In Taiwan, the development areas of wind turbines encompass most of the traditional fishing grounds, requiring the developers to negotiate with local fishers to obtain an agreement (Zhang et al., 2017). In Nantucket Sound, Massachusetts (US), the fishers' organization fought the Cape Wind project and never reached the concept phase (de la Garza, 2021). Lastly, in the UK fishing newspapers, you can read titles such as: "*Wind farms threaten boats*" (Alexander et al., 2013). These situations repeat worldwide, where OWD is planned.

1.4 Relevance for Industrial Ecology

Li et al. (2022) have suggested that expanding offshore wind energy (OWE) can effectively reduce greenhouse gas emissions related to energy. This is due to the fact that OWE does not produce emissions during operations and has the potential to replace fossil fuel-based energy sources, thereby increasing its share in the energy mix. However, the rapid growth of OWE in oceans as a new human activity has raised concerns about its impact on marine ecosystems, which remains unclear despite its noble purpose.

Understanding the environmental impacts of human activities on oceans is crucial, as highlighted by Vázquez-Rowe et al. (2022) Human interaction with oceans has resulted in ecological disasters such as oil spills, overfishing, and plastic pollution. The State of the Ocean report by IOC-UNESCO (2022) highlights the major challenges and discoveries that marine

ecosystems are facing, ranging from coastal to deep-sea environments. The report also reveals how human activities such as marine pollution, fishing, habitat destruction, invasive alien species, underwater noise, and other stressors are endangering the oceans.

When developing offshore wind farms and other ocean-based economic activities, it's important to view them as part of an ocean-industrial ecosystem and consider their impact on the surrounding environment. OWD require significant surface areas to accommodate their operations at sea. The North Sea, for example, is known for its dense coastal populations, extensive industrialization, and intensive use of the sea (Schupp et al., 2021)

In order to face the challenges faced by ocean ecosystems, it is crucial the adoption of sustainable practices that support ocean activities while preserving the health and resilience of marine life and ecosystems. The Blue Economy concept provides a solution that aligns with the European Green Deal, promoting a sustainable economic model based on innovation, circularity, and respect for the ocean (European Commission (2022), n.d.) . This approach requires businesses that rely on marine ecosystems to reduce pollution and increase resilience to climate change. Therefore, industrial ecology can play a vital role in improving the knowledge about environmental impacts of industrial activities in the ocean space, ensuring sustainability and circularity.

1.5 Thesis structure

This thesis consists of four chapters. The first chapter is an introduction to the topic and its importance in the industrial ecology field. It also presents the research questions. The second chapter explores the policies promoting coordinated and shared ocean space in Rhode Island. It discusses the origin of the OWD revolution and reviews literature on MU and its implementation in various European projects. In chapter three, the use of actor strategic models is justified, specifically the comparative cognitive mapping (CCM) framework that is used to organize stakeholders and their perspectives on OWD in Rhode Island. The chapter explains how the framework is applied and its limitations in this case. The sixth chapter presents and discusses the research results, providing answers to the research questions. Finally, the chapter concludes with recommendations and conclusions.

2

The context: Rhode Island Federal Waters

Chapter Summary

The United States has set a target to deploy 30 gigawatts (GW) of offshore wind energy by 2030 as part of its efforts to increase the use of renewable energy and reduce greenhouse gas emissions.

The Bureau of Ocean Energy Management (BOEM) was established to oversee the development of renewable energy projects on the outer continental shelves under US jurisdiction. BOEM created a leasing and permitting process for renewable energy projects, including offshore wind farms. Developers interested in leasing areas for offshore wind projects go through an auction process and, if successful, conduct surveys and submit plans to BOEM for review and approval. Following the success of the Block Island offshore wind farm, other offshore wind farms are being projected in the waters between Massachusetts and Rhode Island, with the permitting process currently underway. The US is making significant efforts to expand its offshore wind energy capacity, with Rhode Island pioneering OWD. The involvement of stakeholders, coordination between states, and the establishment of clear policies and processes are key elements in the successful implementation of these offshore wind projects.

2. The context: Rhode Island Federal Waters

The United States aims to increase the use of renewable energy and reduce greenhouse emissions through offshore wind energy. The current administration has set a target to deploy 30 gigawatts (GW) of offshore wind energy by 2030 (The White House, 2023). Furthermore, OWE is expected to create new jobs and support economic growth facilitating the energy transition. The East Coast and New England states have individual targets for their states to add OWE. OWE in the United States is a new industrial activity that will focus on federal waters. Moreover, RI has ocean and coast pristine areas dedicated to tourism, sailing, and commercial and recreational fisheries.

RI was the first state in the United States that commissioned an offshore wind farm in Block Island (BI). To achieve this, RI designed a Ocean Special Area Management Plan (Ocean SAMP) which is a MSP-based process to support the deployment of offshore energy in RI state waters and specifically contribute to deploying the first OWE in BI. The benefit of the Ocean SAMP process was demonstrated contributing to successfully locating the first pilot OWE in state waters (Smythe & McCann, 2019). The Ocean SAMP process was facilitated by the Coastal Resources Management Council (CRMC), a state-based agency in charge of coastal and state waters in RI (Haggett C. et al., 2020).

2.1 Marine Spatial Planning in Rhode Island

Between 2008 and 2010, Rhode Island created the Ocean SAMP that covered 3800 square kilometers of state waters, federal waters, and an additional 27 miles (50 Km) offshore. The primary goals of the Ocean SAMP were to achieve marine conservation, sustainable economic development, and streamline decision-making for offshore wind. The plan was approved in 2011 under the direction of CRMC. Following its approval in 2011, the plan went into the implementation phase from 2011 to 2015. The CRMC, the state's coastal management agency, directed the Ocean SAMP while utilizing the authority provided under the Coastal Management Act of 1972, 1972 (see Figure 2).

The planning process involved a two-year stakeholder process that resulted in policies and tools for state and federal waters, including the creation of a 34 square kilometer Renewable Energy Zone in state waters for offshore wind energy. These 34 square kilometer laid the groundwork for the siting and permitting of the nation's first offshore wind farm in Block Island state waters. This area was identified through Ocean SAMP's stakeholder process and through the many scientific studies conducted. The Ocean SAMP also includes tools and agreements for implementation, such as "Area of Mutual Interest (AMI)" that allow for interstate coordination of offshore wind energy for the region, specifically between Rhode Island and Massachusetts. The agreement resulted in several actions, including granting official Ocean SAMP stakeholder status

to the Massachusetts Office of Energy and Environmental Affairs, requiring Massachusetts fishermen to join Rhode Island fishermen in the Fishermen’s Advisory Board (FAB) regarding AMI waters and designating Ocean SAMP as the governing planning document for the AMI. These actions were taken to ensure coordination between the two states pursuing wind energy development in the AMI and to influence the selection of priority wind energy leasing areas by the Bureau of Ocean Energy Management (Schumann et al. 2016). The Ocean SAMP also creates two new stakeholder councils a Fishermen’s Advisory Board (FAB) and the Habitat Advisory Board (HAB) which were constituted in state law as advisory to the CRMC (Schumann et al., 2016).

The Ocean SAMP in Rhode Island, provides a comprehensive framework for evaluating potential impacts of proposed activities on the environment, economy and society and for making informed decisions about whether to issue leases and permits for OWD or other type of marine development. The approach is intended to reduce inconsistencies and conflicts (Olsen et al., 2014).

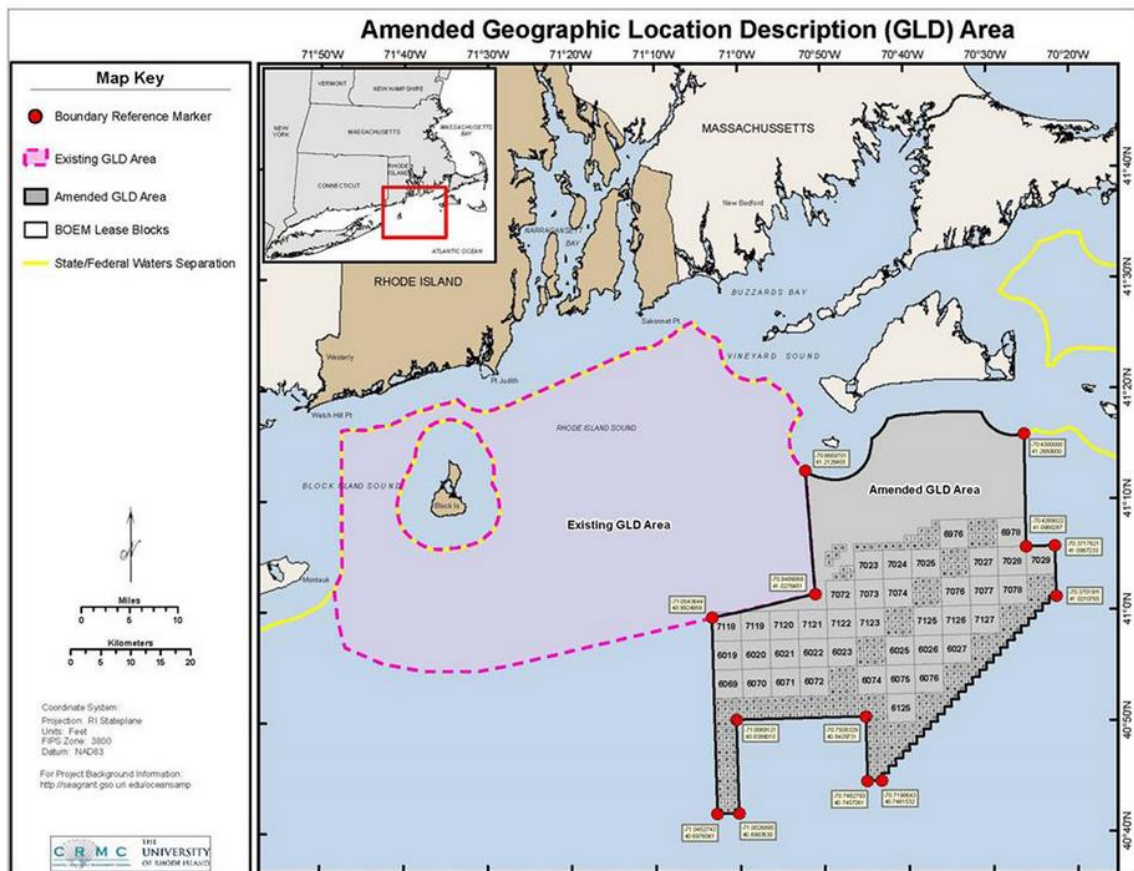


Figure 2: CRMC, Ocean Samp Area Jurisdiction.

Reference figure: OffshoreWIND.biz

The same year the Ocean SAMP was adopted, the Bureau of Ocean Energy Management (BOEM), was established to oversee development of oil and gas, renewable energy and other mineral and energy resources on the outer continental shelves under US jurisdiction. BOEM created a leasing and permitting process for renewable energy projects requiring environmental impact assessments in a sequence of steps and a 25-year term for operational plans that includes decommissioning (Olsen et al., 2014).

The process starts publishing leasing notices for potential interest to developers. A developer that wins a lease through an auction process will conduct surveys in their leasehold and prepare a plan to submit to BOEM for review and approval. If within five years, the developer decides to proceed to commercial development, they must submit a Construction Operation Plan (COP) to BOEM for review and approval. BOEM then prepare a detailed Environmental Impact Assessment for offshore wind projects as part of National Environmental Policy Act (NEPA) analysis of potential impacts for construction, operation, and decommissioning of a commercial offshore wind facility and, if there is no significant impact, BOEM will approve the operational plan for 25 years term to the developer. After 25 years decommissioning is required or the lease may be renewed (Olsen et al., 2014) . In Figure 3 the BOEM’s competitive process authorization for offshore wind or in general other renewable energy is shown (BOEM,2022).



Figure 3: BOEM’s renewable energy competitive authorization over four phases.

2.2 Multi-use experiences

Offshore renewable energy has the potential to be the greatest ocean-based solution to mitigate carbon emissions in the United States. The current Administration set an ambitious goal of deploying 30 gigawatts of offshore wind by 2030 (The White House, 2021).

Investments can spur innovation, drive economic growth and ensure U.S. energy security. But the planning, development, and rapid deployment for commercial offshore energy must occur in a responsible way that embraces community and heard all the concerns of stakeholders.

To tackle the obstacles faced by OWD in the United States, MSP can be used. As recommended by Ryan et al., (2019), MSP can assist in managing data in the regulatory process, decreasing uncertainty, and reducing conflicts with other oceanic space uses such as fishing and recreation. Additionally, combining wind farms with nature conservation and aquaculture can be an effective solution in a competitive sea space environment. However, Steins et al. (2021) highlights that MSP has limitations in organizing multiple uses (MU) in practice due to dealing with "wicked" problems. These problems involve high stakes, different underlying values, and no definitive solutions or answers, necessitating trade-offs.

MU refers to the sharing of resources in close proximity by either a single user or multiple users, as defined by Schupp et al., (2019). In Europe, MU has become a prominent topic in recent years and is expected to play a significant role in developing new OWFs (Schupp, et al., 2021)

Different experiences support MU frameworks in OWF. An example of effective collaboration is seen in The Netherlands where the government established a "Community of Practice (COP) in the North Sea" to manage the balance between offshore wind farms, nature, and seafood production (Steins et al., 2021). Essentially, COP refers to a group of individuals with a shared interest or expertise, who work together through joint activities, discussions, and knowledge sharing. According to Steins et al. (2021), COPs are informal and self-organizing communities built on trust and collaboration, providing a space for members to learn through both formal and informal activities. In the Dutch North Sea context, COPs are tackling the challenges of multi-use scenarios, sharing experiences, and working towards developing solutions. The Community of Practice North Sea (COPNS) is an example of how a COP can address the challenges of MU scenarios in the Dutch North Sea. The COPNS aims to foster the development of new knowledge, practices, and relationships, as well as the creation of shared resources and recommendations for policy and regulation (Steins et al., 2021)

There are similar initiatives to COPs in The Netherlands, such as North Sea Farmers, which focus on practical knowledge exchange and collaboration within seaweed value chains. They are also piloting projects to demonstrate the technical feasibility of seaweed farming between offshore wind turbines. Another initiative, Road2SID, explores the potential for technological progress in achieving better integration and symbiosis between offshore wind farms and other industries, such as floating solar energy, nature-inclusive design, and aquaculture. The findings of

this project will support the development of a roadmap towards symbiosis, including in the design of offshore wind farms.

The MUSES project (2018) conducted extensive research and analysis to identify the potential benefits and challenges of MU activities in Europe's maritime zones. The project developed an action plan highlighting the potential for sustainable blue growth by maximizing the use of maritime resources while also addressing potential environmental impacts.

The European Union (EU) has offered funding through the Horizon Program 2020 and the Interreg program to various regions in Europe, allowing for the testing of various ocean-use combinations in close proximity. Numerous sustainable and efficient ocean space utilization concepts have been proposed by users and the business community, promoting the inclusive sharing of ocean resources rather than the traditional exclusive resource rights concept. Ongoing projects include Multiframe from 2020 to 2023, United from 2020 to 2023, and Ultfarms from 2023 to 2026.

Furthermore, various authors have discussed the potential experiences that MU could offer.

Stelzenmüller et al. (2021) discuss the relationship between MU and MSP, as well as the co-location of various human activities in marine spaces. The terms "co-location," "co-use," and "multi-use" are used interchangeably in this work. Stelzenmüller et al. (2022) emphasize that sustainable co-use regulations of offshore renewables and fisheries require the consideration of socio-ecological trade-offs. Trade-offs involve weighing the benefits and drawbacks of combining these activities, considering ecological impacts, economic considerations, and social factors. MU, in the context of MSP, involves considering how various activities, such as OWF, aquaculture systems, and fisheries, can coexist and share the same marine space.

Przedzimirska et al. (2018), explore innovative methods for promoting sustainable ocean resource management. One approach involves developing new technologies that enable the exploitation of sea resources while enhancing conservation efforts. For example, research projects have investigated the feasibility of creating multi-purpose offshore platforms that can cater to the needs of offshore energy production, mariculture, sea tourism, and regular navigation. The concept of multi-use platforms at sea (MUPS) involves combining various economic activities in designated areas at sea, either completely integrated in a platform or in shared marine space. In Europe, research has been conducted on the feasibility of establishing offshore platforms that can serve multiple purposes, such as offshore energy production, mariculture, sea tourism, and regular navigation. According to Stuiver et al., (2016), MUPS effectively utilize marine space to address issues related to competing claims of ocean space.

Van den Burg et al. (2020), acknowledge the growing interest in using OWF for seaweed cultivation in European waters. The authors see potential for integrating these activities, creating synergistic effects enhance ecosystem services, such as improved biodiversity, habitat creation, and nutrient cycling. Seaweed cultivation can create new habitats and increase marine complexity

enhancing biodiversity and providing new opportunities for marine life to thrive. Additionally seaweed cultivation contributes to nutrient cycling absorbing nutrients from the water, reducing eutrophication and improving water quality. However the authors highlight the need for further research and evaluation of risk and benefits of seaweed cultivation in an OWF setting or MU setting. They mention various risks and liability claims, multiple stakeholders with different interests, regulatory frameworks, and environmental risks such as changes in sedimentation, primary production, and impacts on biodiversity and animal populations. Therefore, MU is seen with potential benefits and challenges.

O'Shea et al. (2022) present a systematic review of studies proposing seaweed aquaculture as a design for MU settings within offshore wind farms. Seaweed aquaculture integrated with wind farms offers benefits like efficient space use, eco-friendly economic development, and enhanced ecosystem services. However, it could also interfere with existing operations, conflict with communities, increase labor market risks, disturb ocean regulations, and harm biodiversity.

In the United States OWD industry is projected for rapid expansion (Tyler et al., 2022), but MU in the United States are still in the early stages of development. However, there are some potential opportunities where MU can be potentially implemented.

As per the findings of , Wilber et al., (2022) OWFs have the capacity to establish intricate habitats that not only attract fish but also offer shelter, consequently bolstering fishery resources. Smythe et al. (2020) mention the potential positive effects of an OWF on coastal and marine tourism. Their study explores the tradeoffs in tourism and recreation at the first offshore wind energy project in BI in the United States.

Furthermore, Bidwell et al., (2023) suggest that OW turbines create structure on the seafloor which is widely considered to function as artificial reefs and thus provide benefits to anglers. Nonetheless, the same article underscores the rapid expansion of OWE and its potential repercussions on existing marine space users, particularly those engaged in recreational angling. Therefore it becomes critical to understand the perspectives of such interest groups, alongside others, concerning offshore wind energy and potential MU experiences

3

Research Framework: Actor models and Comparative Cognitive Mapping

Chapter Summary

This Chapter discusses using actor models and comparative cognitive mapping (CCM) to improve decision-making in organizations and between stakeholders. Understanding important actors, engaging partners, addressing critics, and influencing the network are key to effective decision-making. The chapter also describes various methods for analyzing political and social decision-making, including game theory, social network analysis, and cognitive mapping. The methodology used for this thesis involves semi-structured interviews with stakeholders, which are designed to provide information on similarities, agreement, and conflict, as well as the importance of certain factors, actions, and goals. The chapter explains that by understanding the values, resources, and perceptions of stakeholders involved in a system of interest, decision-makers can identify knowledge gaps, priority issues, and disagreements among actors, which can be used to inform decision-making and adjust strategies as needed. The use of comparative cognitive mapping can help to simplify reality and capture the essence of a system of interest, enabling decision-makers to make more informed decisions and respond quickly to emerging challenges and opportunities.

The chapter also discusses the limitations of the research framework particularly in terms of creating cognitive maps that accurately reflect stakeholder perspectives. The method was originally designed from an engineering perspective and has limitations in dealing with non-quantifiable factors. Therefore, I adapted the method to focus on extracting and visualizing results using ATLAS.ti software while adhering to the theoretical principles of cognitive mapping described by Hermans and Cunnighan (2018).

3. Research Framework: Actor models and Comparative Cognitive Mapping

According to Hermans & Cunningham, (2018) decision-making is heavily dependent on the involvement of actors who play a crucial role in achieving organizational goals, projects, and policies. Command and control environments are not practical, so governments and businesses must effectively navigate and manage networks to succeed. Key aspects include understanding important actors, engaging partners, addressing critics, and influencing the network. By mapping actors, adaptive management is possible, allowing for quick responses to emerging challenges and opportunities (L. Hermans & Cunningham, 2018).

In the past, rational planning and social decision processes were seen as different fields. However, in recent years, there has been a shift towards using techniques from system science and engineering to analyze political and social decision-making. Game theory, social network analysis, and cognitive mapping are some of the methods that have been applied (L. Hermans & Cunningham, 2018). In studying multi-actor decision-making processes, various forms such as games, information flows in networks, debates are utilized. They share a common feature, employing models to capture and clarify important aspects of interactions among actors. As a result, Hermans & Cunningham (2018) label them as "actor and strategy models." These authors use the terms "actor and strategy models" and "actor models" interchangeably. For the purpose of consistency this report will use the term "actor models."

Actor models aim to enhance users' comprehension of actor interactions. These models simplify reality and capture the essence of a system of interest. As system of interest is made up of various interconnected entities that work together to produce a particular desired result Hermans & Cunningham, (2018). An offshore wind energy system where different companies developing in different oceanic areas agree on a common design for transport the energy to land would be, for instance, a system of interest. Actors will come into the picture if they are important in influencing the outcome or if they are affected by the outcome.

Actor models share two assumptions: rationality of.. and resource dependence between.. (Hermans & Cunningham, 2018).

Actor models aim to comprehend the reasons why actors opt for certain actions and how these actions impact their interactions. The belief is that actors act intentionally and rationally, considering the outcomes of their actions and making decisions accordingly. This requires a certain level of **rationality**, even though it acknowledges that complete rationality is not always feasible. Actor models are based on bounded rationality rather than assuming complete rationality. Bounded rationality acknowledges that decisions may be made to achieve certain objectives but may also be influenced by incomplete information, subject to emotional affiliations and disengagements, time constraints, and lack of knowledge (Simon, 1972).

When interacting with others while assuming bounded rationality, actors do so because they anticipate benefiting from them. If they do not need others' actions to achieve their interests, they will not interact with them. However, certain actors expect to gain advantages from these interactions. Resource dependencies arise between actors due to resource differences that shape their interactions. **Resource dependence** refers to the extent to which an individual depends on another's resources to achieve their objectives (Hermans & Cunningham, 2018). Through exchange with others, strategic individuals aim to mobilize resources controlled by others to achieve their objectives. If some actors become aware that others have resources that could prevent them from achieving their objectives, they will try to prevent them from using those resources against them.

When analyzing an actor's behavior, scholars have identified three crucial factors: values, resources, and perceptions. These concepts have been thoroughly discussed and studied by various scholars, including Sabatier (1988), Ostrom (1999), Bots (2008), and Hermans and Thissen (2013).

Values play a crucial role in understanding the motivations of actors. In actor models, values are typically expressed as objectives, which describe specific aspects of a desired future state that actors seek to change or maintain. In this case, the objectives pertain to the specific priorities or goals that each actor has in OWD in Rhode Island that represent their fundamental objectives or values. These values are made more concrete when translated into specific actions. Ultimately, these fundamental objectives represent what is at stake for the actors involved in OWD.

The resources provide the means or instruments for actors to achieve the desired outcomes or goals. In this study, resources refer to actions that each actor carries out or thinks about that are essential to reach their goals. Different types of resources can be recognized, such as organizational capacity, legal power, technical or research skills, man power, and others (Sabatier, 2007).

Beliefs about the world around them, including other actors and issues in the arena, are what perceptions refer to (Bots, 2008). An actor's decision-making process can be influenced by these beliefs, which are shaped by causal factors. Values, on the other hand, are normative beliefs held by an actor and are closely tied to their perceptions. Actors may update their perceptions to fit new information, but it seems more difficult to adapt their values than their causal beliefs or perceptions (Sabatier, 2007). As Bots (2008) noted: "comprehending how actors perceive the relationship between actions and outcomes is critical to understanding their conduct".

For this research the foundation lies in the assumptions of rationality and resource dependence, two main assumptions in actor models. There are various actor models that focus on perceptions such as argumentative analysis, comparative cognitive mapping, and value-focused thinking) that match different situations.

The goal of this research is to organize the data collected into an actor model that represents the values, resources, and perceptions of the stakeholders involved in OWD in RI. The

author of this research believes that CCM is the best actor model for this case, as it has been used in previous research to understand complex systems of interest (Satolli, 2015). CCM aims to understand perceptions of actors in an issue, the cause of problems, preferred solutions, knowledge gaps, priority issues for actors, and disagreements (Hermans & Cunningham, 2018). Values, resources, and perceptions are essential to understanding OWD in RI as a system of interest and to represent the stakeholders' views on the current status of OWD in RI. The stakeholders, in this case, include regulators, environmental agencies, developers, and fishing associations, all of whom have different goals and interests in the OWD process in RI.

In a cognitive map, it is possible to analyze similarities, agreement, and conflict between actors and the importance of certain factors, actions, or goals within a certain group of actors. Following Hermans & Cunningham (2018), the study collected data based on specific research questions for OWD in RI. For each actor (individual, institution, company), a semi-structured interview is completed. The questions designed are based on goals that represent values; means or actions that represent resources; and factors as perceptions that influence the goals or interests at stake that each actor has (see Figure 4).

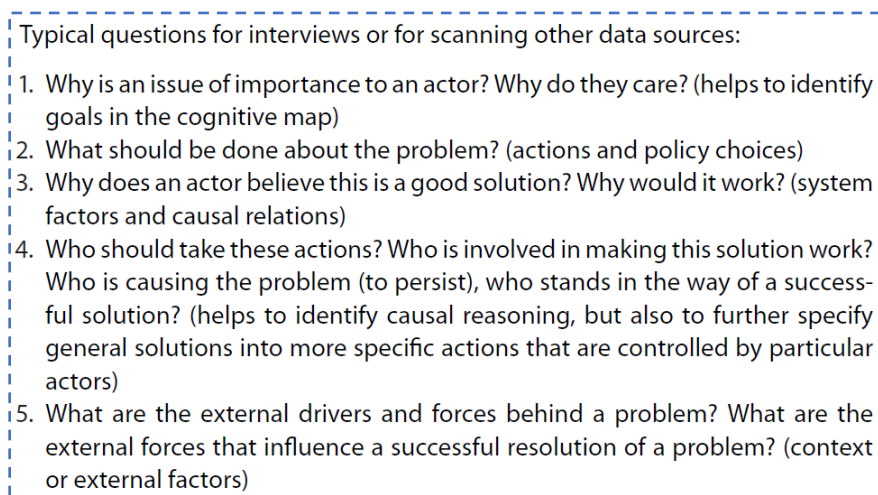
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- Typical questions for interviews or for scanning other data sources:
1. Why is an issue of importance to an actor? Why do they care? (helps to identify goals in the cognitive map)
 2. What should be done about the problem? (actions and policy choices)
 3. Why does an actor believe this is a good solution? Why would it work? (system factors and causal relations)
 4. Who should take these actions? Who is involved in making this solution work? Who is causing the problem (to persist), who stands in the way of a successful solution? (helps to identify causal reasoning, but also to further specify general solutions into more specific actions that are controlled by particular actors)
 5. What are the external drivers and forces behind a problem? What are the external forces that influence a successful resolution of a problem? (context or external factors)

Figure 4: Typical Questions for Interviews (L. Hermans & Cunningham, 2018)

In a cognitive map, the starting points are the factors, actions, and goals, and identifying those is the first step. In addition, there are context or external factors cannot be influenced within a specified arena. For instance, climate change, inflation, or migratory routes of marine mammals in OWD can significantly impact decision-making but are outside the control of the decision-maker.

The process for conducting a comparative cognitive mapping analysis is illustrated in Figure 5. Before selecting a specific actor modeling approach, it is crucial to determine what information is desired about the actors and which are the reasons for choosing them to collect data about them. To support this preliminary analysis, a stakeholder analysis will be conducted. This initial scan will identify variations in the perceptions of different actors in a power/interest grid.

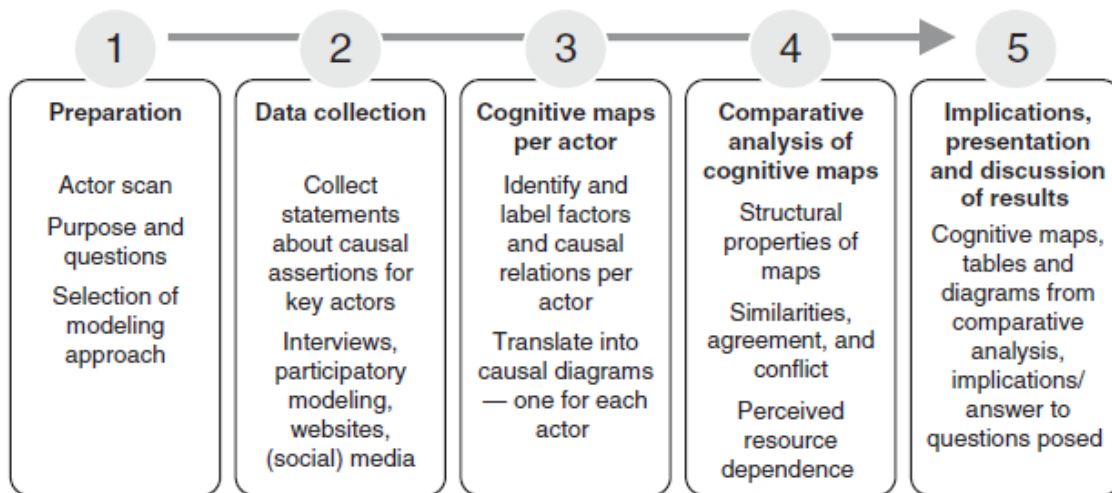


Figure 5: Steps approach to make a comparative cognitive mapping (Hermans & Cunningham, 2018).

3.1 Materials and Methods

Offshore wind development perspectives, challenges, benefits and barriers have been extensively studied in Europe and the United States (Schupp et al., 2021; Kafas et al., 2018; Smythe et al., 2020; ten Brink et al., 2018), and multiple projects are proposing multi-use integration frameworks (MU) in the European context. In United States offshore wind development is a new industry recently invigorated by the impulse of the Federal Government.

MU is barely contemplated in the current setting in the United States. Therefore the efforts are focused in build offshore wind at scale to accelerate the energy transition. While multi-use frameworks are expected in future developments, the more commonly used term in the United States is "coexistence of users" (Smith et al., 2018; Smythe et al., 2020; ten Brink et al., 2018). This term refers to the simultaneous utilization of offshore spaces, including recreational fisheries and offshore wind farms (Smythe et al., 2021). The concept of multi-use, as defined by the UNITED project (See Chapter Two), is scarcely used. To understand which are the present challenges among actors, their drivers or interest and the perceptions that have around OWD in the specific case of Rhode Island and the view and potential use of multi-use in RI among the stakeholders interviewed, this thesis aims to answer the following question:

To what extent may stakeholders' perspectives, interests, and interdependencies influence (impact or modify) processes in offshore wind and implementation of policies that guide how the development is done in Rhode Island and how can the framework of Multi-use be integrated into this industry?

To address these questions, key stakeholders relevant to offshore wind development in Rhode Island were identified for this study by snowball sampling (Creswell, 2009) . This non-

probability sampling method involves initial participants recruiting subsequent participants. In this case, I started with a researcher who was easily accessible due to professional proximity. From there, I was able to connect with a key participant who was well-connected and trusted by other actors involved in OWD in RI. The key participants's contacts were essential to understand OWD in RI. These contacts included federal agency regulators (BOEM), coastal state regulators (DEM, CRMC) federal fisheries agencies (NOAA), consultants working in offshore wind and OW companies. After interviewing a small group of initial respondents, the researcher was referred to other potential respondents that included aquaculture farmers, non-governmental organizations (NGOs), state policy representatives, fisheries board associations and fisheries research foundations. A comprehensive list of stakeholders interviewed is included in Appendix, Supplemental material 1.

Using actor models and CCM theoretical concepts and variables (actions, goals, factors), I aim to structure the perceptions about OWD in RI. This will be achieved by collecting data from interviews and analyzing the different perceptions of stakeholders involved in OWD in RI.

The study will also aim to:

1. Understand the different perceptions of stakeholders involved in OWD in RI, as a case example in the New England region, and their opinions on the MU.
2. Compare different actors' perceptions to identify potential coalitions, understand the grounds for conflict, and assess the usefulness of communication and knowledge sharing among stakeholders.
3. Evaluate the most feasible combinations of MU in federal waters of RI and provide recommendations for implementation.
4. Identify the drivers and barriers to implementing MU offshore wind farms in Rhode Island's federal waters.

3.2 Identification participants and stakeholder analysis

In order to gather a diverse group of interviewees, we utilized a snowball sampling method, as recommended by Creswell, (2009) and explained in section 3.1. Our data collection process targeted various sectors, including municipal government, offshore developers, environmental NGOs, university extension programs, legislators, and other relevant stakeholders. In total, 21 participants were identified from various sectors, including offshore wind energy, mariculture, fisheries, regulatory agencies, and NGOs (See appendix, supplementary material 1).

When using snowball sampling, the sample size and scope are limited by the interviewee's connections. However, this method improves internal validity by triangulating expert perspectives of interest and ensuring their representation (Chazan, 2022). The first three participants recommended other relevant stakeholders in OWD in Rhode Island, and they were invited to

participate via email. The approach was the same for each participant, contact via email. This process was increased to complete twenty-one participants. In addition, a relevant actor from The Netherlands was interviewed regarding MU and the experiences that the country is piloting. All the stakeholders were contacted based on their knowledge and experience working currently in OWD in Rhode Island.

Before applying and following actor models and specifically CCM, it is essential to conduct a stakeholder analysis. Stakeholder analysis involves assessing the situation subjected to the research question and consecutive analysis using actor models.

The interviews and data I collected have given me a clearer understanding of the challenges and opportunities that OWD presents for RI. The participants in my semi-structured interviews expressed concerns about a variety of OWD-related issues in RI, which confirm the problem statement I proposed in this thesis. I also confirmed with the participants that there is a gap between the federal government goal of “deploying 30 gigawatts of offshore wind electricity generation by 2030 while responsibly developing offshore wind energy” (The White House, 2023) and the actors who are actually involved in achieving this goal.

A list of stakeholders and key roles is included in Appendix, Supplemental Material 1.

I initially interviewed 21 participants, but I narrowed the list down to a smaller groups by grouping some together based on their shared interest. I prioritized direct stakeholders over indirect ones, such as regulators (state and federal), ocean users (OW developers, fisheries advisory boards representing to recreational and commercial fisheries), and environmental agencies (NOAA fisheries, DEM) over academia and NGO’s. The list of stakeholders (see Appendix, Supplemental material 1) is balanced with representatives from various levels of government, private companies (OW developers), environmental agencies (federal and state) and local interest groups (NGOs and fisheries associations). However, the list is not complete, as some key stakeholders contacted were not possible to interviewed (Coast Guard, Environmental Protection Agency, sailing sector, etc).

This study used a power versus interest grid, a technique described by Bryson, (2004), to carry out this preliminary stakeholder analysis. This grid is a two-by-two matrix that considers stakeholders' interest in an organization or issue and their power to affect it. The four categories of stakeholders represented include players, subjects, context setters, and the crowd. Players have both significant power and interest, subjects have an interest but little power, context setters have power but little interest, and the crowd consists of stakeholders with little interest or power. The power versus interest matrix used in this analysis is illustrated in Figure 6.

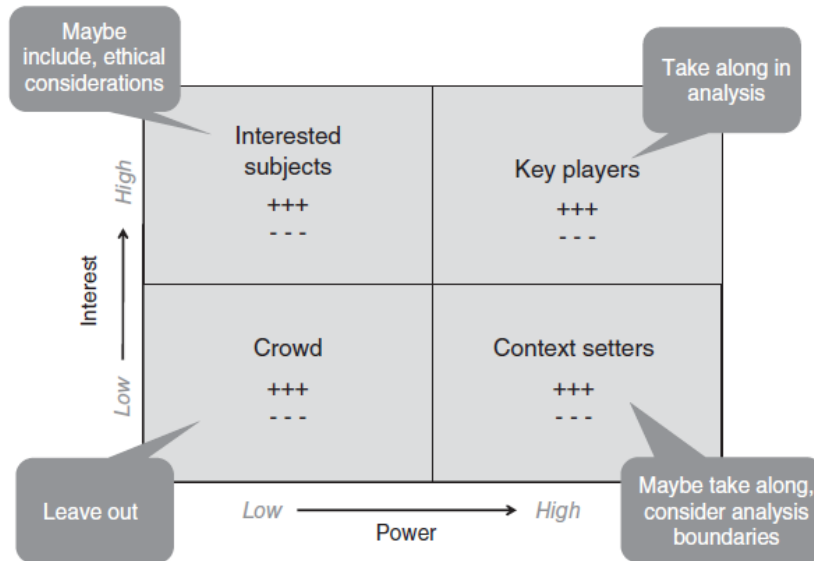


Figure 6: Power/interest grid (L. Hermans & Cunningham, 2018)

3.2.1 A short note on “stakeholders” definition

Hermans & Cunningham, (2018) distinguish between strategic actors and system agents. The first ones trying to influence a system for instance by altering the physical environment or by putting regulations. Often they are policy makers or decision-makers who interact in a dedicated space, that is called decision arena (Ostrom, 2005). The second ones, system agents, operate inside to a system and they are capable of autonomous action. The difference between agents and actors is that strategic actors seek to influence a system and agents are part of a socio-technical or socio-ecological system that produce outcomes of interest to the strategic actors.

In this thesis, “actors” and “stakeholders” are terms used and in some occasions seems to have the same meaning. Going forward the thesis will use mostly the term **stakeholder**. The distinction is that actors are primary concern with performing or executing actions or implementing specific functions. On the other hand, stakeholders encompass any individual, group, or organization that is affected by the decisions, actions, or results of the project and has the ability to influence or be influenced by it.

While actors focus more on executing specific tasks, stakeholders have broader interests and concerns regarding the project’s outcome. They can have varying levels of influence, involvement, or impact on the project, and they often possess different perspectives, goals, or requirements. The distinction between the two terms is important in OWD case in Rhode Island. This study mostly is dealing with stakeholders, along with some actors. The stakeholders can have various levels of influence, involvement, and impact and possess different perspectives, goals, or requirements. In Chapter Five, stakeholder analysis will represent the various levels of power and interest in this case.

3.3 Interview Methodology

The data collection for this research was conducted through semi-structured interviews, as recommended by Hermans & Cunnighan (2018). The Ethics Committee at the Technical University of Delft approved the research process, including the use of open-ended questions in the semi-structured questionnaire, which lasted approximately one hour. Prior to the interview, all participants agreed to sign a consent form, granting permission for the interview to be recorded and transcribed. The signed consent forms and interview model can be found in Appendix, supplemental Material 2 and 6 for reference. The interviews were conducted between December 2022 and March 2023, using Microsoft Teams (Version 1.6.00.1381) with recording and transcription settings enabled.

In order to articulate the concepts explained in this chapter, the questions posed to the participants in an interview will be designed according with the methodology followed by Hermans & Cunningham, 2018. They have been designed to provide information on similarities, agreement and conflict, as well as the importance of certain factors, actions, and goals. For example, participants will be asked about the importance of their objectives, their thoughts on the current OWD in Rhode Island, its causes, and its consequences- particularly about the deployment of offshore wind energy in federal waters. Further questions will explore actions they are doing or may take to advance the design or planning of the offshore wind projects and who they believe should be involved in that implementation. Additional questions will be asked to the participants about the potential implementation of synergies or Multi-Use activities. The list of complete questions is shown in Appendix as Supplemental Material 2.

The interviews were semi-structured, and I asked each stakeholder the same set of questions (See appendix, supplemental material 2). The semi-structured interviews were divided into two parts. Prior to the questionnaire, a brief introduction was given to explain the research's purpose and topic. The questionnaire consisted of an introductory part and two separate sections. The first section contained common questions that focused on the participants' area of expertise related to OWD. The second section included questions that organized the interview results and followed the actor model used in this study. These questions dealt with priority goals, options or actions to achieve those goals, and factors that could positively or negatively influence the outcome. The questionnaire structure helped identify the elements necessary that support the creation of CMs for each stakeholder, as described in Chapter Three, Figure 3. In the last part of the interview, participants were asked about MU and its potential for implementation in the current stage of offshore wind development in Rhode Island.

3.4 Data codification and Organization in ATLAS.ti

The transcriptions of the interviews were directly imported from Microsoft Teams into ATLAS.ti (Version 23.1.2.0), which is a software for qualitative data analysis. It offers various tools for managing and analyzing large volumes of textual, visual, and audio data. The software supports a methodical approach to data analysis, making it possible to identify patterns, themes, and insights within the data. The first step to analyzing the twenty-one semi-structured interviews was importing the data into ATLAS.ti.

After importing the interview transcripts, I created codes or labels to identify common themes, concepts and specific units for analysis. These codes were tailored to answer the research question and were categorized into four main variables that can be distinguished in cognitive maps (CM): goals, actions, factors and external factors that cannot be influenced by the stakeholders. This categorization was based on the work of Hermans & Cunningham (2018) and Thissen & Walker, (2013) who identified these variables as being essential for understanding the cognitive maps of stakeholders.

To ensure effective coding and code segmentation, I established code families and networks that helped me organize the data using ATLAS.ti (Version 23.1.2.0). This approach enabled me to establish relationships between the data and identify possible causes of problems, prioritize issues, identify knowledge gaps, goals and objectives, and preferred solutions related to OWD and MU in Rhode Island.

The number of stakeholders being examined is an important factor to consider when constructing a CCM. Hermans & Cunningham (2018) recommend that CCMs should include between 3 to 15 actors, and this guideline was followed in the current analysis. ATLAS.ti was used to classify stakeholders based on common connections and objectives determined by respective organizations. The code book and families formed are in Appendix, supplemental material 3.

The process of codification in ATLAS.ti posed a challenge as it was my first time dealing with such a large number of interviews. The starting point for a cognitive map is identifying factors, actions, and goals relevant to the system of interest. Once these have been identified, causal relationships can be drawn between them. I maintained a consistent abstraction while organizing codes based on GOALS, FACTORS influencing those goals, and ACTIONS taken to achieve their goals. This organization is related to the theoretical principles of cognitive mapping described by Hermans and Cunningham (2018).

Figure 7 displays the codes utilized most frequently by all stakeholders involved.

I have organized 126 codes across 21 documents, based on the characteristics of cognitive maps: goals, factors, actions, and external context. Upon reviewing the interviews multiple times, I arranged the codes into topics that appeared most frequently. I prioritized the problems mentioned most often in the interviews and organized them by topic. Additionally, I created subgroups of codes for actions and factors while keeping goals in one group.

ATLAS.ti has two functions that can help me determine which codes are the most important:

1. The "G-grounded: frequency of occurrence of specific codes" function shows how often codes have been applied to the data. This function can help me to understand the significance of various codes in the data and identify patterns. The results of this function shows the number of times each code has been applied, as well as the percentage of the data that has been coded with each code.

In the context of offshore wind in Rhode Island, I developed codes for "streamline regulatory requirements" and for "ensure safe navigation and design". Figure 6 displays the results of the "G-grounded" function for these codes. The data reveals that the code for streamlining regulatory requirements has been implemented 30 times, while the code for providing safe navigation and design has been applied 22 times. This indicates that streamlining regulatory requirements is a more prevalent theme in the data. Thus, the "G-grounded" function aids in comprehending the relative significance of different codes.

2. The "D-density": measure of how much of a document has been coded with specific codes. It is calculated by dividing the number of times a code has been applied to a document by the total number of words in the document. The result is a percentage, which indicates the proportion of the document that has been coded with that specific code.

As an example, I developed a code specifically for the "design of compensatory measures" related to offshore wind development in Rhode Island. Additionally, I created a code for "minimizing OWD impacts". Figure 7 displays the "D-density" function results for both codes. Interestingly, the "design compensatory measures" code has a lower density compared to the "minimize OWD impacts" code. This suggests that stakeholders consider it more important to minimize any negative effects on the ocean and maintain access to it, rather than simply obtaining compensatory measures after damage to the ecosystem has already occurred.



Figure 7: Goals (Orange) Actions (Blue), Factors (Purple), and External context (Red) identified in the interviews coding process. (G-grounded) refers to the frequency of occurrence of codes and (D-density) refers to the density feature where is a rich concentration of relevant information both parameters in ATLAS.ti.

As previously explained, ATLAS.ti enables to group related codes into code families or hierarchical structures. This facilitates the organization of codes and establishes relationships between them. In the process of codification, codes that were similar or discussed a specific factor (barrier or benefit) were grouped into the following factor codes showed in Table 1:

Table 1: Code Group Factors in offshore wind development in Rhode Island.

Code name for FACTOR GROUPS:
<i>Benefits (of having offshore wind development)</i>
<i>Decision-making factors (that affect offshore wind development)</i>
<i>Environmental Impact factors (that affect ocean ecosystem because OWD)</i>
<i>External factors- CONTEXT</i>
<i>Legal &regulatory factors (challenges to OWD)</i>
<i>Perceived issues (of stakeholders)</i>
<i>Process factors (that affect to OWD)</i>
<i>Science factors (related to OWD)</i>
<i>User concerns factors</i>

As previously mentioned, I have divided actions into four subgroups: (a) coordination among stakeholders for better collaboration and implementation of OWD; (b) actions to promote the MU framework in the United States; (c) process actions to enhance the overall process of OWD, and (d) actions to encourage stakeholder participation in the OWD process. For a more detailed reference, a comprehensive code book containing factors, goals, and actions can be found in the Appendix as supplementary material 3.

3.5 Limits of the Research Framework

I found creating cognitive maps that accurately reflect stakeholder perspectives very challenging. The method was originally designed from an engineering perspective and has limitations in dealing with non-quantifiable factors. Therefore, I adapted the method to focus on extracting and visualizing results while adhering to the theoretical principles of cognitive mapping described by Hermans and Cunningham (2018).

The starting point for a cognitive map are identifying factors, actions and goals that are relevant to the system of interest. Once these have been identified, causal relationships can be drawn between them. Figure 8 show how it will be the basic structure of a cognitive map (Hermans & Cunningham, 2018).

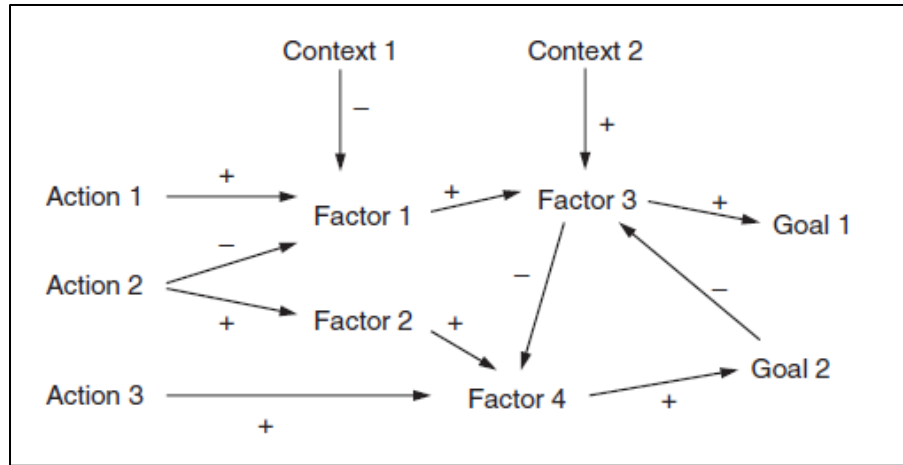


Figure 8: Basic structure of a cognitive map (abstract version) (Hermans and Cunnighan, 2018)

One challenge in creating cognitive maps is identifying causal relationships that are not explicitly stated in the data. For example, if an interview respondent says that they want to achieve a certain goal, it may not be clear from their response what factors they believe are necessary to achieve that goal. Another challenge is assigning positive, negative, or ambivalent values to causal relationships. This can be difficult because it requires making subjective judgments about the value of different outcomes. Additionally, many factors that affect stakeholders' goals are not easily measurable, making it difficult to assign a quantitative value to the causal relationships between them. Hermans & Cunningham, (2018) argue that without the use of measurable factors the use of positive or negative causal relations is meaningless.

In my case, I found that CCM were not well-suited for all aspects of OWD in RI, especially those involving social and regulatory issues. Social issues such as values and traditions, intergenerational equity or lacking trust are often difficult to quantify and compare. Additionally, regulatory issues such as state regulations and limitations on federal consistency can be complex. The factors that appear to be measurable such as income, economic impact or disruption of traditional grounds did not capture the full range of concerns that stakeholders had about OWD in RI.

As a result, I choose to use ATLAS.ti, a computer-assisted qualitative data analysis software, to visualize and compare my results. ATLAS.ti helps researchers organize, code and analyze qualitative data. It can be used to generate frequency counts, track how many stakeholders mention a certain goal or actions and count the number of causal relations or factors that any pair of stakeholders agree on.

The idea of using ATLAS.ti was to generate the frequency counts that I would have to count manually if I used cognitive mapping. This is an advantage of using ATLAS.ti over cognitive mapping. However, one limitation of ATLAS.ti is that the visualizations are not as easy to read as those of cognitive maps.

Sankey diagrams can be used in ATLAS.ti to visualize the co-occurrence of codes or the co-document analysis of documents. Baulaz et al., (2023) effectively showcased the potential impact of offshore wind farms on ecosystems services using Sankey diagrams. In my thesis I also utilize Sankey diagrams with ATLAS.ti to display code -document analysis of documents (comparing interviews of stakeholders) or co-occurrence of codes. However the interpretation of these Sankey diagrams is not always straightforward.

3.5.1 A short note on validation

To reduce bias in the findings, the researcher sought input from three stakeholder groups, which included academia, developers, and federal agencies. This can be done through various methods, such as member checking, where participants are given the opportunity to review and confirm the accuracy of their responses (Hermans & Cunningham, 2018)

The validation process included discussing their responses and reviewing the interview codes with four participants of this research that I contacted after analysing and coding their answers. The aim was to ensure that the analysis aligned with the perspectives and answers of the stakeholders, thereby increasing the validity of the results. In most of the cases and with the exception of some details the coding that was assigned was in agreement with the opinion of the participants.

4

Results and Discussion

Chapter Summary

This chapter aims to understand the perceptions, actions, and objectives of actors involved in OWD in Rhode Island to support marine governance integration and facilitate MSP. The research addresses questions related to stakeholder perspectives, interests, and interdependencies in OWD. Key perspectives identified include communication hurdles, disruption of traditional grounds, fishers' compensation framework, complex regulatory processes, and conflicting decision-making. Stakeholders emphasized the importance of inclusive participation, data sharing, compensatory measures, streamlined regulations, and coordination among agencies to achieve responsible and sustainable OWD. Additionally, stakeholders advocate for integrating MU activities, such as seaweed farming, within OWD, highlighting the need for a regulatory framework and funding for experimental MU. By addressing these considerations and developing policies that support MU activities, sustainable coexistence of different marine activities can be achieved, contributing to the blue economy's expansion and environmental sustainability.

4. Results

4.1 Stakeholder analysis Offshore Wind Development in Rhode Island federal waters

This study focuses on OWD in Rhode Island, including its history and present status. While there is no particular client or problem owner for this thesis, the objective is to produce 30 MW of offshore wind energy on the East Coast of the United States, as mandated by the current government (The White House, 2021). To meet this goal, the government needs to designate one of its agencies to supervise this objective and guarantee its implementation. The Bureau of Ocean Energy Management (BOEM) is a federal agency within the United States Department of Interior (US, DOI) that manages the nation's offshore energy and mineral resources on the Outer Continental Shelf (OCS). BOEM was established in 2010 and its mission is "to promote energy independence, environmental protection, and economic development through responsible, science-based management of energy and mineral resources on the OCS." (BOEM, 2023)

Each state is currently establishing targets for procuring renewable offshore wind energy within their jurisdiction, which involves adhering to their own set of regulations and oversight agencies. Rhode Island, in particular, aims to install 600 to 1000 MW of offshore wind to satisfy the state's renewable energy requirements (Governor office, State of RI, 2022). Failure to progress in this direction implies missing the target set by the Federal Government.

In Rhode Island OWD raises concerns about their impact on the state's fishing industry. The proposed wind farms are located in areas that are vital ecosystems for fishing. The potential loss of access to fishing grounds and restrictions on their activity also worry them. To minimize conflicts between offshore wind energy and fishing, MU in offshore wind farms could be a solution that creates new economic opportunities for fishermen. Despite this, there are varying opinions on the effectiveness of this approach (Claire Haggett et al., 2020).

OWD in RI is a complex process that involves multiple state and federal stakeholders. All parties must comply with regulations, provide advice, facilitate the process, and ensure transparency to guarantee a participatory process for interested parties. These parties include federal and state agencies, developers, NGOs, fishers, and academia, each with its own role to play in offshore wind energy's successful and sustainable development. Supplemental material 1 in appendix provides a list of the actors and describes each role. The list focuses on the state decision arena and federal agencies with decision-making roles in federal waters close to RI.

A useful method for conducting an initial stakeholder analysis is to create a power-interest grid. This grid helps to identify the most important stakeholders by their level of power and interest in the project. Stakeholders with high power and high interest are considered to be Key players. These stakeholders have the ability to significantly impact the success or failure of the project. They

may have access to resources, influence over decisions, or the ability to block progress. For instance, BOEM or Coastal Resource Management Council, can block the progress of an offshore development project because considers that it does not comply with federal regulations, so the project cannot progress. On the contrary BOEM also can give permission to develop, so BOEM is an important player.

Stakeholders with low power and low interest are considered to be low-priority stakeholders. These are unlikely to have a significant impact on the progress of OWD. However, they should be informed of the progress and address any concerns thaty they may have. For instance, universities or City Hall Newport, can be informed and they can ask questions, but they don't have influence in the process.

Figure 6 presents the initial power/interest grid in OWD in Rhode Island, based on the model illustrated in Figure 5, Chapter Three.

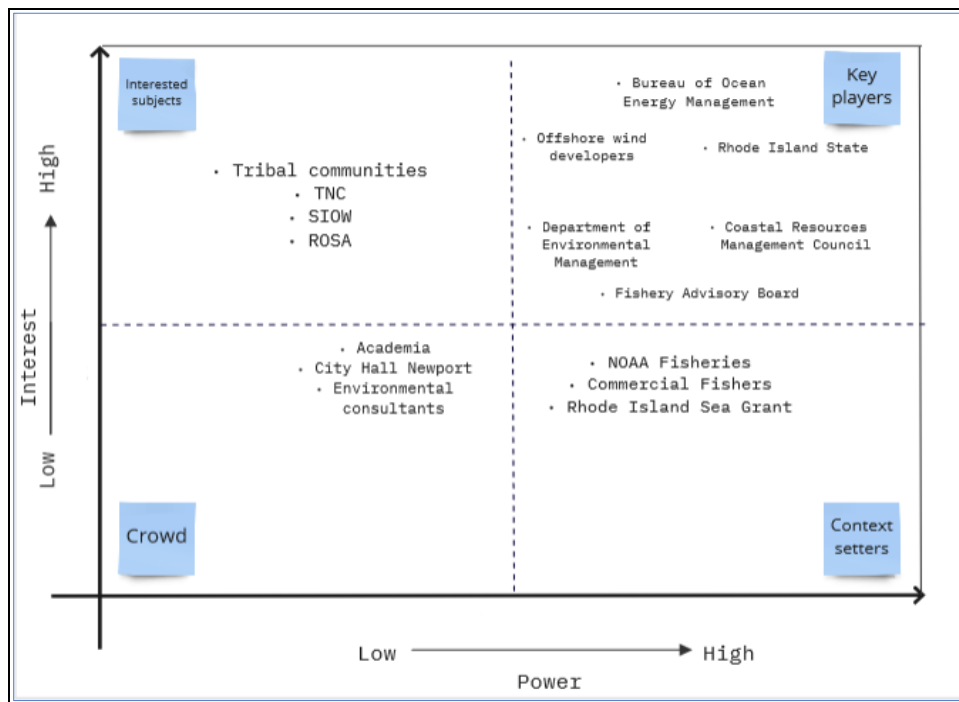


Figure 9: Power/interest grid Offshore wind development in Rhode Island.

While there may be other actors involved in the OWD, this power/interest grid focuses on the primary players at this point. The grid highlights the key players in the top right quadrant, which includes BOEM. This agency possesses both the interest and power to make decisions that further the advancement of offshore wind development in the States. BOEM's rejection of offshore wind developers' applications means this industry cannot progress, making them a crucial player. Additionally, Rhode Island State is also a significant player as some projects require landing in Rhode Island state waters, and the state mandates permits for developments and procuring renewable energy quantities. Furthermore, state regulations, such as the Rhode Island Ocean Special Area Management Plan (Schumann et al., 2016) empower Rhode Island to request federal

consistency (Coastal Management Act, 1972), giving it more influence than other states that don't have MSP plans for their state waters.

Key players in promoting renewable energy and reducing carbon emissions include offshore wind developers, who hold significant influence. They play a crucial role in helping the Federal government achieve its mandate of sourcing 30% of renewable energy exclusively from offshore wind by 2030 (The White House, 2021). These strategic actors occupy the top right quadrant of the grid.

NOAA and commercial fishers play important roles in providing context for developers. NOAA advises on crucial factors such as habitats, species, and fisheries, all protected by federal regulations. Meanwhile, although less powerful, fishers are considered context setters due to their dependence on these factors for their livelihoods.

4.1.1 A short note in the power/interest grid

After processing the interview codes using ATLAS.ti and conducting the analysis, the Power/Interest grid indicated a shift in the position of some key players. The BOEM agency, which represents the interests of the federal government, retains significant power and interest in the success of the offshore wind industry. Developers also hold a considerable influence.

In the case of Rhode Island, the success of the industry is influenced by state agencies and government, while NOAA, a major agency responsible for oceans, holds decision-making power over ocean ecosystems and fisheries.

Some stakeholders have been placed in a position of less power on the grid due to communication difficulties and the challenges faced in being heard. For instance, the Fisheries Advisory Board of RI faces significant communication hurdles.

Consultancies that work for offshore developers in Rhode Island may not have significant power, but they are still interested parties due to the industry's economic importance for these businesses. They are often hired to conduct scientific studies for the offshore developers. These variations in the Power/grid interest matrix can be seen in Figure 10.

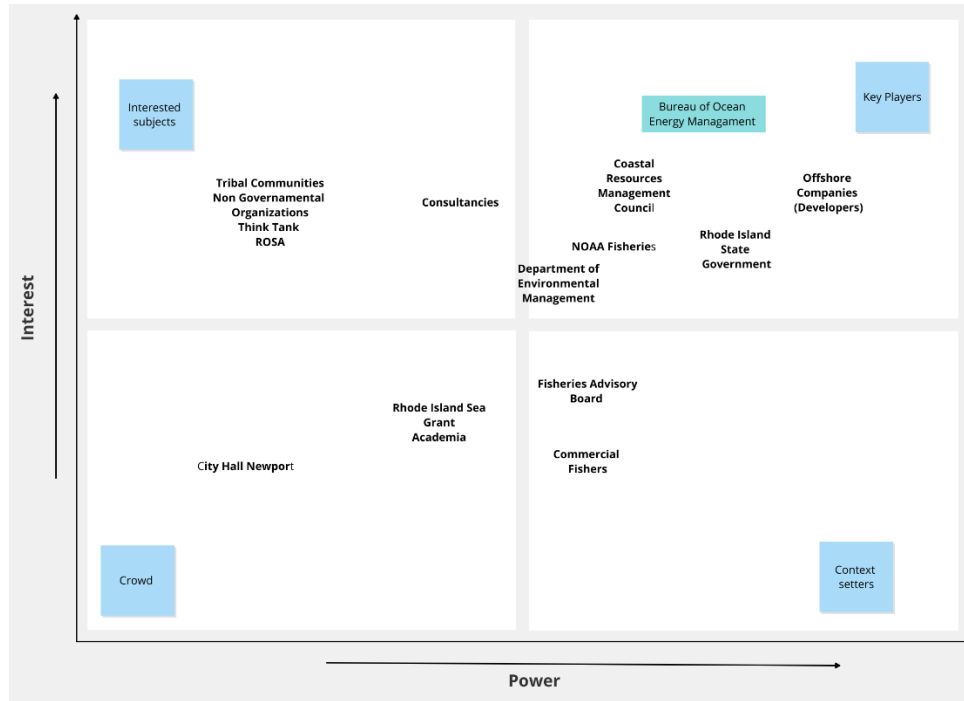


Figure 10: Power/interest grid Offshore wind development in Rhode Island.

4.2 Factors in OWD in Rhode Island: Perceptions of Stakeholders

In accordance with the principles of cognitive mapping theory, CCM functions as an actor model that seeks to comprehend the perspectives of actors in problem-solving or decision-making scenarios. In actor models, values, resources, and perceptions are fundamental components of a system of interest, which, in this case, pertains to OWD in Rhode Island. In CCM, values, resources, and perceptions correspond respectively to goals, actions, and (system) factors.

In the following section, I will present the most basic components of a cognitive map, which are the factors. The factors that have the highest frequency (G-grounded) or significance in explaining stakeholder perceptions of OWD in RI are illustrated in Figure 11.

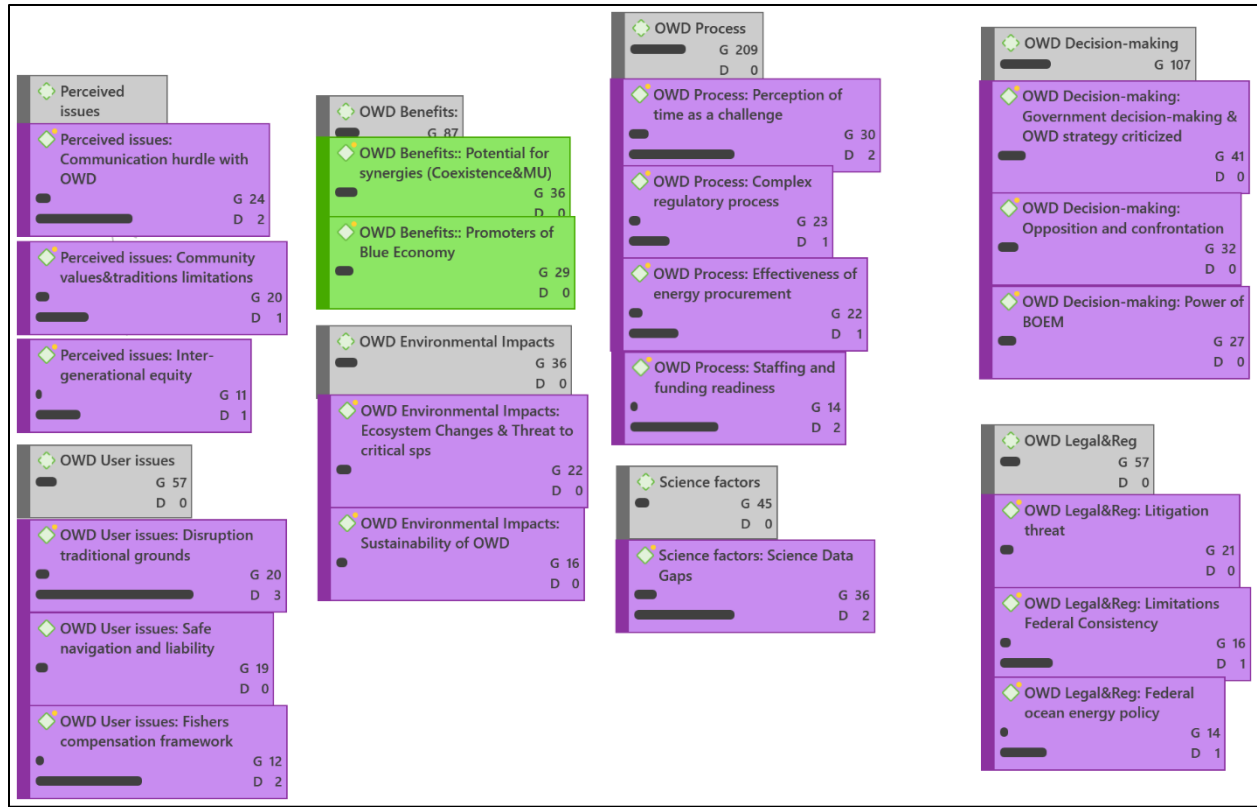


Figure 11: Factor with the biggest frequency (G-grounded) or significance explaining stakeholder perceptions of OWD in RI

The factors that stand out most among the stakeholders interviews who are involved in OWD in RI are discussed below and they are grouped in families of factors (described in Table 1 and in grey color in Figure 9) with common characteristics that we listed and described below:

Benefits of having OWD in Rhode Island

Two main factors are considered to be of utmost importance regarding the benefits of having offshore wind energy (OWE) in Rhode Island, according to the stakeholders:

1. Potential for synergies (G-grounded: 36)

One advantage of OWD is the opportunity for synergies. This means that the space occupied by OWFs can be utilized strategically and cooperatively for various purposes. Federal and State agencies acknowledge this potential and view it as crucial to sharing ocean space. On the other hand, the Fisheries Association representing Rhode Island's fishers as traditional ocean users that were not having physical obstacles on the sea are less keen on possible synergies.

2. Promotion of Blue Economy (G-grounded: 29)

Various consultancies, offshore wind developers, and non-governmental organizations view themselves as promoters of the Blue Economy. They recognize the importance of OWD for the economic growth of coastal states, the creation of new jobs and skills, and the urgency of having renewable energy sources in the United States.

Decision-making factors that affect OWD

This group of codes explains how the stakeholders understand the Federal Government and BOEM strategy carried to develop offshore wind in the United States.

1. Government decision-making process & OWD strategy criticized (G-grounded: 41)

State agencies are often critical of the Federal Government's decision-making process, particularly regarding OWD. One of the main concerns is that the OWD is perceived to be politically motivated, and the procedures used in OWD are inherited from the oil and gas industry, fundamentally different in terms of impacts, spatial dimensions, and regulation. The Federal Government is also perceived to be pressuring the States, which has resulted in criticism of the OWD strategy. Specific concerns include the federal lease of offshore wind areas, the allocation of funds generated from those leases, and the pace at which decisions are made. Many stakeholders feel that the Government's offshore wind energy production goals are too ambitious.

2. Opposition and confrontation toward OWD (G-grounded: 32)

Rhode Island's OWD faces opposition from commercial and recreational fishermen concerned about the potential negative impact on their livelihoods. These concerns are often the focus the discussions, with fears that offshore wind projects could put them out of business. The visual impact on the ocean landscape and the overlap with trawling fishermen further amplify their opposition.

Moreover, the costs of mitigation measures or compensation for any loss of fishing activities pose a challenge for both sides. Opponents frame offshore wind as a foreign intrusion on domestic industries, leading to a negative perception of the projects. However, some believe it is essential to envision a role within OWD rather than try to halt it completely.

Despite the existence of offshore wind supporters, they tend to be less vocal, while opponents dominate the discourse. Confrontation and obstructionist tactics have been observed, making OWD in RI a challenging landscape.

3. BOEM holding regulatory power (G-grounded: 27)

The BOEM agency oversees and enforces regulations in offshore energy, making them crucial for the OWD industry. However, their concentration of power can lead to the perception that they have significant control over the direction and outcomes of offshore energy development. Some

stakeholders feel that BOEM's decision-making approach is overly centralized, potentially limiting collaboration and inclusivity in the decision-making process.

The need for clear policies also raises concerns about the transparency and objectivity of BOEM's actions, as political factors may influence their decisions. In offshore wind projects, BOEM is the ultimate decision-maker, approving construction plans and making decisions based on a third-party (consultants working for Offshore developers) environmental impact statements. This gives them significant influence and control over the outcomes, reinforcing the perception of their extensive power.

Environmental Impact Factors

These factors reflect stakeholders' perspectives on OWD's environmental effects considering the existing and possible impacts throughout the construction and establishment of OWF. The commonly mentioned factors by stakeholders include:

1. Ecosystem changes & Threats to critical & managed species (G-grounded: 22)

Among the stakeholders, there is growing concern regarding the negative impact that offshore wind projects may have on the health of the ocean and the recovery of fish populations. It is feared that these projects could decrease productivity, affecting the traditional fishing grounds and limiting fleet access to the ocean. Fishermen have reported a decline in commercial fishing, and the sighting of a wind project on critical spawning grounds for Atlantic cod has raised concerns about the initial site selection process. The risk to essential fish habitats, such as Cox Ledge, which supports Atlantic cod fishery, is particularly alarming in Rhode Island, and the construction of wind turbines will significantly disrupt the glacial moraine habitat that houses cod resources.

The construction phase of wind projects is also problematic, leading to disturbances to spawning and future availability of fish, and potential effects on fish species and other marine organisms raise questions about their interaction with wind turbines and the alteration of the food chain. Concerns about disrupting reproductive spawning behaviors, noise impacts, and the placement of hard structures on preferred spawning habitats have also been expressed. From the perspective of these stakeholders, efforts must be made to minimize these impacts, especially for sensitive species such as whales, cod, and birds.

2. Sustainability of OWD (G-grounded: 16)

Fisher's associations and state and federal agencies, specifically NOAA, emphasize balancing economic gain from OWD with the long-term preservation of the ocean environment. There are concerns that an increase in OWD initiatives may result in environmental damage or harm to the ocean ecosystem, making it crucial to implement responsible practices throughout all phases of offshore wind projects, including planning, construction, operation, and decommissioning.

Legal & regulatory challenges

These codes relate to the concerns of the participants regarding federal policies and the licensing and permitting procedures that OWD is founded on.

1. Litigation Threat (G-grounded: 21)

Certain groups within the fishing industry and other sectors of the economy have filed lawsuits to stop or delay the development of wind farms. While it may not be feasible to eliminate the wind farm industry, there is a portion of the fishing community that is actively fighting against offshore wind projects through legal means. These legal challenges are hindering the progress of OWD, and it is expected that they will continue to be a significant obstacle in the future.

It is expected that lawsuits may arise, particularly in relation to habitats of vital importance for fisheries. Some stakeholders, like developers and BOEM, think that lawsuits present a significant threat to OWD.

The desire to litigate wind farm projects stems from various concerns and motivations. One key factor is the presence of unknowns and uncertainties surrounding the impact of wind farms. Some stakeholders believe there is a lack of comprehensive information on how wind turbines affect marine life, ecosystems, and the fishing industry. Litigation is seen as a means to demand more research and studies to address these uncertainties.

Opposition to wind farms is another driving force behind the litigation. Specific segments of the fishing community and other interest groups strongly oppose OWD due to concerns about the disruption of fishing grounds, navigation hazards, and the potential loss of livelihoods.

Environmental and conservation concerns also drive litigation. Individuals, organizations, and coastal municipalities may file lawsuits to protect natural habitats, endangered species, or scenic views. They argue that wind farms are located in sensitive areas and could harm biodiversity or negatively impact the visual aesthetics of the landscape in tourist and historic cities such as Newport in Rhode Island.

Legal and procedural issues play a role as well. Complex regulatory processes and interpretations of laws and regulations can lead to legal challenges. Stakeholders may file lawsuits claiming flawed permitting or approval processes, inadequate assessments, or non-compliance with relevant laws.

Lawsuits may be pursued to address these concerns, seek compensation for perceived damages, or demand protective measures and guarantees for affected industries.

2. Limitations Federal Consistency (G-grounded: 16)

The governance structure in the United States for project approvals is complex, with overlapping requirements from state and federal processes. While states have the authority to propose Geographic Location Descriptions (GLDs) under the Coastal Zone Management Act, the

final approval rests with the National Oceanic and Atmospheric Administration (NOAA). State agencies can voluntarily submit projects for federal consistency review, but their recommendations need to be more enforceable, and the federal government has the ultimate decision-making power. This jurisdictional limitation frustrates states, as they cannot regulate federal projects in federal waters.

States rely on their enforceable policies to advocate for protecting specific habitats and resources. These policies encourage wind companies to avoid or mitigate impacts to these areas. However, while states can review projects and provide recommendations, they have limited authority to hold developers accountable to mitigation agreements. This limitation underscores the imbalance of power between states and the federal government.

Rhode Island is an example of the state's challenges in offshore wind projects. They have utilized GLDs to request federal consistency reviews for projects that may impact their coastal zone. However, changes to the coastal zone consistency review process by NOAA and variations among states have resulted in different levels of review.

Additionally, conflicts arise when one state's decisions, such as delays in the review process, impact other states that rely on the energy produced. This highlights the need for better coordination and a more cohesive approach to balancing state and federal authority to effectively manage offshore wind projects.

3. Federal ocean energy policy (G-grounded: 14)

Several stakeholders for different reasons (Fishers, Developers, and Academia) indicate that the United States lacks a national policy for offshore wind. There is no official federal policy or national energy plan dedicated to addressing OWD, resulting in a decentralized approach with individual states and governors promoting offshore wind projects. Although there are funding initiatives, such as the Inflation Reduction Act passed in 2022, they cannot replace a comprehensive national policy framework. The absence of regulations and standardized methods to mitigate the potential impact of offshore wind on fisheries further demonstrates the lack of a cohesive national strategy for OWD.

Efforts to promote offshore wind have primarily relied on executive orders and funding initiatives rather than established laws. While executive orders can be forceful directives, they are susceptible to change with each new administration, making them less authoritative in the long term. The absence of a national policy creates uncertainty and dissent. Some stakeholders highlight the need for a comprehensive national policy (FAB, Academia-Coast Guard, Developers) for offshore wind in the United States, ensuring consistent regulations, environmental protections, and long-term planning.

Perceived issues

Perceived issues refers to several codes that express the frustrations of stakeholders regarding to communicate with with offshore wind developers in Rhode Island, among them: cooperation, actively listening to stakeholders' concerns and ideas, and being more transparent and accessible to address issues.

1. Communication hurdle (G-grounded: 24)

State agencies in Rhode Island, along with NOAA and CFRF, encounter communication challenges when working with offshore wind developers. They hope for collaboration and guidance that aligns with their goals but often feel that their suggestions and feedback are disregarded. This leads to disillusionment as they believe their concerns and ideas are not fully considered, resulting in a lack of respect and understanding. A major obstacle for participants is obtaining relevant information about offshore wind projects, as navigating through various sources and company websites can be difficult and time-consuming.

Developers recognize that certain aspects of business can be sensitive, particularly when project designs and information evolve. However, this sensitivity can sometimes make it hard to maintain transparency, causing stakeholders to worry about inconsistencies in information provided by developers. Regrettably, developers do not always see the advantages of engaging with stakeholders, which can impede effective communication and collaboration.

2. Community values and traditions (G-grounded: 20)

Various stakeholders express their concerns regarding this factor. Fisher representatives and research groups working with commercial fishermen stress the significance of stewardship and trust toward the ocean. They believe that the relationship with the ocean should be considered a responsibility and that its resources are entrusted to the beneficiaries. In contrast, a sense of entitlement is discouraged, and the focus is on care and sustainable practices. The fishing community, particularly the older generation, is resistant to change, as fishing is viewed as a deeply ingrained culture and tribal identity. The shared language, attire, tattoos, and oral history create a strong bond among them.

Furthermore, concerns are raised regarding tribal communities and ancestral lands. These concerns highlight the importance of careful navigation and collaboration to preserve cultural heritage and sustainable resource areas. Historical legacies must be considered to navigate these complex issues and achieve coexistence between communities and the ocean.

Process challenges

This group of codes described the perceptions of stakeholders regarding the implementation of OWD and how those challenges have on impact t impact on their work.

1. Perception of time as a challenge (G-grounded: 30)

During the interviews, various individuals, including government officials, industry professionals, and environmental experts, raised concerns regarding the time-consuming and complex OWD process. They stressed the need for a more efficient and streamlined process that includes stakeholder involvement, organizational considerations, data research, data collection, federal and state regulations, environmental impact statements, and reviews. The ultimate goal is to accelerate the deployment of offshore wind projects while ensuring proper analysis, consideration of environmental impacts, and stakeholder engagement. However, the time constraint is viewed as a significant challenge, given the pressing need to address climate change and promote renewable energy projects rapidly. Participants also emphasized the importance of conducting comprehensive analyses to minimize adverse effects on fisheries, habitats, and other marine ecosystems. The discussion highlighted the need for a balanced approach that expedites OWD while conducting thorough assessments to mitigate any adverse effects.

2. Complex regulatory process (G-grounded: 23)

The regulatory process for OWD in RI is long, complex, and involves multiple federal and state agencies. There is a lack of clear guidance from some of the agencies, which can lead to uncertainty and delays. The process can be expensive and time-consuming according to developers, which can discourage them from pursuing offshore wind projects. Stakeholder engagement is important, but it can be difficult to get everyone on the same page. This code suggests the complex regulatory landscape resulting from the involvement of multiple agencies, each with its own mandates, requirements, and jurisdictions in the offshore wind development process. In RI case, the state has gone beyond the Coastal Zone Management Act intended for consistency review.

3. Effectiveness of energy procurement (G-grounded: 22)

Rhode Island is increasing its use of offshore wind resources to meet renewable energy targets, leading to competition among developers competing for contracts to provide more renewable energy to the state. Regulatory bodies such as the Coastal Resources Management Council and the Board of Public Utilities significantly influence contract agreements with offshore wind developers, mandating certain criteria as part of permitting or power purchase agreements that shapes project development and operation. Policymakers and lawmakers also play a significant role in OWD, setting renewable energy targets and providing a framework for projects. States can signal support for developers by directing utilities to purchase offshore wind power and passing procurement bills to procure specific amounts of offshore wind power. However, interstate competition for offshore wind projects and associated economic benefits highlight the need for regional cooperation. Challenges arise when project infrastructure is located in one state while electricity is sold to another, raising questions about credit attribution of renewable energy. The dynamic involving developers, regulators, policymakers, and states in OWD includes competition,

collaboration, public policy considerations, and regional cooperation and credit attribution challenges.

4. Staffing and funding readiness (G-grounded: 14)

Through discussions with various stakeholders, including State and Federal agencies, it has become evident that numerous critical issues are hindering agencies responsible for addressing climate change, coastal management, and offshore wind development. One of the main challenges is the lack of adequate funding for organizations such as NOAA, which limits their ability to tackle pressing environmental concerns effectively. This financial constraint significantly impacts research capabilities, analysis of potential impacts, and the ability to tackle challenges. Additionally, understaffing and limited resources create significant obstacles, causing small teams to struggle with reviewing projects thoroughly, making informed decisions, and giving necessary attention to each task. Delays in obtaining crucial information, such as decision-making data, further impedes progress and hinders effective planning and management regarding OWD. Furthermore, agencies face a learning curve and a lack of awareness and expertise from the past. Although agencies have made progress, it is clear that they are still adjusting and working towards effective collaboration. The stakeholders emphasize the challenges faced by agencies in navigating complex processes and the necessity for increased staff and funding to cope with the workload associated with OWD.

Science factors

The State and Federal agencies involved in OWD recognize the significance of science in making responsible decisions. They rely on comprehensive research to bridge gaps in key data necessary to comprehend how the ocean ecosystem operates and how it can be impacted by OWD.

1. Science Data Gaps (G-grounded: 36)

State agencies involved in OWD understand the importance of addressing limitations and data gaps to make responsible decisions. However, the lack of detailed data on habitats, fishing activities, and environmental impacts, combined with difficulties acquiring and sharing industry data, presents significant challenges. To overcome these obstacles, stakeholders emphasize the need for comprehensive research and improved analysis from the outset. This includes understanding the effects of buried cables, assessing the impact on fish populations, and informing ocean and multi-use planning. By focusing on these areas, stakeholders can make informed decisions, reduce environmental impacts, and promote sustainable OWD. In particular, the CRMC has highlighted the need for more information on specific habitats and the challenges agencies face in obtaining fishing industry data. Furthermore, there needs to be more understanding of the effects of piling and monopile installation on the sea floor and geology. The CRMC stakeholders have expressed concern about the difficulty of responsibly conducting ocean planning due to insufficient data and inadequate mechanisms to study the long-term impacts of offshore wind farms.

User concerns factors

The following codes pertain to user concerns regarding OWD in RI. Many of these concerns are raised by fishermen and fishing associations.

1. Disruption of traditional grounds (G-grounded: 20)

Many stakeholders (State, Federal agencies, and fishers) are expressing their worries regarding the potential adverse effects of OWD on fishing activities and fishing grounds in Rhode Island. It is widely believed that wind farms can cause changes to the ecosystem surrounding existing turbines, leading to concerns about the loss of traditional fishing areas. Fishermen are concerned about the impact on their businesses and the financial burden they may face if their favorite fishing grounds are affected. Numerous uncertainties exist about the interaction between OWD and the fishing industry, including concerns about timing, unknown variables, and potential impacts on the fishing industry and environmental impacts. The construction phase threatens spawning, future fish availability, and fishing activities. Fishermen and fishing communities are anxious about how OW projects might alter the environment and food chain. The placement of wind turbines in productive fishing areas is particularly concerning, and there are worries about the long-term consequences for the fishing industry and the marine ecosystem.

2. Safe navigation and liability (G-grounded: 19)

The fishermen have expressed worries about potential entanglements with wind infrastructure, safety hazards, and navigational risks, which could impact their livelihoods. They stress the importance of careful planning and have concerns about the lack of insurance coverage and potential liabilities associated with OWD. On the other hand, developers emphasize ensuring that offshore wind projects are carried out without jeopardizing infrastructure or leading to navigational risks. They prioritize their operations and prefer to minimize risks.

3. Fisher's compensation framework (G-grounded: 12)

The CRMC stresses the significance of compensating fishermen for their losses from wind projects and explores various compensation methods. Academic stakeholders acknowledge the contentious nature of financial compensation related to wind projects and advocate for negotiations. Additionally, the need for more standardization in fisheries mitigation plans among different projects results in state-by-state negotiations, resulting in inconsistent outcomes. Furthermore, the BOEM recommends federal agency involvement to establish standards for mitigation and compensation.

4.3 Context or external factors

When talking about cognitive maps, external factors are those that cannot be controlled within a particular situation. While actions are under the control of the actors in the problem area,

contextual factors cannot be influenced within the same area. The United States has yet to implement OWD, and stakeholders are concerned about the potential impact of climate change, misinformation, and uncertain infrastructure reliability on the initiative. Unfortunately, these factors are beyond their control and cannot be altered. The external factors with the biggest frequency (G-grounded) or significance are shown in Figure 12.

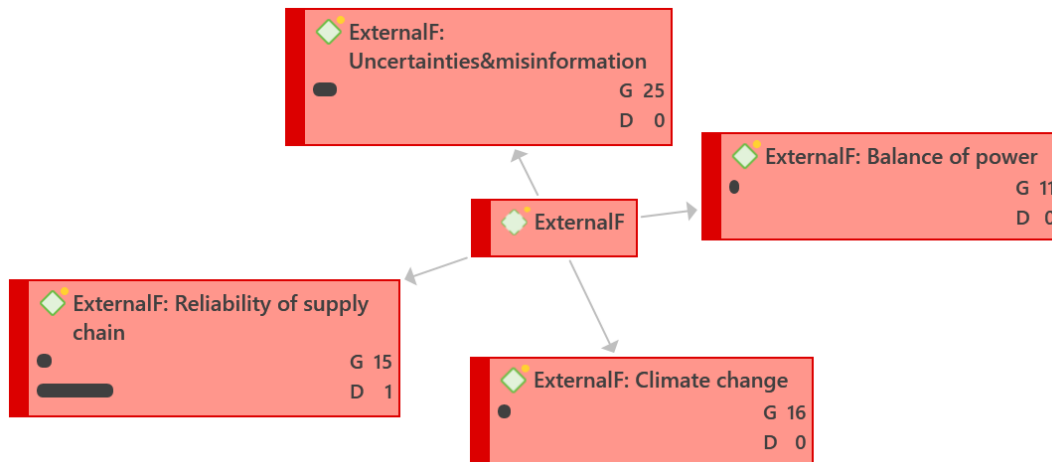


Figure 12: External factors in offshore wind development in Rhode Island

1. Uncertainties & misinformation (G-grounded: 25)

Offshore wind energy projects have been a concern for many due to the unknowns associated with their implementation. These uncertainties stem from the potential long-term effects on various aspects, such as commercial fishing, the environment, users, and other stakeholders. The lack of understanding and information regarding the positive and negative impacts that offshore wind farms may have on different industries and resources is a significant contributing factor to these concerns. However, misinformation, fear, and resistance to change only exacerbate these uncertainties. Developers face numerous challenges, and it is crucial to conduct studies, and assessments, and engage with the public to address these uncertainties and educate them about the benefits and risks associated with offshore wind energy.

2. Climate change (G-grounded: 16)

All stakeholders acknowledge and express concern about the negative effects of climate change on the environment and marine ecosystems, particularly fisheries. OWD is seen as a viable solution, but its complexity and fast-paced implementation present challenges. The urgency of the climate crisis poses planning and cost challenges for the quick deployment of offshore wind. Additionally, the constantly changing nature of climate change requires ongoing learning and adaptation as species and ecosystems react to the environment. For example, in Rhode Island,

climate change has caused changes in the distribution of fish and lobster due to significant water temperature shifts.

3. Reliability of supply chain and infrastructure for OWD (G-grounded: 15)

The perceptions touch upon various aspects related to the development and implementation of offshore wind, including the need for a market and infrastructure, the industrial policies and activities involved, the growth of local suppliers and the labor force, the economic benefits and potential for economic development, the permits and regulations required for infrastructure construction, and the challenges related to interconnection and transmission of power to the grid. Overall, this group of stakeholders highlights the importance of addressing the infrastructure and economic aspects to successfully harness the potential of offshore wind energy.

4. Balance of power (G-grounded: 11)

During multiple discussions, stakeholders have highlighted the complex dynamic between the federal government and states, the lack of consistent policies and regulations, the involvement of multiple agencies in the OWD permitting process, the potential impact on different states, and the need for collaboration between the federal government and states in managing coastal zones. Stakeholders reveal concerns about power and influence distribution, the necessity for an integrated approach, and the challenges faced when navigating the governance system.

4.4 Factors related to Multi-Use Offshore Wind in Rhode Island

During the semi-structured interviews, participants were asked for their opinions on Multi-Use and its potential implementation in Rhode Island. The questions followed the same structure as the first part of the interview. The second part of the interview, dedicated to Multi-Use, can be found in Appendix, supplemental material 2. The most frequently expressed codes by stakeholders are explained below.

There are differing opinions among stakeholders regarding Multi-use, with many expressing skepticism about its current implementation. These opinions can be categorized into three groups, which explain the diversity of views on the applicability of MU.

1. Applicability of MU (G-grounded: 29)

Group Favoring Multi-Use: There is a group (Consultants and NOAA) that supports the idea of multi-use offshore wind farms. They believe it has the potential to bring many benefits, including maximizing offshore resources, promoting sustainability, and enhancing economic efficiency. This group argues that incorporating other activities like aquaculture, tourism, or research within wind farms can lead to synergies, cost reduction, and more job opportunities. They stress the importance of careful planning, collaboration among stakeholders, and technological advancements to ensure the successful implementation of MU.

Skeptical Group: There is a group (SIOW, ROSA), Developers) that has concerns regarding the practicality and potential challenges of multi-use. They acknowledge the concept but are skeptical about its feasibility. Their main points of concern are the environmental impacts, regulatory frameworks, and technical constraints that need to be thoroughly assessed. They believe conflicting interests and complex operational requirements may pose significant hurdles to practical implementation. However, this group is not dismissing the idea outright and suggests proceeding with caution. They emphasize the importance of conducting thorough research and carefully considering the trade-offs involved before making any decisions.

Group Questioning Feasibility: There is a group (Coast Guard Academy, CRMC, Fisheries Board) of individuals who harbor doubts about the practicality of multi-use in offshore wind farms. Their perspective is that the main emphasis should be on enhancing offshore wind energy generation rather than expanding activities. They express concerns about possible conflicts of interest, inadequate space, and technological restraints. This group advocates for allocating resources exclusively towards wind energy production to achieve better outcomes and to prioritize meeting renewable energy goals.

2. Combining expertise for plan MU (G-grounded: 14)

The stakeholders in this discussion highlight the need for a comprehensive marine spatial planning framework in the United States to support multi-use activities in the offshore environment. They express concerns about the lack of coordination and the presence of multiple organizations with overlapping responsibilities, such as BOEM, the Army Corps of Engineers, and NOAA. Without a unified management structure, they anticipate difficulties in obtaining permits and coordinating different activities like aquaculture and energy extraction. They emphasize the importance of a national ocean planning approach and the need for an overarching organization to facilitate coordination and support entrepreneurs in navigating the complex permitting processes.

Furthermore, the stakeholders identify policy barriers and limited incentives for MU activities, which hinder the development of integrated approaches. They suggest the amendment of existing laws, such as the Coastal Zone Management Act, to streamline the permitting process and provide more time for comprehensive project reviews. Additionally, they advocate for regulatory support, particularly from organizations like NOAA, to promote the integration of aquaculture at wind farms and other multi-use initiatives. In general, the stakeholders recognize the early stage of multi-use development and express curiosity and openness to learning more about the possibilities while emphasizing the need for regulatory uptake, legal amendments, and stakeholder engagement to foster the successful implementation of multi-use frameworks.

3. Lack of instruments or tools to finance MU (G-grounded: 11)

Different stakeholders hold differing views on planning and financing for MU. While some agree on the importance of financial mechanisms to support MU-related activities, others caution against viewing it as a magical solution without proper examination. Some suggest utilizing grant or research money to support aquaculture initiatives within the MU framework, while others stress the need for the Federal Government to seek funding to support and facilitate the development and implementation of MU projects.

4.5 Cognitive maps: goals and actions in OWD in RI

In the previous section, we examined the (system) factors, external context factors and MU factors that impact OWD implementation in Rhode Island. As outlined in section 3.5, I discovered that CCM was inadequate in addressing all aspects of OWD in RI, specifically social and regulatory factors. Quantifying and comparing specific factors and their causal relationships can be challenging for different stakeholders with different goals. Typically in a cognitive map, arrows are used to indicate the direction of causality, and positive or negative causal labels are used to indicate a positive or negative causal effect of one factor on another. To create a cognitive map, you can ask actors not just about their goals, but also about their vital objectives and how important they are to them. Additionally, in a cognitive map, you can assign actions to particular actors that allow you to examine the perceived resource dependencies between them. In the Appendix supplemental material 6, displays an effort to create a cognitive map for traditional ocean users. Nevertheless, establishing relationships proved challenging.

In the preceding section, I outlined the primary codes or factors that are most frequently observed among stakeholders. In this section, we can refer to Figure 13 and Figure 14, which display the most significant goals and actions that have relevant representation among the stakeholders.

In Figure 13 (see below), the main goals for various stakeholders are presented. To begin with, it becomes evident that a prominently recurring goal is "Responsible and sustainable setting of OWF", marked by its significant frequency and density (G-grounded: 39; D-density: 3). This objective is embraced by federal agencies (NOAA, BOEM), state agencies (DEM, CRMC), offshore developers, state legislators, and fisheries associations (FABRI) exhibiting a higher density compared to other aspirations such as making informed decisions through research or coexistence with other users interest, obtaining federal permits, or forstoring stakeholder engagement.

The idea of a responsible and sustainable OWF setup encapsulates a broad propose for each stakeholder, encompassing distinct interpretations across stakeholders. For instance, the concept holds different implications for Federal agencies like NOAA as opposed to BOEM. NOAA concentrates its endeavours on comprehending the impacts of OWFs on users and marine

ecosystems, aiming to mitigate adverse effects on fisheries. Conversely, BOEM directs its efforts toward driving economic growth and renewable energy, aligning with the Federal Government's 2030 targets. A similar scenario unfolds for offshore developers, whose primary aspiration revolves around realizing projects at a substantial scale and maximizing the potential benefits of OW. Yet, the notion of responsible and sustainable development carries diverse connotations for developers, contrasting with the perspectives of Federal entities like NOAA or BOEM. In essence, each stakeholder is driven by their distinct set of objectives.

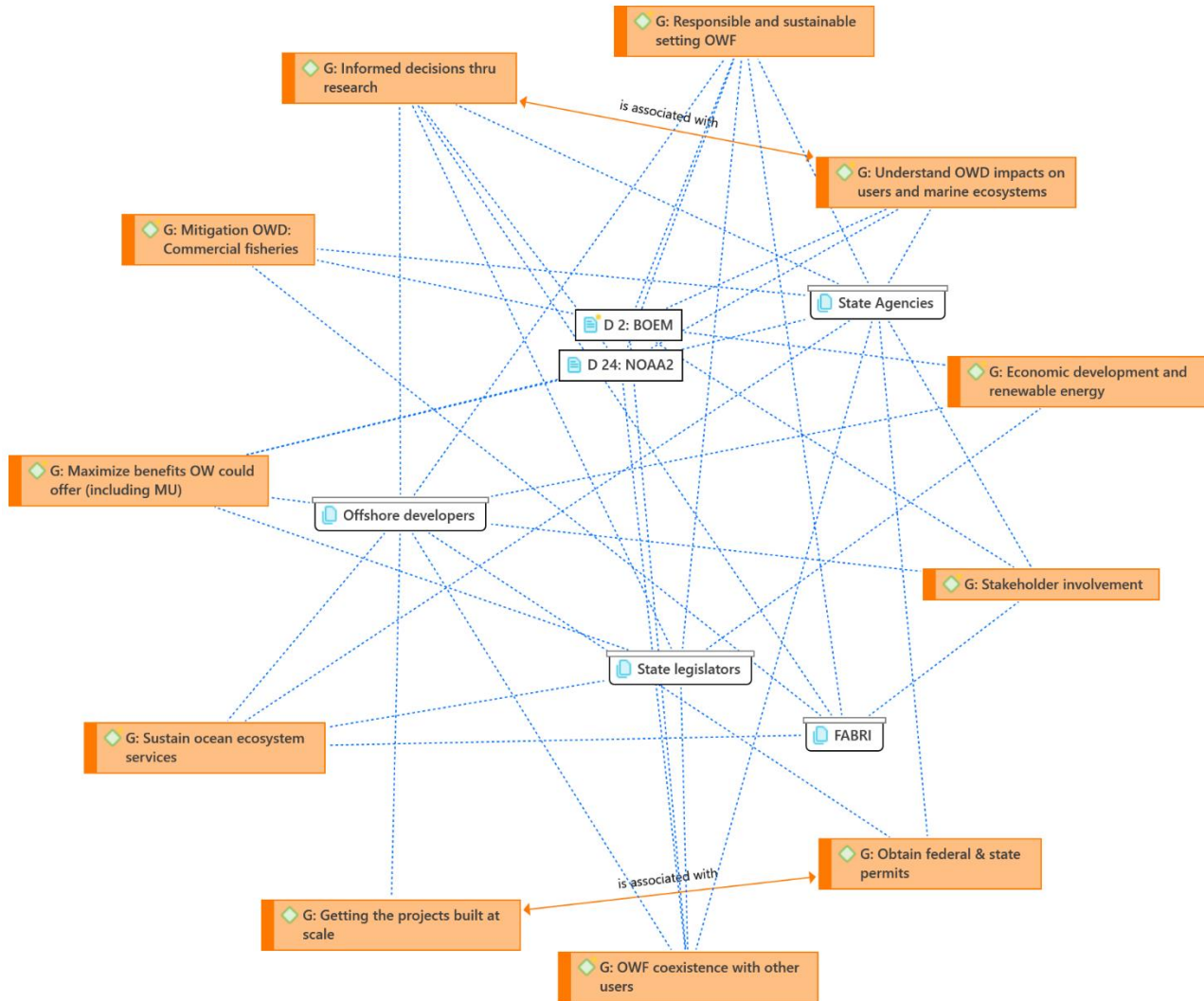


Figure 13: Main goals for stakeholders

Figure 14 (below) illustrates the primary actions proposed by stakeholders to achieve their objectives within OWD in RI context. The key actions suggested by various stakeholders pertain to the following aspects or codes:

1. Inclusive participation and communication: This action is crucial for fostering genuine stakeholder engagement that supports effective decision-making. State, federal agencies and community engagement staff working in OWD recognize the significance of inclusive participation and communication. Among the identified actions, inclusive participation stands out with higher frequency and density than other actions (G-grounded: 41; D-density:2)
2. Streamline regulatory requirements: This action gathers substantial support from stakeholders in most of the cases including offshore developers, legislators, state agencies, federal agencies and new users (seaweed cultivation). However, the rationale behind this action differs among stakeholders. For instance, BOEM aims for a clear pathway to offshore permitting, while offshore developers seek a streamlined regulatory process to reduce permitting requirements.
3. Minimizing OWD impacts and designing compensatory measures: Other notable actions, varying in frequency among stakeholders, revolve around mitigation the impacts of OWD and formulating compensatory measures for fishermen who have lost access to their fishing grounds.
4. Safe navigation design for fishers: For commercial fishers and association of fishermen (FABRI), a pivotal action pertains to ensuring a responsible development of offshore wind particularly by implementing safe navigation designs that reduce risk for fishers on their boats and operations. Offshore developers also share an interest in safe navigation, as they are committed to safeguarding their infrastructure from potential risks.

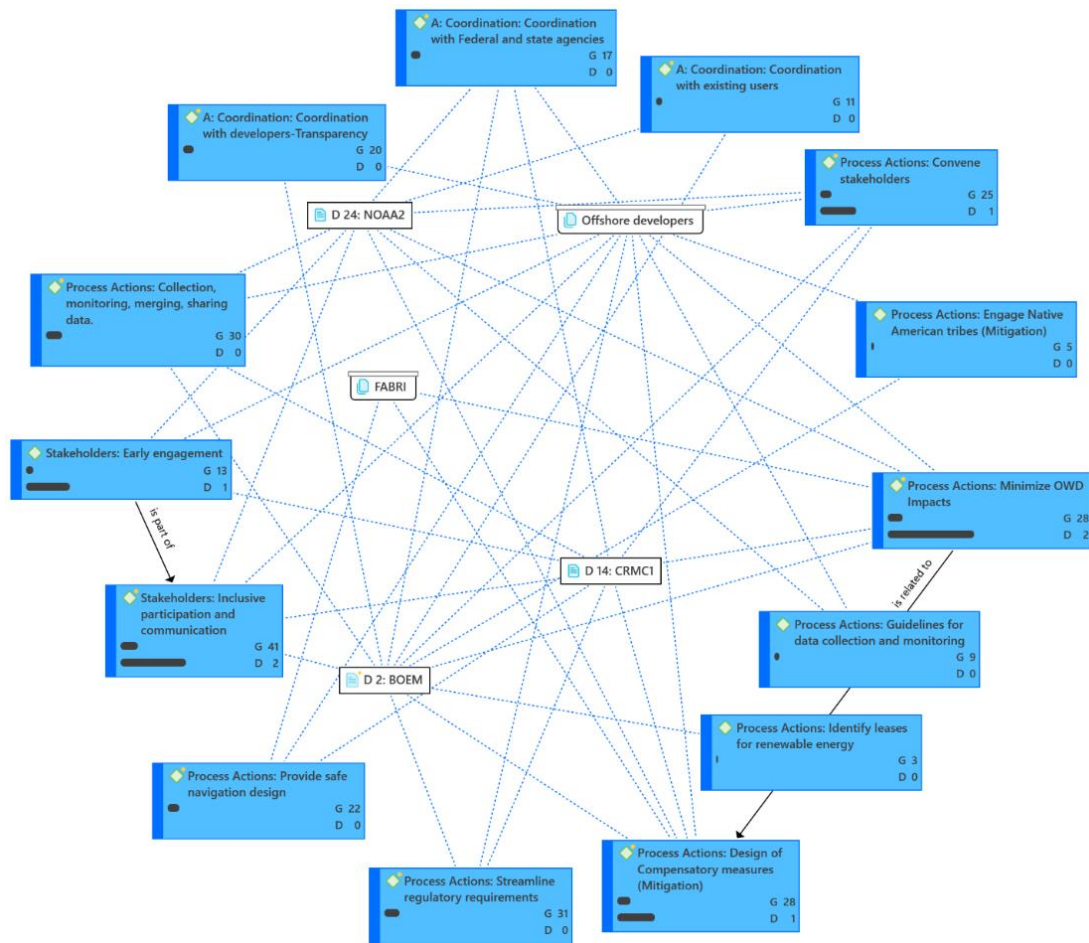


Figure 14: Main actions for stakeholders

After identifying the main factors, actors and goals I employed ATLAS.ti in this thesis to address my research questions. To accomplish this, I utilized Sankey diagrams to conceptualize a cognitive map and visualize the co-occurrence of codes across stakeholders. This aided me in identifying the most crucial factors, goals, and actions in my research.

In this discussion, we will explore the primary goals of various stakeholders and how they relate to actions and factors using Sankey diagrams. For reference and to complete the information in Sankey diagrams, co-occurrence table of goals, actions and factors can be found in Appendix, supplementary material 4.

1. Responsible and sustainable setting OWF (G-grounded: 39; D-density: 3)

Having a responsible and sustainable establishment of OWF as a goal is crucial for NOAA, State agencies, and RI State legislators. In order to achieve this goal, specific stakeholders have identified crucial actions to take. In Figure 15 we can see that the action code "Stakeholder participation and coordination and early engagement" is very important for the stakeholders in the right side of the Sankey diagram. The thickness in the diagram indicates the importance of

that code for the stakeholders. It is acknowledged that communication obstacles exist within the offshore wind industry, which is a crucial aspect for State agencies in RI to overcome in order to facilitate engagement and productive discussions. For example, developers are very reluctant to share information with other stakeholders, and the same is true for fishers. It is interesting that offshore developers believe inclusive participation is for responsible development. This is not surprising, as they also acknowledge communication barriers with other stakeholders. Coincidentally communication hurdles are one of the factors that also have more grounded and density in the documents.

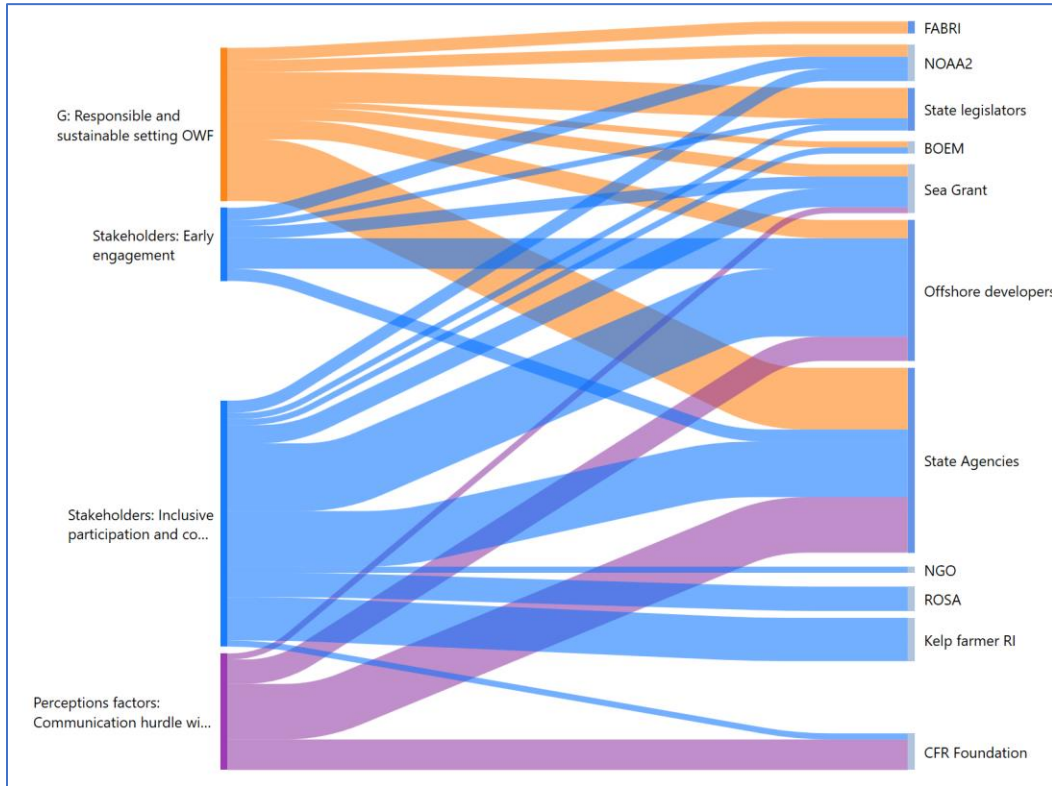


Figure 15: Inclusive participation and early engagement actions (blue); perception factors(purple); goal (orange).

Figure 16 shows that the action code, "collection, monitoring, merging, and sharing data," is crucial for factors like "safe navigation" and "disruption of traditional fishing grounds." This action code is vital for many users, including fishing groups and agencies like NOAA and stage agencies that regulate and support the fisheries in RI. Additionally, this action is essential for the responsible and sustainable development of OWD in Rhode Island, considering the significance of the fisheries sector in the state.

NGOs such as ROSA and CFRF, which are striving to adapt fisheries to the OWI revolution in the ocean, place great importance on data. Utilizing data in their activities gives them the assurance that actions taken by OWI can be sustainable, and disruptions to traditional grounds can be avoided. State agencies and NOAA also recognize the significance of data, ensuring that decision-making regarding permitting is done correctly by possessing the necessary information to provide input into their actions. This includes designing compensatory or mitigation measures for the fishing industry, ensuring safe navigation within or near OWF, and avoiding disrupting traditional fishing grounds. Safe navigation and avoiding disruption of traditional fishing grounds are key priorities for FABRI, ROSA, and CMRF. Interestingly, FABRI does not have a high demand for data, perhaps due to their extensive knowledge of the ocean compared to other stakeholders. However, it is still crucial for them to learn more about navigating without risk and accessing their fishing grounds. Collaboration between FABRI, ROSA, and CRMF could support State agencies and NOAA's actions and main objective of creating a responsible OW setting. These findings are illustrated in Figure 16.

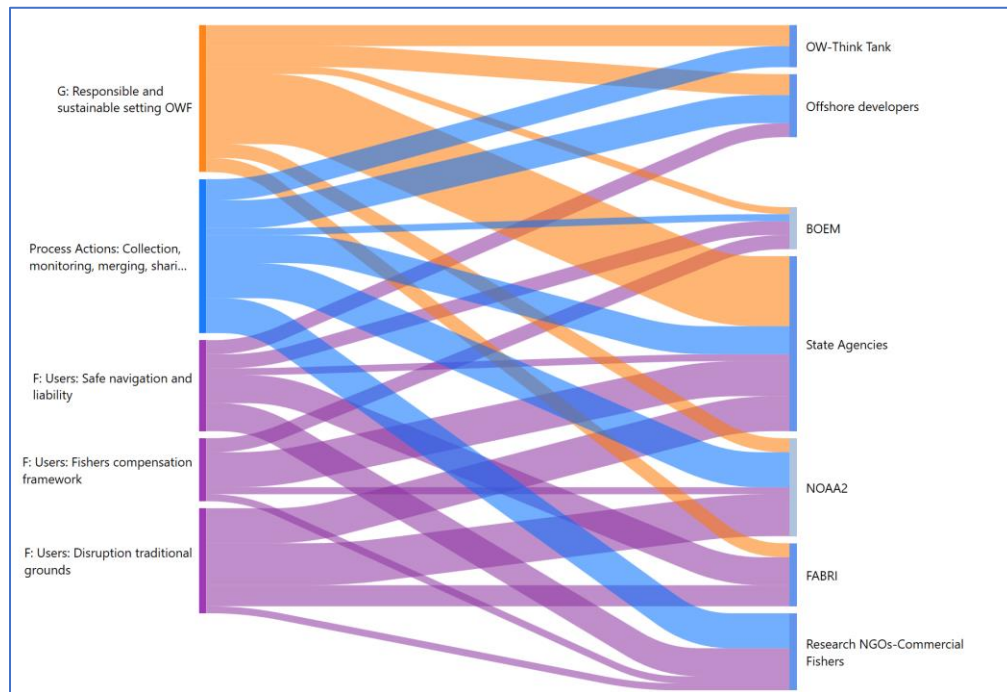


Figure 16: Collection, monitoring, sharing data (blue); user factors (purple); goal (orange).

2. Maximize benefits OW could offer (G-grounded: 25 ; D-density: 2)

In order for stakeholders to maximize benefits of OWD and achieve their goal, it is important for certain stakeholders to establish and create compensatory measures as part of a shared mitigation framework for users, including commercial fishers. BOEM and State Agencies in RI (CRMC) share common perspectives on compensatory measures for fishers affected by OW projects. They advocate for a centralized approach, preferring a single entity or regional fund administrator to manage compensatory funds instead of each state handling its own. They emphasized the need for neutrality in the administrator's role and suggest establishing fair criteria to guide these compensatory measures. BOEM acknowledges the significance of minimizing the impact on both commercial and recreational fishermen and recognizes the current measures in place. The negotiation process between wind energy companies and fisheries groups is critical. However, offshore companies are barely discussing this crucial measure to achieve a common goal, which is to establish responsible and sustainable offshore wind farms. State agencies, such as CRMC, believe that the compensation provided may not be sufficient but consider it the best available option when the disruption of fishing grounds is unavoidable. These findings are illustrated in Figure 17.

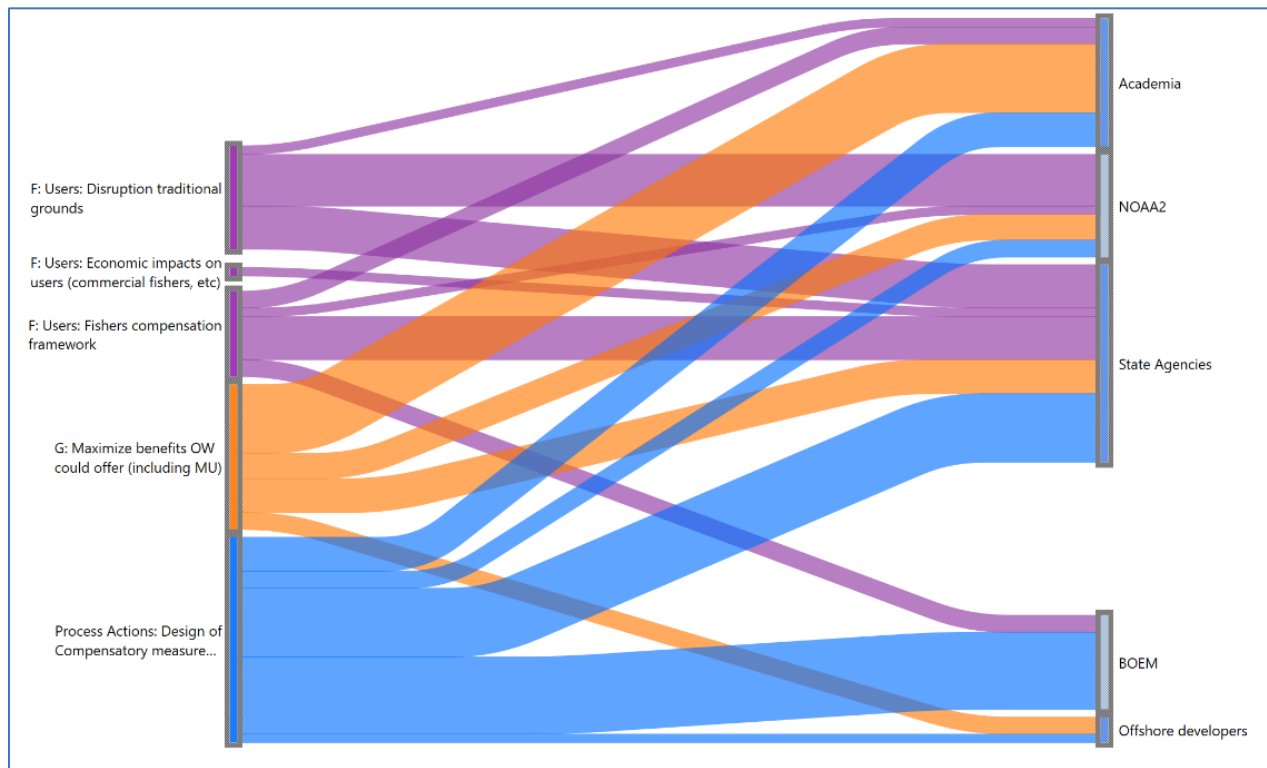


Figure 17: Maximize benefits OW could offer (Action, blue), Goals (orange), Factors (purple).

In Figure 17, the thickness of the lines indicates the frequency of code application. For example, for BOEM, it is essential to create compensatory measures to offset losses for commercial fishers, which is a central concern. The same applies to state agencies. However, NOAA does not

view this as a principal action because it prioritizes preventing the disruption of traditional grounds, which is the main source of livelihood for commercial fishers.

3. Obtain federal and state permits (G-grounded: 20 ; D-density: 1)

Developers, consultancies, and state agencies all consider achieving this goal to be crucial for various reasons. Figure 18 displays the thickness of two significant factors, namely "complex regulatory process" and "perception of time as a challenge." This is noteworthy because one of the most important actions suggested by stakeholders to achieve this goal is to streamline regulatory requirements. It is commonly agreed that the complexity of the regulatory process poses a challenge to the OWD process in RI. Offshore developers find it particularly burdensome due to the deadlines they must meet for their projects. State agencies and NOAA also perceive time as a challenge due to the pressure they face to review hundreds of documents to advise BOEM on granting permits for development. Obtaining federal and state permits is essential for two different reasons: one from the perspective of pressure to make decisions and the other from the perspective of developers rushing to construct the projects. The goal of constructing the projects is also related to streamlining the regulatory process. Without streamlining the process, it is challenging for everyone to achieve the goal of building the projects on a large scale. These findings are depicted in Figure 18 by the thickness of the Sankey diagram.

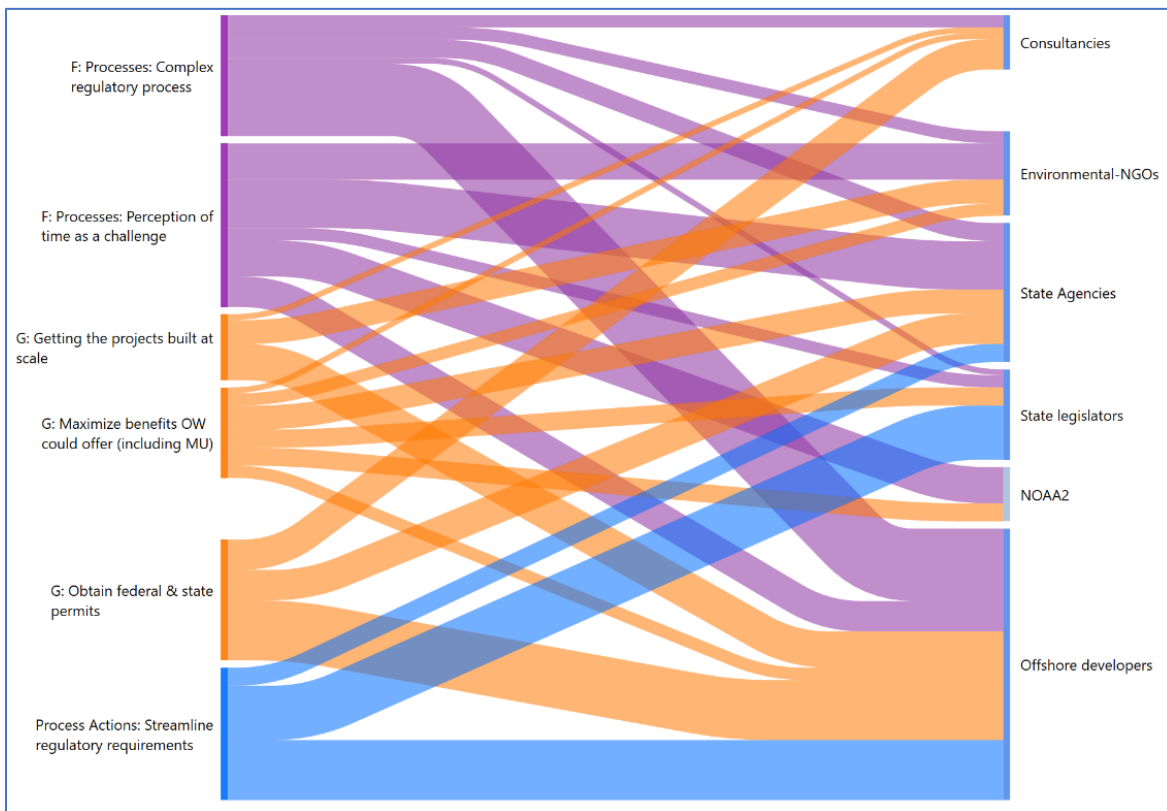


Figure 18: Obtain federal and state permits (Action, blue), Goals (orange), Factors (purple).

4. Informed decisions through research (G-grounded: 23 ; D-density: 2)

During the interviews with stakeholders, it was emphasized that making informed decisions through research is crucial as a goal, and that fishermen should be involved in research related to offshore wind farms. The CFR Foundation working with commercial fishers places great importance on promoting informed decisions based on research, which also can guaranteed the coexistence of users in OW industry.

ROSA aims to enhance knowledge by taking actions that promote communication and sharing among different stakeholder groups involved in Offshore Wind Development (OWD). The Offshore developers prioritize inclusive participation and communication as they feel that it is something they lack, and often face criticism for it. In Figure 19, both ROSA and CRMF Foundation emphasize the significance of research in OWD and encourage the involvement of fishermen in scientific studies. They emphasize engaging stakeholders, promoting knowledge sharing, and prioritizing research to make informed decisions.

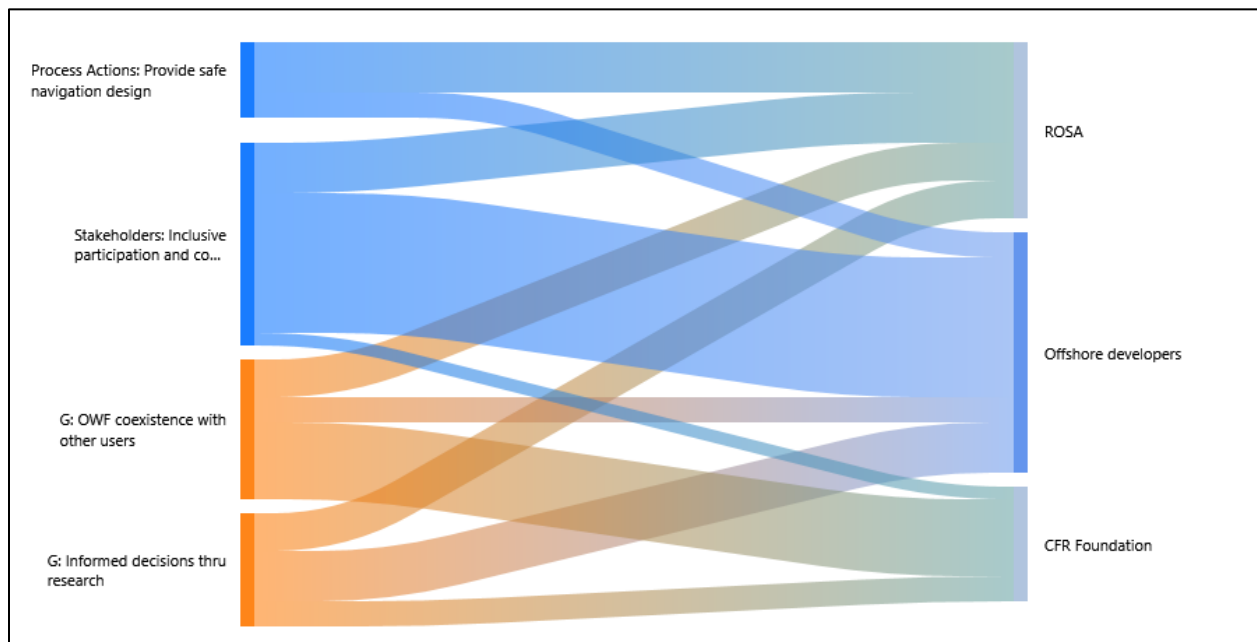


Figure 19: Informed decisions through research (Action, blue), Goals (orange), Factors (purple).

4.6 Potential for Multi-Use in Rhode Island

A group consisting of Academia, Federal and State agencies, Kelp farmers, and Research NGOs foundation advocates for MU as a means to maximize the benefits that OW can offer. They believe incorporating other activities, such as seaweed farming, can lead to synergies, cost reduction, and more job opportunities. To achieve this objective, a regulatory framework for MU should be established to guide the synergies as is shown in Figure 20 where main actions for implementing MU in RI are represented. To accomplish this, experimental MU should be funded, and an agency that leads should be created to manage activities within OWF. NOAA sees itself as an agency that can lead or organize activities for MU.

Some stakeholders are skeptical about the practicability of MU and have raised concerns about potential challenges. Their main points of concern include the environmental impact, regulatory frameworks, and technical constraints (SLOW and ROSA). The Environmental NGO is focused on promoting nature restoration and achieving a net positive impact in OWF but acknowledges the need for a regulatory framework and funding.

Finally, there is a group that has doubts about the practicality of MU endeavors in OWF, although they do not outright object to it. Their stance at the present moment is that the primary focus should be improving offshore wind energy generation rather than expanding activities (Offshore wind developers). They have reservations about potential conflicts of interest, limited space, and technological limitations. This group advocates for devoting resources solely to wind energy production to achieve superior results and to prioritize meeting renewable energy objectives and it has not representation in Figure 20.

It is interesting to note that according to FABRI, the current generation of fishers finds it impractical to engage in MU activities due to the high risk and liability involved. However, these individuals have expressed their belief in activities that promote carbon sequestration, such as kelp farming.

In the Appendix of supplementary material 5, it shows a summarized table outlining the primary activities required to promote multiuse and the main stakeholders advocating for the MU framework.

4.7 Discussion: an answer to research questions

This study have been done on the premise that by understanding the perspectives of actors, their actions and objectives, it could support the integration of marine governance and facilitate MSP. This would assist the process of OWD during the initial stages an improve or promote MSP in federal and state waters. Moreover, the results inform about perspectives of stakeholders regarding the potential implementation of MU experiences, that also can be useful to improve marine governance and support MSP within OWF.

The following questions will be discussed as part of the main research:

1. *What common stakeholders perspectives connect their actions and objectives to OWD in Rhode Island?*
- Offshore wind industry (developers) should acknowledge the communication hurdles with stakeholders (States, FABRI). They believe that inclusive participation should happen to promote Responsible and sustainable setting OWF but practice according to other stakeholders fall short. This perspective reveals that if effectively offshore developers wish to responsible and sustainable setting of OWD, they should play a more active role in early engagement with users of the ocean space, transparency and collaboration.
 - Research institutes and NGOs working with fishers that strive to adapt fisheries to the OWI that is coming are key organizations playing a role that connect fishers with offshore wind developers. The action of sharing data and engaging in a dialogue with OWI since the beginning can give them assurance to both that actions taken by OWI can be sustainable and disruptions to traditional grounds can be minimized or avoided and have a guarantee of safe navigation within OWF and contribute to the objective of responsible and sustainable setting of OWD.
 - When impact is not avoidable, BOEM and State agencies should implement actions looking for common perspectives of compensatory measures for fishers affected by OW projects, advocating for a centralized approach with a regional fund and a neutral administrator. Offshore companies should enter in this conversation and recognize that these measures are crucial to have the goal of responsible and sustainable setting OWF.
 - State legislators, offshore developers believe that expediting OWD permitting process and improving policy regard to power transmission to the grid is critical and support their common goal: maximize benefits that OW can offer. Additionally, streamline permitting requirements and reduce the number of permits needed as well as the leasing process will facilitate a smother and quicker development. However in the opposite side, and recognizing that the decision making process and the permitting process is complex, NOAA and CRMC believe that time pressure and lack of staff complicated the process and

time pressure does not help to review the necessary permits and have the adequate evaluation of the projects. CRMC and NOAA share common objectives, with responsible OWD management being a top priority.

- The regulatory framework for OW involves multiple federal, state and local jurisdictions. Coordination as an action among different agencies is difficult and challenging. CRMC, the coastal agency of RI, has been involved in the regulatory and permitting process of OWD in state waters. Working closely with BOEM and other stakeholders, CRMC ensures that OWD is conducted with the highest consideration for the environment and the interests of coastal communities, particularly the fishing industry. However, state agencies like CRMC and the Department of Environmental Management (DEM) have expressed criticism towards BOEM's decision-making process concerning OWD. They feel that BOEM has too much authority and needs to improve their approach to decision-making.
- A recent study conducted by Ercolano, (2022) investigated into the conflicts and concerns between fishermen and OWD off the coast of Rhode Island. The study aimed to provide recommendations for preventing spatial and financial concerns and improving the working relationship between maritime stakeholder groups. It revealed that fishermen are worried about the impact of OWD on their fishing grounds, while representatives from the Fishery Advisory Board in Rhode Island (FABRI) expressed concerns about the sustainability of the ocean ecosystem and the services it provides. Interestingly, the FABRI representative's primary concern was to maintain the ocean ecosystem services for the future, which highlights the importance of this issue compared to the economic impacts, which were the primary concern of the fishermen in the Ercolano study.
- Climate change is a major crisis from the point of view of most of the stakeholders and as external factor; they recognize that it is the central crisis of our time, and they believe in offshore wind as a critical solution to combat the crisis; it shows that many stakeholders like ROSA, Environmental NGOs, State agencies and Federal agencies see offshore wind as a key solution.
- The balance of power as external factor in OWD involves key themes. Firstly, there is a recognized divide between state and federal authority. While states recognize that they cannot regulate federal activities in federal jurisdiction, they express concerns about the loss of power and influence that this divide entails. State agencies highlight the jurisdictional divide in regulating OWD and emphasize that this division of power diminishes the power and influence of the state.
- Various stakeholders hold differing opinions regarding the feasibility of offshore wind projects. Environmental NGOs, consultancies, and state legislators express concerns that the absence of a market and infrastructure may hinder the development of such projects.

On the other hand, some stakeholders stress the significance of a local supply chain and skilled labor force in the growth of the offshore wind industry. Additionally, infrastructure development, including cables, substations, and transmission lines, is crucial for connecting offshore wind to the grid and delivering power. Without these in place, the realization of offshore wind projects may face obstacles, but these factors that condition OWD are not influenced for the main stakeholders. Li et al., (2022), discuss the requirements of raw materials of the OWI given the growing demand for renewable energy. OWI demands significant amounts of metals, rare earth elements, and other materials. This could lead to supply chain risks.

2. *What are the stakeholders' primary interests in OWD in Rhode Island?*

Many stakeholders view OWD as a crucial element in incorporating additional sources of renewable energy. However, each stakeholder has their own primary interest in this industry. Offshore wind developers are focused on constructing projects at a large scale, while also decreasing the time required for obtaining federal permits. They desire a clear roadmap towards implementing their projects within a reasonable timeframe. While they strive to understand the needs of users, they sometimes struggle with effective communication, leading to tensions that may hinder the process.

Fishing communities aim to maintain their traditional livelihood despite acknowledging the grave impact of climate change. They prioritize dealing with the effects of climate change over engaging with offshore wind companies. The absence of a federal policy for offshore wind leaves them feeling vulnerable to the threat of losing their livelihood to this emerging industry. Their primary concern is to carry on the fishing practices that have been passed down for generations.

State agencies like DEM, CRMC, and federal agency NOAA aim to adhere to regulations and safeguard the interests of their local users, especially in the case of Rhode Island. As an agency responsible for the ocean, NOAA strives to protect its resources and ensure the responsible development of offshore wind.

Academics and investigators aim to support responsible development of the wind industry while considering the climate emergency. NGOs like TNC are interested in promoting offshore wind in a responsible manner, but they also support experiments that help restore ecosystems impacted by development.

The state aims to promote development in Rhode Island, and OWD presents an opportunity. However, they are committed to responsible development and will promote procurement bids that prioritize responsibility for all stakeholders involved.

3. *What are the interdependencies between stakeholders in OWD in Rhode Island?*

Offshore companies are seeking assistance from consultancies and agencies to obtain the necessary permits for developing lease areas in the state.

Research foundations and fisheries associations are working with commercial fishers to identify areas that are not suitable for offshore wind development and exploring new techniques that don't endanger their boats and adapt to this new industry.

Federal agencies and other agencies rely on studies to advise BOEM on permitting OWD, often facing resource and time constraints.

Stakeholders emphasize the importance of coordination and communication to express their opinions and concerns.

4. *How can MU activities integrated into OWD and what policies support this?*

Among stakeholders of Academia, Federal and State agencies, Kelp farmers, and Research NGOs foundation advocates for MU as a means to maximize the benefits that OW can offer. They believe incorporating other activities, such as seaweed farming, can lead to synergies, cost reduction, and more job opportunities. To achieve this goal, a regulatory framework for MU should be established to guide the synergies. To accomplish this, experimental MU should be funded, and an agency that leads should be created to manage activities within OWF as main actions expressed by stakeholders. NOAA sees itself as an agency that can lead or organize activities for MU.

By addressing these considerations and developing policies that support MU activities, it is possible to ensure the sustainable coexistence of different activities in the marine environment and improve the environmental impacts of industrial processes and ocean use for sustainability and circularity in the context of the expanding blue economy.

4.8 Conclusions

This report explores stakeholder's perspectives, interest, and interdependencies in OWD in Rhode Island, USA and how the concept of MU can be integrated into the industry. The thesis uses actor models and comparative cognitive mapping methodology as the framework to implement this thesis, however reflect stakeholder perspectives can be very challenging in CCM, so the author found that CCM was suitable for all the aspects related to stakeholders in OWD. Assigning values to causal relationships posed a significant challenge. Therefore this thesis adapted the method to focus on extracting results with tools incorporated in the software Atlas.ti for visualization and comparison of results instead of relying on cognitive maps. To reduce bias in the findings the researcher sought input from four stakeholders already interviewed: academia, developers, DEM (RI) and NOAA. Their suggestions were incorporated in the code to correct the codes that were chosen by the author.

Based on the findings, the thesis concludes that stakeholder participation and alignment of perspectives can facilitate the development of policies and guidelines that minimize conflicts and maximize synergies in the early stages of OWD. Understanding the different actor perceptions can help in the integration of marine governance and the utilization of tools like MSP. This thesis also highlights the importance of promoting an integrated approach to governance creating a federal policy that reflects the views and expectations of the stakeholders for OWD and renewables in federal and state waters. Create a federal policy for OWE that includes collaboration between federal and states in managing common interests that concern: ocean space, renewable energy in the ocean, coastal communities and protection of marine ecosystems.

The thesis suggests several common grounds for addressing conflicts in OWD, including collaboration and guidance that aligns with the goals of state agencies and other stakeholders, streamlining policies and promoting collaboration among stakeholders to ensure interconnection, grid integration, and sustainability of marine ecosystems and communities of users such as commercial fishers. For those assessments, the best sound science and data are essential in order to progress toward responsible OWD and reduce uncertainties that create frustration and opposition among stakeholders.

In order to achieve the maximum benefits in the OWD state, legislators should prioritize implementing reforms that work in tandem with one another, instead of assuming that simplifying the system and increasing stakeholder engagement cannot coexist. To simplify the process and increase efficiency for offshore developers, it would be beneficial to streamline permitting requirements and reduce the number of permits needed, as well as improve the leasing process. It is also essential to implement reforms that will facilitate a smoother and quicker process of OWD. It is necessary to simplify the state agencies' permitting requirements by reducing the number of agencies involved and minimizing complexity. The current permitting requirements provoke time constraints and staffing challenges that hinder responsible decision-making in the permitting process. Rushing to obtain permits is not favorable to responsible offshore wind development.

On the other hand, some stakeholders stress the significance of a local supply chain and skilled labor force in the growth of the offshore wind industry. Additionally, infrastructure development, including cables, substations, and transmission lines, is crucial for connecting offshore wind to the grid and delivering power. Without these in place, the realization of offshore wind projects may face obstacles, but these factors that condition OWD are not influenced for the main stakeholders.

Multi-use activities in OWD can bring several benefits to the the emerging OWI, enhancing economic efficiency, maximizing offshore resources and minimizing conflicts. There are several ways to incorporate other activities like aquaculture, kelp farming or research within offshore wind farms. Still, the most relevant for all stakeholders is to design guidelines, start a dialogue and education about the potential of activities of MU in OWF, and finally look for tools or strategies of financing pilot projects that can support research and help to visualize which combination of MU will be possible in the area of study. The priority is now complete large-scale projects of OWD. Most of the stakeholders cannot visualize MU because of the current challenges to deal with.

Offshore renewable energy has the potential to be the greatest ocean-based solution to mitigate carbon emissions in the United States. The current Administration in the United States set an ambitious goal of deploying offshore wind by 2030. Investments can spur innovation, drive economic growth, and ensure U.S. energy security. But the planning, development, and rapid deployment for commercial offshore energy must occur in an equitable way that embraces community and Tribal partnerships throughout project development, conserve and monitors wildlife and biodiversity, and prioritizes ecosystem health.

The conversation and dialogue sould continue about offshore energy deployment at scale. Discussions about the opportunities and challenges that come with this goal, as well as the importance of ensuring equity remains a top priority for the U.S. as the country strive to achieve this goal.

All users or actors using marine space are essential to make decisions when large projects are proposed, such as OWD; reaching agreements is only possible with the collaboration of all stakeholders. Therefore decision-making cannot be arbitrary or rushing into permitting decisions; decisions that could affect many users must be taken by consensus or balancing all the users.

Limitations

In my research, I discovered that the CCM actor model is not ideal for all aspects of offshore wind development (OWD) in Rhode Island, particularly those related to social and regulatory matters. Social issues, such as cultural values and traditions, generational equity, are often challenging to measure and evaluate. While factors like income, economic impact, and disruption to traditional areas may be quantifiable, they do not fully encompass all of the concerns expressed by stakeholders regarding OWD in Rhode Island.

To simplify the process of visualizing and comparing my results, I opted to utilize ATLAS.ti, a software that assists in qualitative data analysis. Using ATLAS.ti allowed me to generate frequency counts automatically, which would have been a time-consuming task if I had used cognitive mapping. However, it should be noted that one drawback of ATLAS.ti is that its visualizations are not as clear or logical as those produced by cognitive maps.

I conducted 21 interviews and the resulting information was extensive. It was time-consuming to work with the codes in ATLAS.ti, as it was my first time using the software. Overall, I found the methodology used for this study to be not the most adequate, and it may be worthwhile to try a similar study with a different actor model and more straightforward coding. Although ATLAS.ti was helpful to me, it was challenging to combine the elements of CCM in the software's graphing capabilities. Although I could map cognitive maps in ATLAS.ti, it was difficult to discern causal relations in this case.

5. References

- Alexander, K. A., Potts, T., & Wilding, T. A. (2013). Marine renewable energy and Scottish west coast fishers: Exploring impacts, Opportunities and potential mitigation. *Ocean and Coastal Management*, 75, 1–10. <https://doi.org/10.1016/j.ocecoaman.2013.01.005>
- Baulaz, Y., Mouchet, M., Niquil, N., & Ben Rais Lasram, F. (2023). An integrated conceptual model to characterize the effects of offshore wind farms on ecosystem services. *Ecosystem Services*, 60, 101513. <https://doi.org/10.1016/J.ECOSER.2023.101513>
- Berkenhagen, J., Döring, R., Fock, H. O., Kloppmann, M. H. F., Pedersen, S. A., & Schulze, T. (2010). Decision bias in marine spatial planning of offshore wind farms: Problems of singular versus cumulative assessments of economic impacts on fisheries. *Marine Policy*, 34(3), 733–736. <https://doi.org/10.1016/j.marpol.2009.12.004>
- Bidwell, D., Smythe, T., & Tyler, G. (2023). Anglers' support for an offshore wind farm: Fishing effects or clean energy symbolism. *Marine Policy*, 151. <https://doi.org/10.1016/j.marpol.2023.105568>
- Bots, P. W. G. (2008). *Analyzing actor networks while assuming "frame rationality"* (Networks in Political Science, Ed.).
- Bureau of Ocean Energy Management. (2022). National Renewable Energy Development Plan: Wind Energy Call Areas Leasing Process. BOEM. <https://www.boem.gov/sites/default/files/oil-and-gas-energy-program/Leasing/Five-Year-Program/2019-2024/DPP/NP-Wind-Energy-Comm-Leasing-Process.pdf>
- Bryson, J. M. (2004). What to do when stakeholders matter: Stakeholder Identificatixon and analysis techniques. *Public Management Review*, 6(1), 21–53. <https://doi.org/10.1080/14719030410001675722>
- Chazan, C. K., & Starr, M. (2022). *THE ROLE OF FEDERALISM IN INITIATING OFFSHORE WIND DEVELOPMENT IN THE UNITED STATES AND EUROPE*.
- Christopher, T., Goldstein, M., Williams, M., & Carter, A. (2022). *The Road to 30 Gigawatts: Key Actions To Scale an Offshore Wind Industry in the United States*. Retrieved July 4, 2023, from <https://www.americanprogress.org/article/the-road-to-30-gigawatts-key-actions-to-scale-an-offshore-wind-industry-in-the-united-states/>
- Claire Haggett, B., ten Brink, T., Russell, A., Roach, M., Firestone, J., Dalton, T., & McCay, B. J. (n.d.). *SPECIAL ISSUE ON UNDERSTANDING THE EFFECTS OF OFFSHORE WIND ENERGY DEVELOPMENT ON FISHERIES OFFSHORE WIND PROJECTS AND FISHERIES* (Vol. 33, Issue 4).
- COASTAL ZONE MANAGEMENT ACT. (n.d.).
- Creswell, J. W. (2009). *Research Design. Qualitative, Quantitative, and Mixed Methods Approaches* (Third Edition). Sage Publications.

- de la Garza, A. (2021, September 30). U.S. Fishermen Are Making Their Last Stand Against Offshore Wind. *TIME*. <https://time.com/6102900/offshore-wind-fishing/>
- Ercolano, E. (2021). *IMPACTS OF OFFSHORE WIND DEVELOPMENT ON FISHERMEN IN MASSACHUSETTS AND RHODE ISLAND AND RECOMMENDATIONS TO MITIGATE SPATIAL AND FINANCIAL CONFLICTS*.
- European Commission (2022). (n.d.). *The EU Blue Economy Report.2022*. <https://doi.org/10.2771/923170>
- European Commission. (2020). Communication from the Commission to the European Parliament and the Council (COM(2020)741). Eur-Lex. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0741&rid=1>
- FACT SHEET: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs* . (2021, March 29). Briefing Room, Statements and Releases.
- FACT SHEET: Biden-Harris Administration Continues to Advance American Offshore Wind Opportunities* . (2023, March 29). Briefing Room, Statements and Realeases. <https://www.whitehouse.gov/briefing-room/statements-releases/2023/03/29/fact-sheet-biden-harris-administration-continues-to-advance-american-offshore-wind-opportunities/>
- Global Wind Energy Council. (2022). Home. <https://gwec.net/>
- Hermans, L. M., & Cunningham, S. W. (2018). *Actor and strategy models: practical applications and step-wise approaches*. (John Wiley & Sons., Ed.).
- Hooper, T., Ashley, M., & Austen, M. (2015). Perceptions of fishers and developers on the co-location of offshore wind farms and decapod fisheries in the UK. *Marine Policy*, 61, 16–22. <https://doi.org/10.1016/j.marpol.2015.06.031>
- IOC-UNESCO. 2022. (2022). *State of the Ocean Report 2022 Pilot edition*. <http://www.unesco.org/open-access/terms-useccbysa-en>
- Jones, P. J. S., Lieberknecht, L. M., & Qiu, W. (2016). Marine spatial planning in reality: Introduction to case studies and discussion of findings. *Marine Policy*, 71, 256–264. <https://doi.org/10.1016/J.MARPOL.2016.04.026>
- Satolli J. (2015). *Teamwork on the North Sea A search for the understanding of key challenges for self-organization between relevant stakeholders necessary for rolling out a North Sea Offshore Grid*.
- Kim, T., Park, J. Il, & Maeng, J. (2016). Offshore wind farm site selection study around Jeju Island, South Korea. *Renewable Energy*, 94, 619–628. <https://doi.org/10.1016/j.renene.2016.03.083>
- Kyriazi, Z., Maes, F., & Degraer, S. (2016). Coexistence dilemmas in European marine spatial planning practices. The case of marine renewables and marine protected areas. *Energy Policy*, 97, 391–399. <https://doi.org/10.1016/j.enpol.2016.07.018>
- Li, C., Mogollón, J. M., Tukker, A., Dong, J., von Terzi, D., Zhang, C., & Steubing, B. (2022). Future material requirements for global sustainable offshore wind energy development. *Renewable and Sustainable Energy Reviews*, 164. <https://doi.org/10.1016/j.rser.2022.112603>

- Olsen, S. B., McCann, J. H., & Fugate, G. (2014). The State of Rhode Island's pioneering marine spatial plan. *Marine Policy*, 45, 26–38. <https://doi.org/10.1016/j.marpol.2013.11.003>
- O'Shea, R., Collins, A., & Howe, C. (2022). Offshore Multi-use setting: Introducing integrative assessment modelling to alleviate uncertainty of developing Seaweed Aquaculture inside Wind Farms. *Environmental Challenges*, 8. <https://doi.org/10.1016/j.envc.2022.100559>
- Ostrom, E. (1999). COPING WITH TRAGEDIES OF THE COMMONS. In *Annu. Rev. Polit. Sci.* (Vol. 2). www.annualreviews.org
- Przedzimirska, J., Zaucha, J., Depellgrin, D., Fairgrieve, R., Kafas, A., Calado, H. M. G. P., de Sousa Vergílio, M. H., Varona, M. C., Lazić, M., Schultz-Zehden, A., Papaioannou, E., Bocci, M., Läkamp, R., Giannelos, I., Kovacheva, A., & Buck, B. (2018). Multi-use of the sea: from research to practice. *SHS Web of Conferences*, 58, 01025. <https://doi.org/10.1051/shsconf/20185801025>
- Ryan, K., Bates, A., Gopnik, M., Danylchuk, A., & Jordaan, A. (2019). Stakeholder Perspectives on the Value of Marine Spatial Planning Towards Advancing Offshore Wind in the U.S. *Coastal Management*, 47(3), 269–291. <https://doi.org/10.1080/08920753.2019.1596675>
- Sabatier, P. A. (2007). *Theories of the policy process*. Westview Press.
- Schultz-Zehden, A., & Lukic, I. (2018). *Ocean Multi-Use Action Plan, MUSES project*.
- Schumann, S., Smythe, T., Andrescavage, N., Fox, C., & McCann, J. (n.d.-a). *The Rhode Island Ocean Special Area Management Plan, 2008-2015: From Inception through Implementation*.
- Schupp, M. F., Bocci, M., Depellegrin, D., Kafas, A., Kyriazi, Z., Lukic, I., Schultz-Zehden, A., Krause, G., Onyango, V., & Buck, B. H. (2019a). Toward a common understanding of ocean multi-use. *Frontiers in Marine Science*, 6(APR). <https://doi.org/10.3389/fmars.2019.00165>
- Schupp, M. F., Kafas, A., Buck, B. H., Krause, G., Onyango, V., Stelzenmüller, V., Davies, I., & Scott, B. E. (2021). Fishing within offshore wind farms in the North Sea: Stakeholder perspectives for multi-use from Scotland and Germany. *Journal of Environmental Management*, 279. <https://doi.org/10.1016/j.jenvman.2020.111762>
- Schupp, M. F., Krause, G., Onyango, V., & Buck, B. H. (2021). *Dissecting the offshore wind and mariculture multi-use discourse: a new approach using targeted SWOT analysis*. <https://doi.org/10.1007/s40152-021-00218-1>/Published
- Simon, H. A. (1972). *Theories of Bounded Rationality* (CB McGuire and R. Radner, Ed.). North Holland Publishing Company.
- Smythe, T., Bidwell, D., & Tyler, G. (2021). Optimistic with reservations: The impacts of the United States' first offshore wind farm on the recreational fishing experience. *Marine Policy*, 127. <https://doi.org/10.1016/j.marpol.2021.104440>
- Smythe, T. C., & McCann, J. (2019). Achieving integration in marine governance through marine spatial planning: Findings from practice in the United States. *Ocean & Coastal Management*, 167, 197–207. <https://doi.org/10.1016/j.OCECOAMAN.2018.10.006>

- Spijkerboer, R. C. (2021). The Institutional Dimension of Integration in Marine Spatial Planning: The Case of the Dutch North Sea Dialogues and Agreement. *Frontiers in Marine Science*, 8. <https://doi.org/10.3389/fmars.2021.712982>
- Steins, N. A., Veraart, J. A., Klostermann, J. E. M., & Poelman, M. (2021). Combining offshore wind farms, nature conservation and seafood: Lessons from a Dutch community of practice. *Marine Policy*, 126. <https://doi.org/10.1016/j.marpol.2020.104371>
- Stelzenmüller, V., Gimpel, A., Haslob, H., Letschert, J., Berkenhagen, J., & Brüning, S. (2021). Sustainable co-location solutions for offshore wind farms and fisheries need to account for socio-ecological trade-offs. *Science of The Total Environment*, 776, 145918. <https://doi.org/10.1016/J.SCITOTENV.2021.145918>
- Stuiver, M., Soma, K., Koundouri, P., van den Burg, S., Gerritsen, A., Harkamp, T., Dalsgaard, N., Zagonari, F., Guanache, R., Schouten, J. J., Hommes, S., Giannouli, A., Söderqvist, T., Rosen, L., Garção, R., Norrman, J., Röckmann, C., de Bel, M., Zanuttigh, B., ... Møhlenberg, F. (2016). The governance of multi-use platforms at sea for energy production and aquaculture: Challenges for policy makers in European Seas. *Sustainability (Switzerland)*, 8(4). <https://doi.org/10.3390/su8040333>
- Thissen W, & Walker W. (2013). *Public Policy Analysis* (W. A. H. Thissen & W. E. Walker, Eds.; Vol. 179). Springer US. <https://doi.org/10.1007/978-1-4614-4602-6>
- Tyler, G., Bidwell, D., Smythe, T., & Trandafir, S. (2022). Preferences for community benefits for offshore wind development projects: A case study of the Outer Banks of North Carolina, U.S. *Journal of Environmental Policy and Planning*, 24(1), 39–55. <https://doi.org/10.1080/1523908X.2021.1940896>
- UNESCO-IOC/European Commission. (2021). MSPglobal International Guide on Marine/Maritime Spatial Planning. In Paris, Unesco. (*IOC Manuals and Guides, no 89*).
- United. (n.d.). Retrieved July 4, 2023, from <https://www.h2020united.eu/>
- van den Burg, S. W. K., Röckmann, C., Banach, J. L., & van Hoof, L. (2020). Governing Risks of Multi-Use: Seaweed Aquaculture at Offshore Wind Farms. *Frontiers in Marine Science*, 7. <https://doi.org/10.3389/fmars.2020.00060>
- van Hoof, L., Steins, N. A., Smith, S., & Kraan, M. (2020). Change as a permanent condition: A history of transition processes in Dutch North Sea fisheries. *Marine Policy*, 122. <https://doi.org/10.1016/j.marpol.2020.104245>
- Vázquez-Rowe, I., Parker, R., Hamilton, H., & Liu, H. (2022). Industrial ecology for the oceans. In *Journal of Industrial Ecology* (Vol. 26, Issue 6, pp. 1842–1846). John Wiley and Sons Inc. <https://doi.org/10.1111/jiec.13301>
- Wilber, D. H., Brown, L., Griffin, M., Decelles, G. R., & Carey, D. A. (2022). Demersal fish and invertebrate catches relative to construction and operation of North America's first offshore wind farm. *ICES Journal of Marine Science*, 79(4), 1274–1288. <https://doi.org/10.1093/icesjms/fsac051>
- Zhang, Y., Zhang, C., Chang, Y. C., Liu, W. H., & Zhang, Y. (2017). Offshore wind farm in marine spatial planning and the stakeholders engagement: Opportunities and challenges for Taiwan. *Ocean and Coastal Management*, 149, 69–80. <https://doi.org/10.1016/j.ocecoaman.2017.09.014>

6. Appendixes

Supplemental material 1

Table: Initial list of organizations with stakeholders involved in the development of offshore wind farms in federal waters of Rhode Island

Actor	Description of Key Role (s)
U.S. Department of the Interior- Bureau of Ocean Energy Management	Managing the nation's offshore energy resources including wind. Responsibilities include: leasing, EIAs, permitting, revenue management.
Offshore wind Developers	OWD have goals of provide a source of clean and renewable energy, reducing emissions and promote economic development in Rhode Island
State of Rhode Island Department of Environmental Management	DEM oversees environmental review and permitting process for offshore wind projects in Rhode Island waters. DEM engages in public outreach and education to inform stakeholders.
Rhode Island Coastal Resources Management Council	CRMC is responsible for issuing permits for offshore wind energy in state waters. CRMC conducts environmental reviews and assesses potential impacts on coastal and marine resources. Works closely with other agencies such as BOEM and DEM.
Academia (University of Rhode Island)	Research and educative institution that is critical in advancing offshore wind energy development in the state through research, education, and collaboration with industry and government partners.
Planning and economic development City Hall Newport, Rhode Island	An office dedicated to improving the economic well-being and quality of life for Newport residents
Rhode Island Sea Grant	Conduct research, provide technical assistance, and engage with stakeholders and the public to promote the sustainable development of marine resources
Fisheries Advisory Board (FAB)- CRMC	FAB ensures that offshore wind projects in the state are developed to minimize impacts on fishery resources and the fishing industry.
Rhode Island Senate Senate Environment Committee	Creation and design of policies in line with the Energy policies and the Act on Climate legislation of Rhode Island. Energy demand procurements.
Commercial Fisheries Research Foundation (CFRF), Rhode Island	CFRF conducts research and provides scientific data to support sustainable commercial fishing practices in the State. CFRF advocates for the fishing industry in RI, including measures to minimize impacts and fair compensation
Responsible Offshore Science Alliance, ROSA	A regional organization that promotes science-based decision-making and facilitates collaboration among stakeholders to ensure that offshore wind development is conducted responsibly and sustainably.
Environmental Consultants, Rhode Island	Consultants work for developers in environmental impact assessments needed to obtain the permits that BOEM requires to obtain the permitting to develop a commercial offshore wind farm

Offshore wind Policy
The Nature Conservancy

The Nature Conservancy (TNC) collaborates with stakeholders, offshore wind developers, and federal agencies responsible for leases and permits to ensure that offshore wind development is conducted while reducing dependence on fossil fuels and maximizing environmental and community benefits.

Special Initiative Offshore Wind (SLOW)

The Special Initiative on Offshore Wind (SLOW) is an independent organization that provides objective strategic guidance on offshore wind issues. SLOW facilitates a regional approach to fisheries compensatory mitigation for East Coast states.

NOAA Fisheries
Greater Atlantic Regional Fisheries Office (GARFO)

GARFO monitors offshore wind projects to ensure compliance with fishing and marine resources regulations and enforces regulations when necessary to protect marine species.

Supplemental material 2
Interview to stakeholders

Multi-Use as an integrated solution to reduce conflicts among stakeholders.

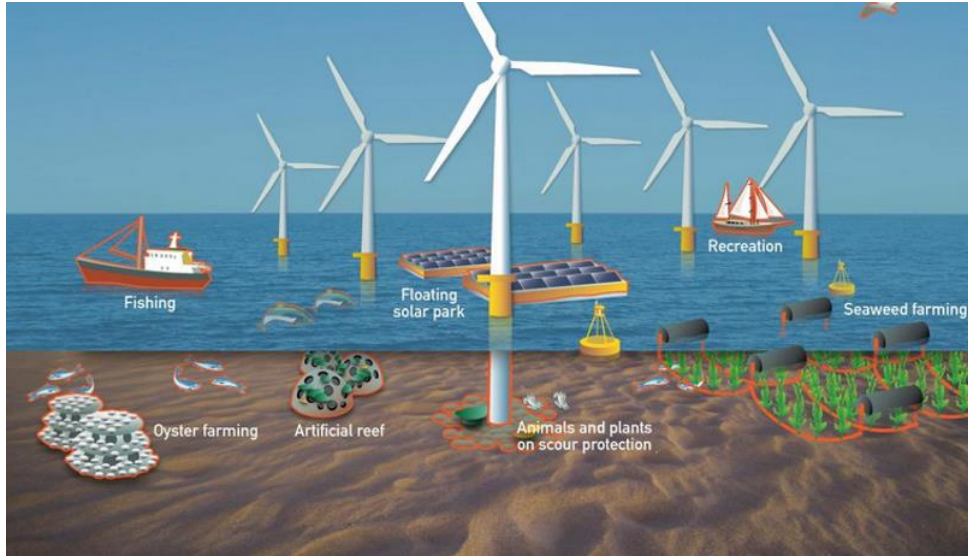
Interview Questions – Draft- Lola Herrera-Ximenez

I. Context questions - general questions to stakeholders Offshore wind development in RI- Intro current situation _	
1.	What is your title, and what do you do?
2.	Can you explain what is happening in OWD in RI and what you are doing about that?
3.	What is your organization’s role in RI OWD, and why do you care about OWD in RI?
4.	What are your objectives (as a professional or as part of your organization) in RI OWD projects?
5.	Are these objectives equally important, or are there ones that you need to care about more?
6.	Which actions will be positive to develop OW, and why would they work?
7.	Who/What among the stakeholders should take action to develop OW successfully/sustainably in RI?
8.	What stands in the way of the successful planning of OWD in RI? Why?

Definition of Multi-Use (MU): Read to the stakeholders and show them the picture

Multi-Use refers to the combination of multiple marine activities in the same area (multi-use; MU) or the “joint use of resources in close geographic proximity by either a single user or multiple users” (Shupp et al., 2019)

[United project](#) - Definition of multi-use by the project h2020United- Horizon 2020 program (EU)



An example of Multi-Use

II. Questions about Multi-Use for all the stakeholders (Questions adapted from Schupp, 2021)	
9.	Do you see added value for society, the state economy, and local communities in developing MU in the case study area? Why? How do you think MU would contribute to the blue economy? (At the local/regional/national scale)
10.	Is you/your organization open to ideas for establishing Multi-Use activities in Offshore Wind Energy projects in RI? Yes/No, Why? (oyster beds, seaweed aquaculture, kelp cultivation, commercial fisheries, recreational fisheries, reefs, marine reserves, and others)
11.	What actions would promote MU/ or improve the environmental compatibility of marine activities and users of RI OWD area?
12.	Which actor(s) do you consider particularly important to develop/widen/strengthen MU in the RI OWD area?

Supplemental material 3
Book of codes

Book of Codes: Offshore wind development in RI and Multi_Use

<p>Actions Coordination</p> <ul style="list-style-type: none"> A: Coordination: Cooperation fishing groups A: Coordination: Coordination between research institutions A: Coordination: Coordination States involvement A: Coordination: Coordination with developers-Transparency A: Coordination: Coordination with existing users A: Coordination: Coordination with Federal and state agencies A: Coordination: Developing regional -marine planning A: Coordination: Interdisciplinary collaboration A: Coordination: Working with consultancies 	<p>Decision making process factors</p> <ul style="list-style-type: none"> Decision making process: Government decision-making & OWD strategy criticized Decision making process: Inclusive Planning and Decision-making Decision making process: Opposition and confrontation Decision making process: Power of BOEM Environmental Impacts OWD: Environmental Impacts OWD:: Ecosystem Changes & Threat to critical sps Environmental Impacts OWD:: Sustainability of OWD
<p>Actions Multi-use</p> <ul style="list-style-type: none"> A: Multi-use: Engagement Regional Planning A: Multi-use: Funding for experimental Multi-use A: Multi-use: Guidelines Multi-use experiences A: Multi-use: Increasing awareness Multi-Use A: Multi-use: Leadership for MU A: Multi-use: Marine Protected Areas A: Multi-use: More opportunities for research A: Multi-use: Nature restoration-net positive impact A: Multi-use: Oceanographic surveys-Coexistence A: Multi-use: Potential offshore aquaculture A: Multi-use: Regulatory framework for Multi-use A: Multi-use: Seaweed farming 	<p>External Factors</p> <ul style="list-style-type: none"> ExternalF: Balance of power ExternalF: Climate change ExternalF: Macroeconomics-inflation rates ExternalF: Reliability of Infrastructure ExternalF: Reliability of supply chain ExternalF: Shared goals by actors ExternalF: Uncertainties&misinformation
<p>Benefits OWD factors:</p> <ul style="list-style-type: none"> Benefits OWD:: Comprehensive approach to marine ecosystems Benefits OWD:: Frequency of recreational fishing vessels Benefits OWD:: Increasing renewable energy supply Benefits OWD:: OWD Cooperation thru data sharing Benefits OWD:: Potential for synergies (Coexistence&MU) Benefits OWD:: Promoters of Blue Economy Benefits OWD:: Promoting Energy Security Benefits OWD:: Slow down climate change 	<p>Factors related to Processes in OWD</p> <ul style="list-style-type: none"> F: Processes: Applicability of MU F: Processes: Collaborative Resource Utilization F: Processes: Collaborative-Holistic decision-making process F: Processes: Combining expertise for plan MU F: Processes: Complex regulatory process F: Processes: Effectiveness of energy procurement F: Processes: Lack of instruments/tools to finance MU F: Processes: Level of economic impact F: Processes: Long and Cumbersome permitting process F: Processes: Perception of time as a challenge F: Processes: Staffing and funding readiness F: Processes: Trained personal and labor force

Book of Codes: Offshore wind development in RI and Multi_Use

<p>Factors related to Users in OWD F: Users: Balance energy vs food F: Users: Disruption traditional grounds F: Users: Economic impacts on users (commercial fishers, etc) F: Users: Fishers compensation framework F: Users: Income fishers F: Users: Safe navigation and liability F: Users: Scenic View Preservation</p>	<p>Legal&Reg factors Legal&Reg factors: Constraints state regulations Legal&Reg factors: Federal ocean energy policy Legal&Reg factors: Limitations Federal Consistency Legal&Reg factors: Litigation threat Perceptions factors Perceptions factors: Communication hurdle with OWD Perceptions factors: Community values&traditions limitations Perceptions factors: Inter-generational equity Perceptions factors: Lacking trust</p>
<p>Goals stakeholders G: Balance Energy security and food security. G: Climate mitigation by OWD G: Economic development and renewable energy G: Education and awareness G: Follow mandate from Congress and Fed government G: Getting the projects built at scale G: Informed decisions thru research G: Maximize benefits OW could offer (including MU) G: Meet climate goals states-Decarbonization G: Mitigation OWD: Commercial fisheries G: Nature inclusive design projects G: NOAA leading agency G: Obtain federal & state permits G: Outreach G: OWF coexistence with other users G: Prioritize compliance with regulations and Acts G: Protection endangered or managed sp. G: Responsible and sustainable setting OWF G: Reviewing OWD projects (federal consistency) G: Science Gaps G: Stakeholder involvement G: Support decision making G: Sustain ocean ecosystem services G: Understand OWD impacts on users and marine ecosystems</p>	<p>Process OWD Actions Process Actions: Collection, monitoring, merging, sharing data. Process Actions: Convene stakeholders Process Actions: Design Environmental Monitoring (Mitigation) Process Actions: Design of Compensatory measures (Mitigation) Process Actions: Develop a procurement system targeting specific needs(for instance MU) Process Actions: Developing best practices Process Actions: Engage Native American tribes (Mitigation) Process Actions: Evaluate OWD impacts Process Actions: Guidelines for data collection and monitoring Process Actions: Identify leases for renewable energy Process Actions: Innovate and adapt to mitigate Process Actions: Minimize OWD Impacts Process Actions: Participation thru NEPA comments Process Actions: Provide safe navigation design Process Actions: Streamline regulatory requirements</p>
	<p>Science factors related to OWD Science factors: Science Data Gaps Science factors: Spatial Planning Integration</p>
	<p>Stakeholders participation Stakeholders: Early engagement Stakeholders: Inclusive participation and communication</p>

Supplemental material 4
 Co-occurrence Analysis

	Decision making process: Government decision-making & OWD strategy criticized Gr=21	Decision making process: Opposition and confrontation Gr=22	Decision making process: Power of BOEAM Gr=27	Environmental Impacts OWD: Ecosystem Changes & Threat to critical sps Gr=21	F: Processes: Collaborative-Holistic decision-making process Gr=19	F: Processes: Complex regulatory procurement Gr=23	F: Processes: Effectiveness of energy challenge Gr=22	F: Users: Perception of time as a challenge Gr=20	F: Users: Disruption traditional grounds framework Gr=12	Legal&Reg factors: common mitigation Gr=21	Perceptions factors: Litigation threat hurdle with OWD Gr=24	Perceptions factors: Communication values&traditions limitations Gr=26	Science factors: Science Data Gaps Gr=20
• G: Getting the projects built at scale Gr=15	0	0	0	0	0	0	2	0	0	0	1	0	0
• G: Informed decisions thru research Gr=23	0	0	0	0	0	0	0	0	1	0	0	0	2
• G: Maximize benefits OW could offer (including MU) Gr=25	0	0	0	0	0	0	1	0	0	0	0	0	0
• G: Obtain federal & state permits Gr=20	0	0	0	0	1	0	0	0	0	0	0	0	0
• G: Responsible and sustainable setting OWF Gr=39	2	0	0	2	0	1	0	0	0	0	0	0	0
• G: Support decision making Gr=10	0	0	0	0	0	0	0	0	0	0	0	0	2
• G: Understand OWD impacts on users and marine ecosystems Gr=15	0	0	0	0	0	0	0	2	1	0	0	0	1
• Process Actions: Collection, monitoring, merging, sharing data. Gr=30	0	1	0	1	0	0	1	0	0	0	0	0	2
• Process Actions: Convene stakeholders Gr=25	0	0	0	0	0	1	0	0	0	0	1	0	0
• Process Actions: Design of Compensatory measures (Mitigation) Gr=28	1	0	0	1	0	0	0	0	3	0	0	0	0
• Process Actions: Develop a procurement system targeting specific needs (for instance MU) Gr=12	0	0	0	0	0	3	0	0	0	0	0	0	0
• Process Actions: Innovate and adapt to mitigate Gr=14	0	0	0	0	0	0	0	0	0	0	0	0	1
• Process Actions: Minimize OWD Impacts Gr=28	0	0	0	0	0	0	0	0	1	0	0	0	0
• Process Actions: Provide safe navigation design Gr=23	0	0	0	0	0	0	0	3	0	1	1	0	1
• Process Actions: Streamline regulatory requirements Gr=31	0	0	1	0	0	3	2	2	0	0	1	1	0
• Stakeholders: Early engagement Gr=13	0	0	1	0	0	0	0	0	2	0	0	0	0
• Stakeholders: Inclusive participation and communication Gr=41	0	0	1	0	1	0	0	1	0	0	4	1	0

Supplemental material 5

Primary activities required to promote multiuse and the main stakeholders advocating for the MU framework.

	BOEM Gr=69		Academia Gr=139; GS=3		Commercial fishers Ass Gr=86; GS=1		Consultancies Gr=106; GS=2		Environmental-NGOs Gr=81; GS=1		Federal agencies Gr=256; GS=3		Offshore developers Gr=208; GS=3		OW-Think Tank Gr=45; GS=1		Research NGOs-Commercial Fishers Gr=113; GS=2		State Agencies Gr=277; GS=3		Totals	
	Absolute	Table-relative	Absolute	Table-relative	Absolute	Table-relative	Absolute	Table-relative	Absolute	Table-relative	Absolute	Table-relative	Absolute	Table-relative	Absolute	Table-relative	Absolute	Table-relative	Absolute	Table-relative	Absolute	Table-relative
• F: Processes: Applicability of MU Gr=28	0	0.00%	2	3.77%	3	5.66%	2	3.77%	0	0.00%	2	3.77%	8	15.09%	4	7.55%	3	5.66%	4	7.55%	28	52.83%
• F: Processes: Combining expertise for plan MU Gr=14	0	0.00%	2	3.77%	0	0.00%	1	1.89%	0	0.00%	3	5.66%	1	1.89%	1	1.89%	1	1.89%	5	9.43%	14	26.41%
• F: Processes: Lack of instruments/tools to finance MU Gr=11	0	0.00%	0	0.00%	1	1.89%	2	3.77%	0	0.00%	2	3.77%	1	1.89%	0	0.00%	0	0.00%	5	9.43%	11	20.76%
Totals	0	0.00%	4	7.55%	4	7.55%	5	9.43%	0	0.00%	7	13.21%	10	18.87%	5	9.43%	4	7.55%	14	26.41%	53	100.00%

Supplemental material 6
Approval Technical University for this Investigation

Date 19-Dec-2022
Contact person Dr. Cath Cotton, Policy Advisor Academic
Integrity
E-mail c.m.cotton@tudelft.nl



Human Research Ethics Committee
TU Delft
(<http://hrec.tudelft.nl/>)
Visiting address
Jaffalaan 5 (building 31)
2628 BX Delft
Postal address
P.O. Box 5015 2600 GA Delft
The Netherlands

Ethics Approval Application: Toward a sustainable sharing of maritime space in Rhode Island.
Applicant: Herrera Ximenez, Lola

Dear Lola Herrera Ximenez,

It is a pleasure to inform you that your application mentioned above has been approved.

Thanks very much for your submission to the HREC which has been conditionally approved. Please note that this approval is subject to your ensuring that the following conditions are fulfilled:

- Make sure that the contents of the informed consent form are in line with requirements for informed consent in the US.
- Ensure that the tools and methods you will use for your research are GDPR-compliant.
- Make sure that any re-identification risks for participants are clear in the informed consent form (i.e. re-identification based on their organisational knowledge or views).
- Specify COVID-19 risks and measures you will take to mitigate these risks on the informed consent form.
- We advise a precautionary approach on the publication of interview transcripts: in principle we advise not to publish transcripts or provide access to them as raw data (other than to eg: examination boards). If it is necessary to do so particular care must be taken to make sure that transcripts are not only "anonymous", but not identifiable. Where it is felt that transcripts or transcript summaries must be published, we advise that where possible the transcript/summary itself should be approved by participants or else it is confirmed by the TU Delft Privacy Team that this is not necessary.

Good luck with your research!

Sincerely,

Dr. Ir. U. Pesch
Chair HREC
Faculty of Technology, Policy and Management

