**Methodology**

**Appendix I. Methods: *Developing a list of observable attributes for each institution, including Year, Jurisdictional Scope (Spatial Jurisdiction, Subject Matter Jurisdiction), source of jurisdiction, defined objectives, strategies, defined inter-institutional relationships, and practical coordination (Vertical and Horizontal)***

In our research paper titled "Mapping the Architecture of Global Governance in the Ocean Economy”, we first designed a methodological approach to meticulously identify and analyse observable governance attributes within Intergovernmental Organizations (IGOs), ensuring that these attributes accurately reflect the evolving discourse in global governance studies, with a particular emphasis on global governance.

Our exploration commenced with an extensive literature review conducted primarily using Google Scholar. The selection of keywords was crucial, aiming to encompass a wide array of discussions pertinent to governance structures, mechanisms, and the specific roles of intergovernmental global organisations within the realm of ocean governance. These keywords included "governance structures”, "mechanisms”, "Intergovernmental Global Organisations”, "IGOs”, "United Nations”, and "United Nations Environmental Management Group”, each chosen to cast a wide net over the scholarly discourse surrounding global governance, especially as it pertains to the ocean economy.

The initial search yielded a significant body of literature, from which we meticulously screened the first ten results for relevance. This screening process was not merely a superficial glance but a deep dive into each paper's content, focusing on those directly discussing governance structures or global governance mechanisms. Our criteria for inclusion were stringent, favouring comprehensive reviews, foundational papers, and recent studies that delve into the intricacies of governance structures, mechanisms, or challenges in the sphere of global governance. This rigorous process led us to select 79 pieces of literature from the initial pool of 90 (**see sheet “Literature on Global Governance” and “Screened Literature” in the Governance Attributes Evaluation file**), each providing valuable insights into the governance attributes that we sought to explore.

Adopting an inductive analysis approach, we immersed ourselves in the selected literature, allowing us to identify recurring themes, concepts, and governance features discussed across various sources. This iterative, inductive process was pivotal, enabling themes to surface organically from the literature, thereby ensuring that our identification of governance attributes was grounded in scholarly discourse (**see sheet “Inductive Analysis\_Attribute” in the Governance Attributes Evaluation file)**.

The emergent themes and concepts were then categorised into specific observable governance attributes, such as Jurisdictional Scope, Source of Jurisdiction, and Defined Objectives. This categorisation process was deeply rooted in the literature, affirming that each attribute not only reflected but also contributed to ongoing discussions within the field of ocean governance (**see sheet “Categorised themes\_Concepts” in the Governance Attributes Evaluation file)**.

We synthesised and interpreted these attributes into a structured table (**see table xx**), meticulously documenting the descriptions, contexts, examples, and literature citations that underscored the existence and relevance of each attribute. This synthesis was not merely an aggregation of data, but a thoughtful compilation that highlighted how each attribute was discussed and framed within the academic discourse.

Validation was integral to ensuring the integrity and relevance of identified attributes. After synthesising the governance attributes into a structured table, validation entailed a meticulous comparison of our findings against the existing scholarly discourse using established frameworks and theories as benchmarks to ascertain the accuracy and contribution of our identified attributes to the field of ocean governance. This process affirmed the validity of our approach and underscored our contribution to the understanding of the intricate governance landscape of the ocean economy.

**Table xx. Synthesis of Intergovernmental Organizations (IGOs) key attributes, their descriptions, contexts, examples, and relevant literature sources for each attribute.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute | Description | Context and Explanation | Examples | Corresponding Framework |
| Year of Establishment | Indicates an IGO’s age, historical context, experience, and reflects the demand and supply of services at creation. | The year of establishment provides insight into an IGO’s origins, evolution, and institutional memory, critical in understanding its governance framework, decision-making processes, and cultural norms. It reflects on the political, social, and economic conditions at inception. (Barnett & Finnemore, 2004; Karns & Mingst, 2010; Weiss & Thakur, 2010). | IMO: 1948, IOC of UNESCO: 1960, UNFCCC: 1992 | Historical Institutionalism: This framework emphasizes the role of history and path dependence in shaping the development and performance of institutions. It also highlights the importance of critical junctures, feedback effects, and institutional change over time. (Pierson & Skocpol, 2002; Thelen, 1999; Mahoney & Thelen, 2010). |
| Jurisdictional Scope | Encompasses both Spatial and Subject Matter jurisdiction, indicating an IGO’s geographic coverage, thematic focus, influence, and impact. | Jurisdictional scope, covering both spatial and subject matter jurisdiction, is pivotal in global governance. Spatial jurisdiction delineates geographical areas where an IGO operates, while subject matter jurisdiction defines thematic areas of focus. This dual scope clarifies an IGO’s authority and responsibilities, playing a key role in addressing specific environmental and governance issues efficiently. (Berman, 2007; Halliday & Shaffer, 2015; Zürn & Faude, 2013). | Spatial: Global to regional, general to specific  Subject Matter: Environmental, maritime laws, conservation, etc. | Legal Pluralism: This framework recognizes the diversity and complexity of legal sources and norms that shape global governance, and the interactions and conflicts among them. (Berman, 2007; Halliday & Shaffer, 2015; Zürn & Faude, 2013). |
| Source of Jurisdiction | Indicates an IGO’s legal basis and authority, reflecting on compliance and enforcement. | Sources of jurisdiction, like laws and treaties, create structured frameworks that significantly influence governance systems. These sources are vital for coordinating governance activities across levels and sectors, reflecting the complexities of central and lower-level interactions and societal connectedness. They are also crucial in ensuring accountability and transparency within governance systems. (Abbott & Snidal, 1998; Koremenos et al., 2001; Gehring & Faude, 2014). | Ranges from hard to soft, binding to voluntary. Laws, constitutions, conventions, treaties, agreements | Rational Design: This framework emphasizes the role of rational choices and strategic interactions in shaping the design and functioning of institutions, based on the costs and benefits of cooperation. (Abbott & Snidal, 1998; Koremenos et al., 2001; Gehring & Faude, 2014). |
| Defined Objectives | Indicates an IGO’s mission, vision, expected outcomes, and impacts. | Defined objectives provide a clear sense of purpose and direction for governance institutions, aligning activities with specific goals. They are vital for enhancing transparency and accountability and fostering coordination among various actors within governance systems. However, rigid adherence to defined objectives may sometimes limit institutional flexibility and adaptability. (Locke & Latham, 2006; Latham & Locke, 1991; Doran, 1981). | Varies from broad and vague to narrow and specific | Goal Setting Theory: This framework focuses on the motivational effects of setting specific and challenging goals, and the factors that influence goal attainment. (Locke & Latham, 2006; Latham & Locke, 1991; Doran, 1981). |
| Strategies | Indicate means and methods of achieving objectives, reflecting an IGO’s adaptation and innovation capabilities. | Strategies provide a framework for resource allocation towards goals and adaptability to changing circumstances. They facilitate coordination and collaboration among stakeholders, fostering collective action towards shared objectives. While essential for adaptability, strategies should not be inflexible, impeding necessary institutional evolution. (Kim & Mackey, 2014; Young, 2010; Levin, 1998). | Varies from formal and legalistic to informal and pragmatic | Complex Adaptive Systems: This framework views institutions as dynamic, emergent, and adaptive systems that respond to feedback and environmental changes. (Kim & Mackey, 2014; Young, 2010; Levin, 1998). |
| Defined Inter-Institutional Relationship | Indicates an IGO’s role in the institutional environment and its influence on other actors and institutions. | These relationships determine how institutions interact within governance systems, facilitating collaboration, efficiency, and innovation. They are critical for co-producing outcomes that resonate with diverse stakeholder needs and for enhancing legitimacy and credibility of governance institutions. (Sørensen & Torfing, 2007; Provan & Kenis, 2008; Börzel, 1998). | Varies from dominant and central to peripheral and marginal | Network Governance: This framework emphasizes the role of networks and relationships among actors and institutions in shaping governance outcomes, processes, and structures. (Sørensen & Torfing, 2007; Provan & Kenis, 2008; Börzel, 1998). |
| Vertical Coordination | Indicates an IGO’s interactions and collaborations across different levels of governance. | Vertical coordination ensures alignment and coherence between various governance levels, enhancing communication, accountability, and the ability to address multifaceted issues. However, challenges can arise from misalignment of priorities or conflicts of interest between different levels. (Hooghe & Marks, 2003; Bache & Flinders, 2004; Piattoni, 2010). | Varies from strong and top-down to weak and bottom-up | Multi-level Governance: This framework examines the interactions and interdependencies among different levels of governance, from local to global, and the challenges and opportunities they pose. (Hooghe & Marks, 2003; Bache & Flinders, 2004; Piattoni, 2010). |
| Horizontal Coordination | Indicates an IGO’s interaction with actors and institutions at the same governance level. | Horizontal coordination aligns efforts of different institutions at the same level, fostering coherence and unified approaches. It’s vital for addressing complex issues, promoting innovation and learning, yet can face challenges in communication and balancing power among institutions. (Abbott & Snidal, 2010; Hale & Roger, 2014; Abbott et al., 2015). | Varies from dominant and competitive to subordinate and cooperative | Orchestration: This framework explores the ways in which institutions coordinate their actions and policies with other actors and institutions, without formal authority, through information, network, and catalytic mechanisms. (Abbott & Snidal, 2010; Hale & Roger, 2014; Abbott et al., 2015). |

**Appendix 2. Method: Data collection and evaluation**

In our research, we adopted a systematic and purposeful approach to construct a comprehensive baseline of global governance for the ocean economy. This involved a **purposive iterative search process** that began by identifying the primary institutions responsible for ocean governance, specifically Intergovernmental Organizations (IGOs), as initially identified by the United Nations Environmental Management Group (EMG) and the UN-Oceans network (UN-Ocean)[[1]](#footnote-1) (see Table xx). We further refine our focus by carefully excluding institutions with regional scopes or those unrelated to ocean issues, thereby narrowing our target to a selected group of 49 IGOs.

The **primary data collection method involved document analysis**, which entailed a comprehensive review of official documents, such as conventions, protocols, resolutions, statutes, standard operating procedures, and extensive explorations of official web pages, reports, policy briefs, press releases, and other relevant online resources. These documents were sourced from authoritative platforms, including the UN Treaties Collection and UN General Assembly Resolutions Tables. The collected documents were then systematically organised and imported into NVivo, a qualitative data analysis software for meticulous examination. **Each document was carefully classified and named** for quick identification, ensuring that metadata such as title, author, year of publication, and document URL were accurately captured.

Subsequently, we focused on **extracting ocean governance attributes** from these documents, defining them as measurable indicators of key ocean governance features for each institution, including Year, Jurisdictional Scope (Spatial Jurisdiction, Subject Matter Jurisdiction), source of jurisdiction, defined objectives, strategies, defined inter-institutional relationships, and practical coordination (Vertical and Horizontal) (**see table xx in Appendix I**). Using NVivo, we **create a structured node hierarchy to represent these attributes and their definitions**. The coding process involved assigning relevant sections of the documents to appropriate nodes using the drag-and-drop function, supported by detailed annotations to standardise and interpret the information uniformly across different IGOs, following a defined guideline that we developed (**see Appendix XX, Extracting ocean governance attributes: Guideline for data standardisation**).

These annotations were crucial in ensuring a standardised presentation of the data, including additional information sourced from official web pages and other relevant resources. Following the organisation and coding of the data, **annotations were exported as an Excel sheet**, serving as the primary data source for further in-depth analysis. The use of NVivo facilitated a methodical, organised approach to data handling, significantly enhancing the efficiency of our analytical process.

Our research uses both narrative and graphical illustrations to gain a comprehensive understanding of the data. Narrative analysis connects each finding to our research questions by incorporating citations for transparency and academic rigour. Graphical elements such as charts, tables, and maps were selected to provide intuitive and accessible data representation. To maintain the highest data quality standard, we followed the guidelines set forth by Lincoln et al. (1985) and focused on trustworthiness, credibility, transferability, dependability, and confirmability. In addition, we implemented techniques such as triangulation and reflexivity. Triangulation involved comparing data from various documents and sources to validate our findings, while reflexivity, a critical self-examination of our assumptions and biases, ensured that our interpretations and conclusions were objective and grounded in data. Taken together, these measures reinforce the integrity, rigour, and reliability of our research, significantly contributing to the discourse on global governance in the context of the ocean economy.

**Methods: Theories selection and ocean governance features identification**

By undertaking an extensive analysis of the governance literature and utilising a **qualitative content analysis approach,** we delved into the collected data to uncover the patterns, themes, and structures inherent in global ocean governance. First, we delineate a comprehensive approach to identifying and selecting pertinent governance theories and features, focusing specifically on their application to ocean economy governance within the framework of ((IGOs) framework. This meticulous process is outlined as follows.

**Literature Search and Selection**

The initial phase of our methodology involved a systematic search within the Scopus database, utilising the keywords “governance AND theories” to compile a broad spectrum of articles. The search yielded a total of 816 articles. To refine this extensive collection and target our research towards ocean governance, we incorporated additional keywords such as "marine," "ocean," "coastal," and "environmental governance." This refinement process and exclusion of country-specific studies streamlined the pool to a more manageable count of 58 papers after eliminating overlaps and focusing on those most aligned with our research objectives (**see the” Initial Literature selection” in Governance Theories Papers**).

Following this, we performed a meticulous screening process, assessing titles and abstracts for their relevance to governance theories as applied within environmental or ocean contexts. This step was crucial in ensuring the selected literature directly contributed to our understanding of governance within the specified domain. Furthermore, we prioritised publications from the last 10 to 15 years, aiming to capture the most current theories and practices in governance. The final selection of articles was manually curated based on their abstracts and relevance to the study's objectives, thus ensuring a focused and relevant theoretical foundation for our research (**see sheet “Stage 2 Lit\_Review” in Governance Theories papers**). After this process, the literature was reduced to 37.

**Appendix 3 Method: Theories and their Features Identification**

To extract relevant theories from the selected literature, we established criteria that[[2]](#footnote-2) focused on their applicability to ocean governance challenges, evidence of their practical application, and interdisciplinary potential. This approach ensured that the selected theories were theoretically sound and practically relevant to unique aspects of ocean governance.

A detailed screening process based on established criteria allowed us to identify theories that directly addressed or could be adapted to the challenges of ocean governance. This process involved thoroughly reviewing the abstracts, introductions, and conclusions of academic papers. Extract from the text where the theories were identified was also documented in the matrix and labelled “Theories passage of text”, which contains the exact passage in the paper from where governance theory has been identified. Present this information in a quotation and use an ellipsis—three consecutive periods, with one space around each (. . .)—to exclude extra or unnecessary words. We then identified various features corresponding to each identified theory by critically reviewing the documented “passage of text” explaining the theory and then extracting keywords and phrases. These keywords and phrases were documented in the matrix and labelled “Theory features”. Following this strategy, a total number of 37 multidisciplinary theories with their corresponding features were initially identified. A matrix mapping the identified theories against critical governance features further aided in visually discerning which theories encompassed multiple aspects pertinent to our study (**see sheet “Stage 2 Lit Review”, “Theories Consolidation”, and Final Selection of theories” in Governance Theories and Features Identification**).

**Streamlining Governance Theories**

Given the diversity and breadth of identified governance theories (37 theories), from "Science-Policy Theory" to "Sociotechnical Change," we embarked on streamlining these into a focused set (**see sheet “theories consolidation” in Governance Theories papers**). This process was guided by criteria designed to highlight theories that are most relevant to our research objectives, emphasising those that address transboundary management, stakeholder collaboration, and systemic design features that are crucial for effective global governance of the ocean economy.

The key steps in this process were consolidating related theories to avoid redundancy and prioritising theories based on their direct relevance to ocean governance challenges. The final selection of theories was thus aligned with our research objectives, ensuring a coherent theoretical framework for our analysis (**see sheet “theories consolidation” in Governance Theories papers**).

*The streamlining process was guided by five key criteria, leading to the selection of theories that were most pertinent to our research objectives.*

*1. Grouping-related Theories: Theories with overlapping principles were consolidated to avoid redundancy. For instance, "Adaptive Governance" and "Adaptive Governance Theory" were combined into a single category of "Adaptive Governance." Similarly, "Game Theory" and "Evolutionary Game Theory" were merged, recognising their shared focus on strategic interactions within governance systems.*

*Selected Theories:* ***Adaptive Governance and Game Theory.***

*2. Alignment with Ocean Governance Challenges: Theories directly addressing the nuances of ocean governance, such as transboundary management and stakeholder collaboration, were prioritised. "Collaborative Environmental Governance" and "Cross-Boundary Governance Theory" emerged as particularly relevant, offering insights into cooperative mechanisms and managing shared marine resources.*

*Selected Theories:* ***Collaborative Environmental Governance, Cross-Boundary Governance Theory.***

*3. Prioritisation Based on Research Objectives: Theories contributing to understanding systemic design features in global governance are highlighted. "Science-Policy Theory" was chosen to explore the interface between scientific understanding and policy-making, a critical aspect of ocean governance. "Regime Theory" and "International Relations Theory" were also selected to examine formal and informal governance arrangements on a global scale.*

*Selected Theories:* ***Science-Policy Theory, Regime Theory, International Relations Theory.***

*4. Consideration of Theoretical Diversity: A range of theoretical perspectives were included to ensure a comprehensive analysis. "Critical Theory" provided a lens through which power dynamics and equity in governance could be examined. At the same time, "Actor-Network Theory" offers a method for understanding the roles and relationships of various stakeholders in governance networks.*

*Selected Theories: C****ritical Theory, Actor-Network Theory, Institutional Ecology***

***Stakeholder Theory***

*5. Exclusion of Less Relevant Theories: Theories less directly applicable to the study's focus on intergovernmental global organisations and the ocean economy were set aside. For example, "Prospect Theory" and "Theory of Production, Life, and Ecology" were deemed less relevant to this research's specific objectives.*

*Excluded Theories:* ***Prospect Theory, Theory of Production, Life, and Ecology.***

**Streamlining Process of Governance Features**

Given the extensive array of theory features identified from the literature, we embarked on a systematic approach to distilling these into a coherent set that aligns with our research objectives: the identification of key systemic design features for global governance pertinent to the ocean economy, with a particular focus on Intergovernmental Global Organizations (IGOs) (**see sheet “Final Ocean-Gov Design Features” in Governance Theories Papers**). This process comprises the following stages.

*Thematic Consolidation*: We began by grouping similar features to mitigate redundancy. For instance, attributes related to "Flexibility, Diversity, Learning, Innovation" and "Capacity to Respond to and Shape Change" were amalgamated under the broader theme of adaptive governance. This step was guided by conceptual overlaps among the features and the potential for thematic synthesis.

*Prioritisation of Relevance*: We then scrutinised each feature for its direct pertinence to the unique challenges and attributes of ocean governance. Features were categorised as high-, medium-, or low-priority, and the rationale behind these priorities was meticulously documented. Features emphasising collaborative governance and cross-boundary coordination, such as "Joint Participation and Deliberation" and "Management and Coordination," were deemed highly relevant because of their centrality in managing shared oceanic resources.

*Alignment with Identified Theories*: The synthesised features were subsequently mapped to the final selection of theories to ensure a cohesive match between the theoretical underpinnings and identified features. For example, features underscoring adaptability were linked to "Adaptive Governance," while those focusing on collaboration and trust were associated with "Collaborative Environmental Governance" and "Cross-Boundary Governance Theory." The logic for these pairings was also carefully recorded (**see sheet “Final Ocean-Gov Design Features” in Governance Theories Papers**).

*Reduction Based on Theoretical Saturation*: An iterative review was conducted to eliminate features that did not contribute additional insights beyond those covered by the prioritised features, adhering to the principle of theoretical saturation.

*Final Selection and Validation*: The refined set of features was validated via a secondary review of ocean governance literature, examining their application in relevant case studies. The outcomes of this validation process were systematically presented in a matrix format, confirming that the selected features were robust, pertinent, and reflective of the contemporary challenges and dynamics within global ocean governance **see sheet “Validation of selected features” in Governance Theories Papers**). Fourteen features were identified in this study.

*Documentation and Synthesis*: The entire procedure was thoroughly documented from the initial consolidation of the features to the final selection. This comprehensive record keeping serves as a testament to methodological rigour and a transparent guide for future research initiatives in related fields.

**Data Preparation and Coding Scheme Development**

With the established theoretical foundation, we set out to systematically map the features of ocean economy governance design for the selected IGOs from our main dataset (Ocean Governance and Ocean Economy Governance matrix). We prepared our main dataset by extracting relevant information, focusing on aspects such as institutions' spatial and subject matter jurisdiction (**see “extract of relevant info” in IGOs gov\_design feature\_identification**). The data extraction process involved creating a matrix that details each institution's approach to governance, including its spatial and subject matter jurisdiction, sources of jurisdiction, defined objectives, strategies, defined inter-institutional relationships, and vertical and horizontal coordinators. A coding scheme was then developed, grounded in the identified design features defined by specific indicators, to systematically analyse how these features manifest within the governance structures of various IGOs. (**see sheet “coding scheme\_Indicators” in IGOs gov\_design feature\_identification**).

A pilot coding exercise on several institutions (the first five institutions – IOC, FAO, IMO, UN DOALOS, and UNFCCC Secretariat) allowed us to refine the coding scheme, ensuring its applicability across different governance contexts. This step was crucial for addressing any ambiguities and enhancing the scheme's precision in capturing the nuances of governance practices (**see ‘Pilot coding results’ in General Feature identification**).

**Systematic Analysis and Synthesis**

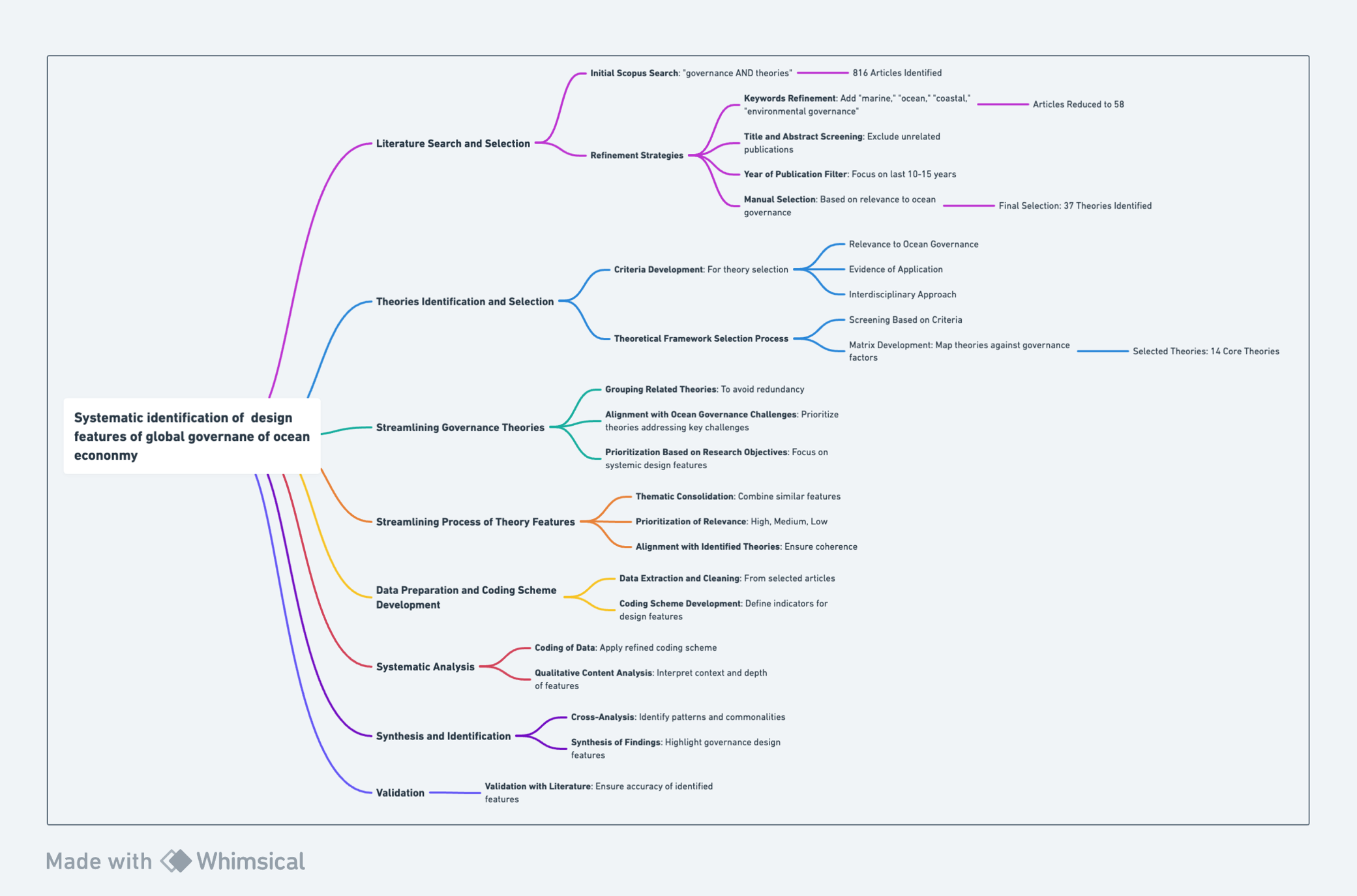
Applying the refined coding scheme (**see sheet ”refined coding scheme” in IGOs gov\_design feature\_identification file**) across the dataset, we conducted a systematic analysis to identify instances of governance design features. This was complemented by a qualitative content analysis, which provided deeper insights into how these features are integrated within the institutions' governance frameworks. "✓" indicates alignment with the governance design feature based on the information provided in sheet 1 “Extract of relevant information” for each institution. In cases where a ✓ is not assigned, it would indicate either a lack of explicit information supporting that governance design features or that the institution's activities do not prominently or directly align with the feature in the context of the available data. We have provided a column to briefly justify our coding. The justifications provide a brief rationale based on these institutions' typical and well-documented functions in their contribution to global governance, policymaking, and implementation in their respective domains (**see sheet “final coding results\_matrix” in IGOs gov\_design feature\_identification file**).

**Validation**

Finally, validating our findings through reviews and comparisons with existing literature ensured that the identified design features accurately reflected the governance structures and strategies of the analysed institutions. This step was pivotal in affirming the robustness and relevance of our analysis (**see the “validation of features” sheet in the IGOs gov\_design feature\_identification file**).

This comprehensive methodology, from the initial literature search to the final validation of findings, provides a robust framework for exploring systemic design features of global governance in the ocean economy. By meticulously identifying and analysing governance theories and features within the context of IGOs, our research offers significant insights into the complexities and dynamics of ocean governance, contributing to the scholarly discourse on the sustainable management and conservation of ocean resources. **By examining the application of governance theories and models** within the specific context of ocean governance, we sought to understand the overall architecture of governance, including aspects such as decentralisation, coordination mechanisms, niche building, and the degree of integration or fragmentation. Furthermore, we investigated the manifestation of governance principles, such as subsidiarity, accountability, transparency, and stakeholder participation in the identified governance structures.

Our **iterative and reflexive approach** allowed us to continuously integrate new insights and findings from the baseline data assembly, thus enabling a deeper understanding of the systemic design features of global ocean governance. This process revealed both the strengths and limitations of the current architecture, and provided a foundation for proposing potential enhancements or reforms.



1. The UN Oceans is the interagency coordination mechanism on ocean and coastal issues within the UN system. <https://www.fao.org/fishery/docs/brochure/UN-Oceans/leaflet.pdf> [↑](#footnote-ref-1)
2. Relevance to Ocean Governance Challenges: Theories should directly address or be adaptable to the unique challenges of ocean governance, such as managing common-pool resources, addressing transboundary environmental issues, and engaging multiple stakeholders.

   Evidence of Application: Preference was given to theories applied in practical ocean and environmental governance contexts or used to analyse environmental or marine management case studies, demonstrating their applicability and effectiveness.

   Interdisciplinary Approach: Theories that incorporate or can be integrated with interdisciplinary approaches are valuable, given the multifaceted nature of ocean governance, which spans ecological, social, economic, and political dimensions. [↑](#footnote-ref-2)