

Overcoming worldwide Marine Spatial Planning (MSP) challenges through standardizing management authority

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ABSTRACT

In a continuation of the previous research published in Ocean and Coastal Management, titled “An authority for marine spatial planning (MSP): a systemic review”, this research aims to name the Marine Spatial Planning (MSP) management authority most capable of overcoming some of the numerous MSP implementation challenges faced worldwide. The modified Delphi method and the Soft Systems Methodology (SSM) were employed to posit the following questions: What characteristics should an MSP management authority possess? What level of governance should a MSP management authority possess in order to effectively coordinate and communicate with national, regional, and international bodies? Which authority, from the authorities already involved in MSP planning and implementation, best meets the proposed requirements? An analysis of the results from first few steps of the SSM helped elucidate the characteristics necessary of an effective MSP management authority. This information was then shared, via Google forms, with a panel of experts chosen to participate in our modified Delphi method-based questionnaires. The results of our study indicate that national-level Maritime Authorities (MAs) are best suited to act as the MSP management authority. It is, therefore, of paramount importance that governments entrust MAs with the duties of planning and nationally implementing MSP. Taking into consideration that MAs fulfil most, if not all, of the characteristics required of an effective MSP management authority, it would seem to be the most obvious choice.

1. Introduction

The UNESCO's Step-by-Step Approach for Marine Spatial Planning toward Ecosystem-based Management recommended that authorities, for planning and implementing the management plan, be established at the very beginning (Ehler and Douvère, 2009). There is global consensus as well that a well-established management authority is needed to successfully implement MSP (Ehler and Douvère, 2009) and is required before initialising any MSP processes (Beck et al., 2009). Ehler and Douvère (2010) and Schaefer and Barale (2011) have argued that an MSP management authority could be formed from existing agencies or could warrant the creation of an entirely new agency. However, regardless of the chosen management authority, implementation has almost always been left at the discretion of existing agencies (Ehler and Douvère, 2010). Ehler (2008) argued that, as of yet, there is no single solution or unique recipe for successful MSP implementation; however, it's believed that one authority type (agency), in particular, is better equipped than the rest for the task at hand.

In a continuation of the previous research published in Ocean and Coastal Management, titled “An authority for marine spatial planning (MSP): a systemic review”, Therefore, the researchers of this paper would like to investigate MSP management authority requirements in

more detail since the current governance structure is fragmented and ineffective. It is clear that MSP implementation limitations have become a global concern as numerous studies highlight the tenuous position of MSP management authorities as well as other pertinent issues; such as trans-boundary issues; and call into question the capabilities of these authorities with regards to their qualifications (Jay et al., 2016; van Tatenhove, 2017; Johansson and Ramberg, 2018; Hassler et al., 2018; Santos et al., 2021) that have, on a global scale, resulted in the formation of national MSP management authorities made up of multiple departments/agencies (Gissi et al., 2019). The following questions will be investigated: What characteristics should an MSP management authority possess? What level of governance should a MSP management authority possess in order to effectively coordinate and communicate with national, regional, and international bodies? Which authority, from the authorities already involved in MSP planning and implementation, best meets the proposed requirements?

2. Literature review

According to the ‘Status of MSP’ listed under the MSP Programme on the United Nations Education, Scientific, Cultural Organisation (UNESCO) website (<https://www.mspglobal2030.org/msp-roadmap>

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/msp-around-the-world/) that the researchers accessed on the October 19, 2019, “in August 2018 about 70 countries were preparing or had prepared about 140 MSP plans at the national, regional, or local levels”. Of the 138 plans that passed the pre-planning phase, only 37 have gone on to be implemented (Table 1).

MSPs from multiple countries were investigated to better understand the current choice(s) of MSP management authorities. A list of MSP initiatives and implementing agencies, by country, is provided in Table 2. Based on this, it is evident that no single department/agency is chosen to act as the management authority. Instead, the responsibility is shouldered by a multitude of departments/agencies such as Fisheries, Environmental, Ecological, Maritime Authority (MA), Councils, Urban Planning, Ministry of Interior and Marine Water Management.

3. Methodology

As shown in Table 3, this study combined two methodologies: the modified Delphi method and the Soft Systems Methodology (SSM). The SSM is described as “an organized, flexible process for dealing with situations which someone sees as problematical situations which call for action to be taken to improve them, to make them more acceptable, less full of tensions and unanswered questions” (Checkland, 1989). Steps 1 through 4 of the SSM were conducted based on desk research, while Steps 5 and 6 were conducted using a questionnaire developed on the modified Delphi method.

The Delphi method is a process in which expert panellists, drawn from opposing sides of an argument, state their preliminary opinions about a situation (by means of a questionnaire) without knowing the opinions of the other panellists involved in the study. After tabulating the results at the end of each round of questionnaires, panellists are provided with an anonymised summary of the other panellists' opinions and rationales. This encourages each panellist to take into consideration the opinions and rationales of the other panellists and to reconsider their own opinions and rationales thereby imposing upon them that they will be held responsible for the judgments that they introduce (Weaver, 1971; Linstone and Turoff, 1975; Ayton et al., 1999). This method has found to be useful when the problem situation does not lend itself to precise analytical techniques (Keeney et al., 2001). However, the technique employed in this study was, more accurately, the modified Delphi method since open-ended questions (typical of the Delphi method) were replaced in favour of the results of Steps 3 and 4 (systems thinking) of the SSM method.

Affinity diagrams were used during the analysis phases of the study and the consensus result for each statement was taken into consideration only if it had garnered more than 51% consensus since, according to appropriate statistical methods (Skulmoski et al., 2007), the process can be considered concluded when the answers near a consensus. The interquartile range (IQR) is often used as a measure for consensus in Delphi literature due to its robustness as a statistical measure (Warth et al., 2013). Therefore the consensus results of this study were measured with IQR, whereby the IQR should be ≤ 1 . The median, mean and IQR of every questions' results were calculated.

Using ResearchGate (www.researchgate.net), we were able to invite industry experts with publications in MSP or marine environmental management-related fields to participate. While planning the modified Delphi method stages of the study, a cover letter was sent to prospective participants introducing to them the study details and to determine their willingness to participate. A survey tool (pilot study followed by reliability and validity assessment) was then conducted.

The statements of the questionnaire were developed during Round 1

Table 2

MSP plans from around the globe taken from the UNESCO MSP and European MSP websites.

Country	Initiative	Implementing agency
Angola	EEZ and Territorial Sea	MSP has been institutionalized since 2018 within the new Directorate of Sea Affairs within the Ministry of Fisheries and the Sea
Australia	Marine bioregional plan for the South-west Marine Region, 2012	Department of Sustainability, Environment, Water, Population, and Communities
Belgium	Marine Spatial Plan for the Belgian part of the North Sea 2012	Belgian Minister of the North Sea
Canada	Ocean affairs	Fisheries and Oceans Canada (DFO)
Croatia	Currently, there is no single MSP plan for the entire Croatian marine area, but the entire territory of the Republic of Croatia is covered by various spatial plans, which comprise both terrestrial and marine areas	The Ministry of Construction and Physical Planning and the Croatian Institute for Spatial Development
Finland	Finland's eight coastal regions will develop three maritime spatial plans by the end of March 2021	Finnish Ministry of the Environment Department of the Built Environment
German	The North Sea and Baltic Sea German EEZs (2) and for the territorial sea areas	German Federal Ministry of the Interior, Building, and Community Federal Maritime and Hydrographic Agency (BSH)
Ireland	Towards a Marine Spatial Plan for Ireland, 2017 ; Ireland's National Marine Planning Framework (NMPF), 2018	The Department of Housing, Planning and Local Government
Latvia	Maritime Spatial Plan for The Internal Marine Waters, TWS and EEZ, 2016	Ministry of Environmental Protection and Regional Development,
New-Zealand	The Hauraki Gulf Marine Park, 2017	A governance group representing a partnership between local and central government agencies
Seychelles	The Seychelles MSP Initiative occurring in two phases, phase 1 2014–2017, phase 2 2018–2020	Ministry of Environment, Energy, and Climate Change (MEECC)
Slovenia	Slovenia has not started the official planning yet; however, some preliminary activities have been initiated	The Ministry of the Environment and Spatial Planning; Spatial Planning, Construction and Housing Directorate
Sweden	According to the Environmental Code, there will be three marine spatial plans	Swedish Agency for Marine and Water Management (SwAM)
UAE	Plan Maritime 2030: Abu Dhabi Coastal and Marine Framework Plan	The Urban Planning Council (UPC)
UK	The East Marine Plans, the South Marine Plans and the North West, North East, South East and South West plans	The Marine Management Organization. The marine plan authorities responsible for developing Marine Plans are the Secretary of State for the inshore and offshore regions
USA	Draft Marine Spatial Plan for Washington's Pacific Coast, 2017	The Department of Ecology is administrating the plan
USA	The Rhode Island Ocean Special Area Management Plan	The Coastal Resources Management Council (CRMC)

Table 1

Summary of MSP plans from around the globe as taken from the UNESCO MSP website.

Pre-Planning	Plan Analysis	Plan Develop	Plan Complete	Plan Approved	Plan Implemented	Plan Revision
138	101	79	69	43	37	7

Table 3

Shows the methodologies used (in bold) and illustrates that the modified Delphi method was used in Steps 5 and 6 of the SSM.

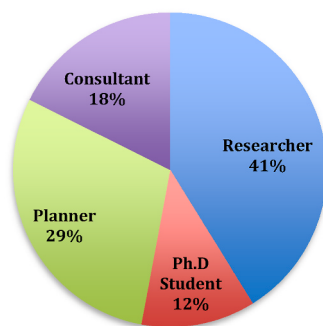
Soft system methodology	Step (1)	The problem situation unstructured (What?)	
	Step (2)	The problem situation expressed (Why?)	
	Step (3)	CATWOE (finding root causes)	Systemic thinking
	Step (4)	Building the model	
	Step (5)	Comparison with the real world (step 2)	Modified Delphi
	Step (6)	Recommendation	
	Step (7)	Implementation	

of the modified Delphi method based on the results of Steps 3 and 4 of the SSM (the characteristic required of an MSP management authority were deduced from the root definition) (Table 6), in addition to the summary of the authorities deduced from (Table 2).

The first questionnaire (Round 2 of the modified Delphi method) involved the panel of experts. Of the 104 experts invited, 17 agreed to participate. Although the number of the sample size may seem small, yet, “the Delphi group size does not depend on statistical power, but rather on group dynamics for arriving at consensus among experts. Thus, the literature recommends 10 to 18 experts on a Delphi panel” (Okoli and Pawlowski, 2004).

The participant's relationship with MSP and their nationalities are shown in Fig. 1. A Likert scale was provided: 5-Strongly Agree, 4-Agree, 3-Neither, 2-Disagree, 1-Strongly Disagree. The participants were asked to rank their degree of agreement/disagreement to a list of characteristic required of an MSP management authority that had been deduced from the root definition and presented in Table 6. They were then asked to rank their degree of agreement/disagreement with the following six (6) departments/agencies thought to be most suited to the task: Fisheries, Sustainability, Environmental, Maritime Authority, Spatial Development and Interior, Building and Community.

In Round 3, anonymised summaries of the results of Round 2 were shared with the participants. The questionnaire for Round 3 was developed, based on an analysis of the results of Round 2, and sent to the participants. Two (2) departments/agencies (Fisheries and Interior, Building and Community) were eliminated from Round 3 as they had received the lowest scores. A ranking system, with 1 ranking the most preferred and 4 ranking the least preferred was provided. Participants were then asked to rank the remaining four (4) departments/agencies by order of preference.



4. Results

4.1. Step 1: Identifying the problem situation (what?) and step 2: expressing the problem situation (why?)

In this step, the problem situation is, first, identified then analysed to provide a better grasp of all the factors involved. Only then is it expressed with the aim of addressing the question: In terms of authority, what are the MSP implementation challenges and why do they occur?

An analysis of the answers suggests that there is global consensus on the need to identify an administrative body capable of, effectively and fairly, spearheading the entire MSP process while careful not to ignore the needs of any one sector (Schaefer and Barale, 2011). Ehler and Douvère (2009) have even gone so far as to argue that without clear management authority, an MSP initiative is likely to fail in its infancy.

It is of note, however, that MSP has never been successfully implemented anywhere in the world (Santos et al., 2021) as the currently practiced implementation practices have decreased overall efficiency and effectiveness (Hassler et al., 2018). Add to that the need for trans-boundary communication, and MSP implementation becomes a seemingly impossible task to accomplish given that agencies of different nationalities and differing levels of legislative and institutional jurisdictions need to coordinate with each other (Jay et al., 2016; van Tatenhove, 2017; Hassler et al., 2018). Although zoning is one of the tools of MSP, it too, faces many implementation challenges (McWhinnie et al., 2015) as negotiating the boundaries of maritime areas has always been an obstacle (Queffelec and Maes, 2013). Table 4 shows the challenges facing MSP and their possible reasons.

As shown in Table 2, there is no single authority governing MSP planning and implementation. The responsibility is, instead, spread across numerous departments/agencies such as Fisheries, Environmental, Ecological, Maritime Authority, Councils, Urban Planning, the Ministry of Interior and Marine Water Management etc.

The information gathered during this stage provided helpful notions and a clearer understanding of the current situations that MSP management authorities face. This helped express the problem situation as illustrated in Fig. 2. It can be deduced that conflicts and inconsistencies arise when more than one department/agency is tasked with MSP planning and implementation (as illustrated by the MSP (1) Authority under Country A in Fig. 2). Fig. 2 posits that there could be divergent plans within one (1) country as well as opposing plans in neighbouring countries running concurrently. None of the plans are compatible with the other as they were developed independently without consulting each other. Forcing institutions with dissimilar operational structures and standard operating procedures (SOP) to work together only serves to further impede MSP implementation.

4.2. Step 3: CATWOE

To perform this step of the conceptual model, the Customers, Actors, Transformation, Worldview, Owners, Environmental constraints

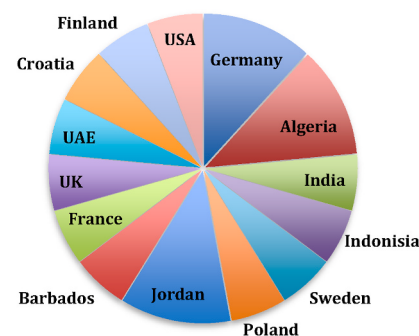


Fig. 1. Shows the participants' relationships with MSP and their nationalities.

Table 4

Shows the challenges facing MSP and their possible reasons.

What	Why
•MSP has never been properly implemented (Santos et al., 2021).	•“There is tension between the different rule systems of the United Nations Convention on the Law of the Sea (UNCLOS), International Maritime Organization (IMO), Regional Sea Conventions, the EU, nation-states and sub-national authorities” Van Tatenhove (2017). •Internationally, MSP is weak as it has not been explicitly specified in UNCLOS or the CBD (Ardron et al., 2008; Saunders et al., 2016). •Governments hold the primary authority for implementing MSP in addition to “realpolitik” factors (Santos et al., 2021), as part-time politicians working on MSP are not prioritizing sea area as their most important area and they lack the needed knowledge to make informed decisions, for instance, municipalities (Johansson and Ramberg, 2018).
• Decreasing the overall efficiency of MSP (Hassler et al., 2018).	• MSP domestic plans are emerging in diverse ways in addition to varying domestic administrative and authorities, which make regional coherence hard to enhance, moreover, the development of MSP are not chronologically synchronized and have evolved in diverse directions (Hassler et al., 2018). • “Conceptual and institutional fragmentation MSP’s is facing” as the current practice of MSP procedures are organized on the national and/or sub-national level (van Tatenhove, 2017). • Institutional incompatibilities at regional and neighbouring countries (Hassler et al., 2018). • The involvement of many agencies in MSP is somehow not in its favour (Johansson and Ramberg, 2018). • Institutional ambiguity (Freire-Gibb et al., 2014; Van Tatenhove, 2017). • The Directive 2014/89/EU of the European Parliament and of the council of July 23, 2014 establishing a framework for MSP leaves choosing of the authority and the practical implementation of MSP to the member states (Soininen and Hassan, 2015; Jay et al., 2016). • Expertise is generally realm specific (Beger et al., 2010).
• The trans-boundary approach is not an easy job to achieve as many challenges face authorities that seek to coordinate with each other (Jay et al., 2016; van Tatenhove, 2017; Hassler et al., 2018).	• Due to the political boundaries and the national interest, not to forget the governance structure differences between the administrations running MSP on the ground, as there are possibilities of having “unevenly matched administrative structures and processes, technical difficulties of sharing information, language barriers, and other impediments to good communication” (Jay et al., 2016). • According to van Tatenhove (2017), conceptual and institutional fragmentations hamper trans-boundary MSP (TMSP) as it articulates different approaches to TMSP: Blue economy (social and economic) and environment protection (Soininen and Hassan, 2015). • The MSP principles try not to limit themselves within the political

Table 4 (continued)

What	Why
• Zoning is one of the tools of MSP; however, when applied it faces numerous challenges (McWhinnie et al., 2015). • Deciding on an appropriate geographical maritime area to be under the focus of management is always a challenge (Queffelec and Maes, 2013).	boundary as they favour a trans-boundary approach (European Commission, 2007; Douvere and Maes, 2009). • Increasing number of activities and developments in the marine environment and the pressures associated with them (McWhinnie et al., 2015). • This is because the effects to the marine or coastal area had occurred beyond the management area (Smith et al., 2011) and in many cases, instead of taking an ecological standpoint, the geographical and political boundaries often become the determinant factors (Pressey et al., 2002).

(CATWOE) approach has been used to generate a root definition.

The followings are the elements of CATWOE.

- Customer: The stakeholder’s perception of who the customer(s) are may differ, and this should be recognized.
- Actors: These are all of the stakeholders (or stakeholder groups) involved in the transformation; these are the people who make the business run.
- Transformation: This is the main business activity, the thing that drives the activities of the company. Because the organization takes inputs and “transforms” them into outputs, the word “transformation” is utilized. This is the transformation process that is depicted here.
- Worldview: This summarizes a stakeholder’s beliefs about the organization or business system; why the organization exists and what it should be doing.
- Owner: In the eyes of each stakeholder, who in their opinion owns the business system, and who could instigate change or even closure?
- Environment: All organizations and businesses operate within the constraints imposed by their environment (Think about business rules - policies, procedures or constraints).

A root definition, as defined by Checkland (1981), is a “*concise, tightly constructed descriptions of human activity systems which state what the system is; what it does is then elaborated in a conceptual model which is built based on the definition. Every element in the definition must be reflected in the model derived from it*”. The outcomes of the CATWOE were based on the different viewpoints of stakeholders (Table 5), leading to the following root definition: A management authority has to have particular characteristics, skills and standard operating procedures (SOPs) that are nationally and internationally compatible with their counterparts and neighbours in order to effectively and efficiently plan, implement and monitor MSP initiatives in an informed, cohesive and sustainable manner that satisfies the needs of all users and decision-makers while considering and managing all limitations.

4.3. Step 4: Conceptual model

The next step is to develop a conceptual model (diagram) as per the root definition. The root definition focuses on the definition of the system, ‘what the system is’, while a conceptual model identifies ‘what the system must do to be the system named in the definition’ (Checkland, 1981). Checkland defined conceptual models as “*a systematic account of a human activity system, built based on the system’s root definition, usually in the form of a structured set of verbs in the imperative mood. Such models should contain the minimum necessary activities for the system to be the one named in the root definition*” (Checkland, 1999). However, to avoid

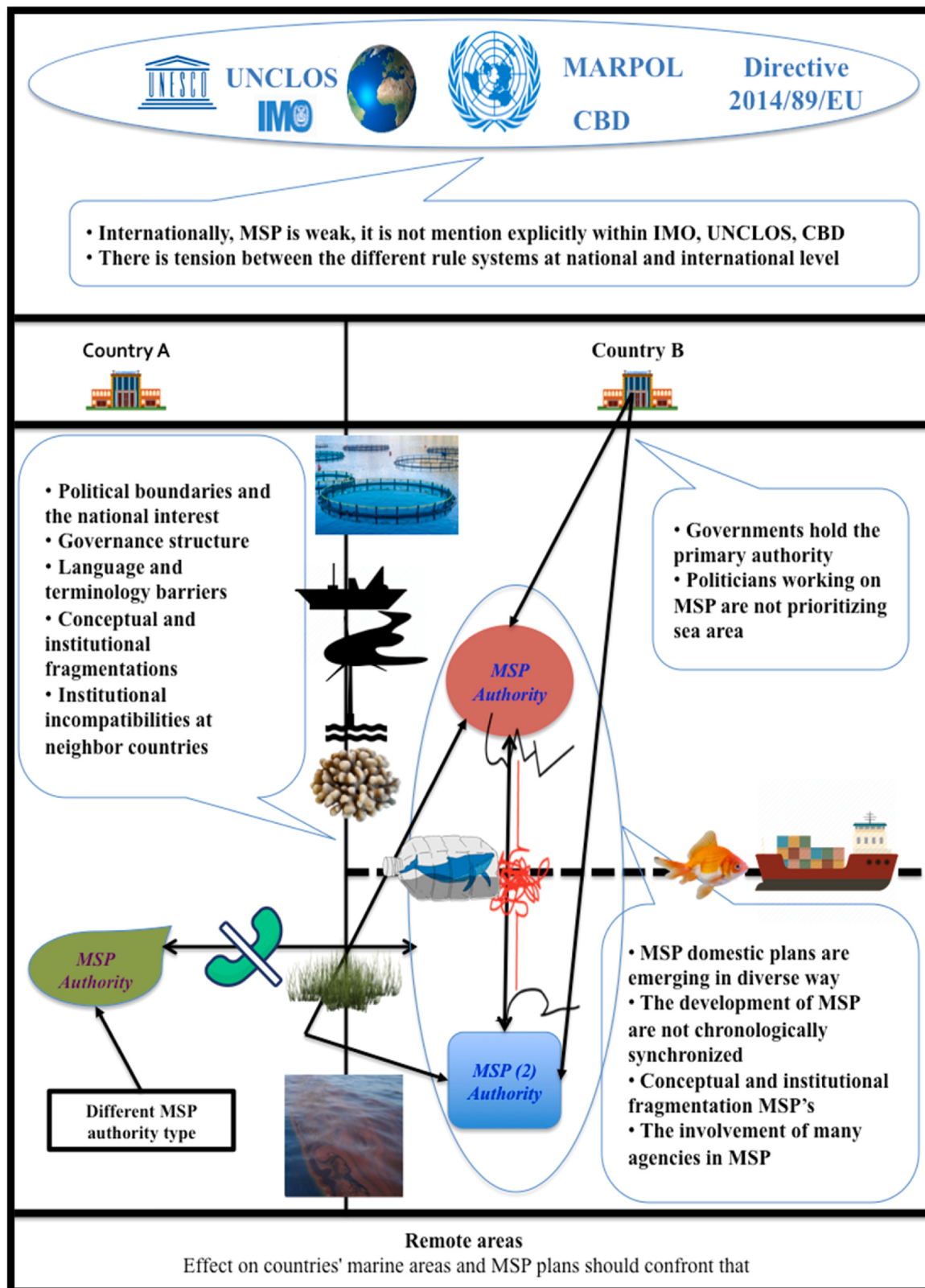


Fig. 2. Problem situation of MSP where marine areas (MSPs 1,2,3) are subjected to varying international, national and local legislations and priorities within the country in addition to a lack of communication and coordination between neighbouring countries.

Table 5
CATWOE analysis results.

Customer	Marine area users: General public, fishermen, marine species and habitats, shipping and logistics companies, oil and gas companies, the navy, ports, undersea cables, renewable energy infrastructures etc.
Actors	The potential departments/agencies that interact directly with marine areas and are responsible for its management include, but is not limited, to the following: Environmental (international and national), Fisheries, Maritime and Hydrographical, Maritime Affairs, Sustainability, Marine Management, Interior, Building and Community.
Transformation	- Possess characteristics, skills and authority to guide national counterparts and neighbouring countries to implement similar, correlated, interdependent MSP initiatives in order to work towards a similar and shared goal. - Implementing MSP initiatives towards achieving better management of marine areas while taking into consideration the needs and priorities of all users while respecting the trans-boundary implications of implemented initiatives and water dynamics.
Worldview	Satisfaction of all users of marine areas while implementing a variety of MSP initiatives both domestically and trans-boundary.
Owner	Local, national and international governments and non-governmental organizations (NGOs).
Environment	Limitations resulting from political (boundary issues), economic, social, technological, legal and environmental constraints.

Table 6
Characteristics necessary of an MSP management authority as deduced from the root definition (Round 1) and participants' responses to the relevant questionnaire (Round 2). Participants were required choose an answer from the following options: 5-Strongly Agree, 4-Agree, 3-Neither, 2-Disagree and 1-Strongly Disagree.

	MSP characteristic deduced from the root definition	Round of Modified Delphi		
		Round 1		
		Median	Mean	IQR
1	Understandings of all marine areas that users need	5	4.71	0.5
2	Institutional and governmental frameworks support through legislative and regulatory policy	4	4.41	1
3	Government entity	5	4.35	1
4	Strong legal bases at the national level	5	4.35	1
5	Strong legal bases at the regional level	4	4.29	1
6	Strong legal bases at international level	4	4.12	1
7	Matching Organizational structure with other MSP authorities at the domestic level	4	4.24	1
8	Matching Organizational structure with other MSP authorities at the regional level	4	4.12	1
9	Understanding general aspects of the marine environment	5	4.65	1
10	Ability to implement and monitor MSP	5	4.59	1
11	Ability to coordinate trans-boundary issues	4	4.41	1
12	Wide experience of the multi aspects of maritime areas and domains	5	4.41	1
13	Understanding of jurisdictional boundaries	5	4.53	1
14	Understanding of biological boundaries	4	4.18	1
15	Understandings of all marine habitat needs	4	4.29	1
16	Strong understanding of international maritime regulations (IMO regulations) (16 responses)	5	4.38	1
17	Matching Organizational structure with other MSP authorities at international level	4	4	1
18	Wide experience of marine areas' chemistry	3	3.63	1
19	Understanding of the furthest effect of saltwater (Tides)	4	4.06	1.5
20	Understandings of all humans needs	4	4	2

inconsistencies while building the model, the 3Es technique is usually used to measure the functioning of the transformation process (Checkland and Scholes, 1990). These are the three (3) criteria that have to be

met in order to model the actions of a root definition: 1) Efficacy (for 'Does the means work?') – Have the activities of the proposed model of management system been identified as a result of transformation of the operating system? 2) Efficiency (for 'Amount of output divided by the amount of resources used.') – Are the minimum requirements of the proposed model; such as human resources, skills, awareness and understanding; used efficiently in identifying the appropriate management processes? 3) Effectiveness (for 'is the transformation meeting the long-term aim?') – Does this system contribute to reaching a stage of satisfying the needs of all users?

Based on the conceptual model (Fig. 3), the following questions should be answered to complete this step: What characteristics and skills are required of an MSP management authority? Which authority possesses an operational structure, standard operating procedures (SOPs) and jurisdiction that are comparable and compatible with neighbouring countries? Which authority is most adept and best equipped to manage and negotiate trans-boundary issues? Which authority has the support of international organizations, yet still operates within the confines of the laws of the land?

In order to identify the characteristics necessary of the ideal MSP management authority, a list was prepared in the conceptual world (Table 6) that is believed to fulfil the root definition. This list was later presented to the panel of experts in the first questionnaire (Round 2 of the modified Delphi method) and will appear later in the next step. The same was done with the list of six (6) potential MSP management authorities (Table 7).

4.4. Step 5: 'Real world' comparison

At this stage, the paper moves on from systems thinking to the problem situation in relation to the 'real world'. The comparison between the systems thinking and the 'real world' aims to reconcile the conceptual models with reality. For comparison, it is necessary to involve the participants in discussing potential changes to the problem situation. Therefore, an online questionnaire based on the modified Delphi method was used to reconcile the views of the participants with the recommended characteristics. Based on the conceptual model (Fig. 3), a list of characteristics and potential MSP management authorities were developed for Round 1 of the modified Delphi method.

In Round 2, a questionnaire containing the list proposed characteristics necessary of an MSP management authority (Table 6) was developed with the help of Google Forms. In order to investigate the suitability of the proposed characteristics, the questionnaire was shared with the panel of experts. The interquartile range (IQR) for the majority of the statements from Round 2 was less than or equal to 1 ($IQR \leq 1$) which indicated that the level of consensus was high. However, the higher IQR scores were found to disagree with the statements. Individual mean scores were used to determine the level of importance of each statement. The analysis showed that the mean results were ≥ 4 except for the statement: "Wide experience of marine areas chemistry" which scored < 4 with ($IQR \leq 1$). Therefore, it was not in the questionnaire for Round 3.

An analysis of the data presented above (Table 6) resulted in the search for a potential real-world MSP management authority that possessed most of the characteristics mentioned above. Participants were asked to rate each potential MSP management authority (shown in Table 7) according to if they possessed the characteristics that the participant had ranked highly in (Table 6). The results showed consensus ($IQR \leq 1$). It also showed that "Sustainability" scored the highest mean number with 4.41, while "Fisheries" and "Interior, Building and Community" scored the lowest mean numbers; with 3.58 and 3.41, respectively. Therefore, both these options were excluded from the list of potential MSP management authorities when preparing the questionnaire for Round 3. Only the remaining four (4) options; which had not achieved a consensus ($IQR \geq 1$); were included. In Round 3, an anonymised summary of the results of Round 2 were shared with

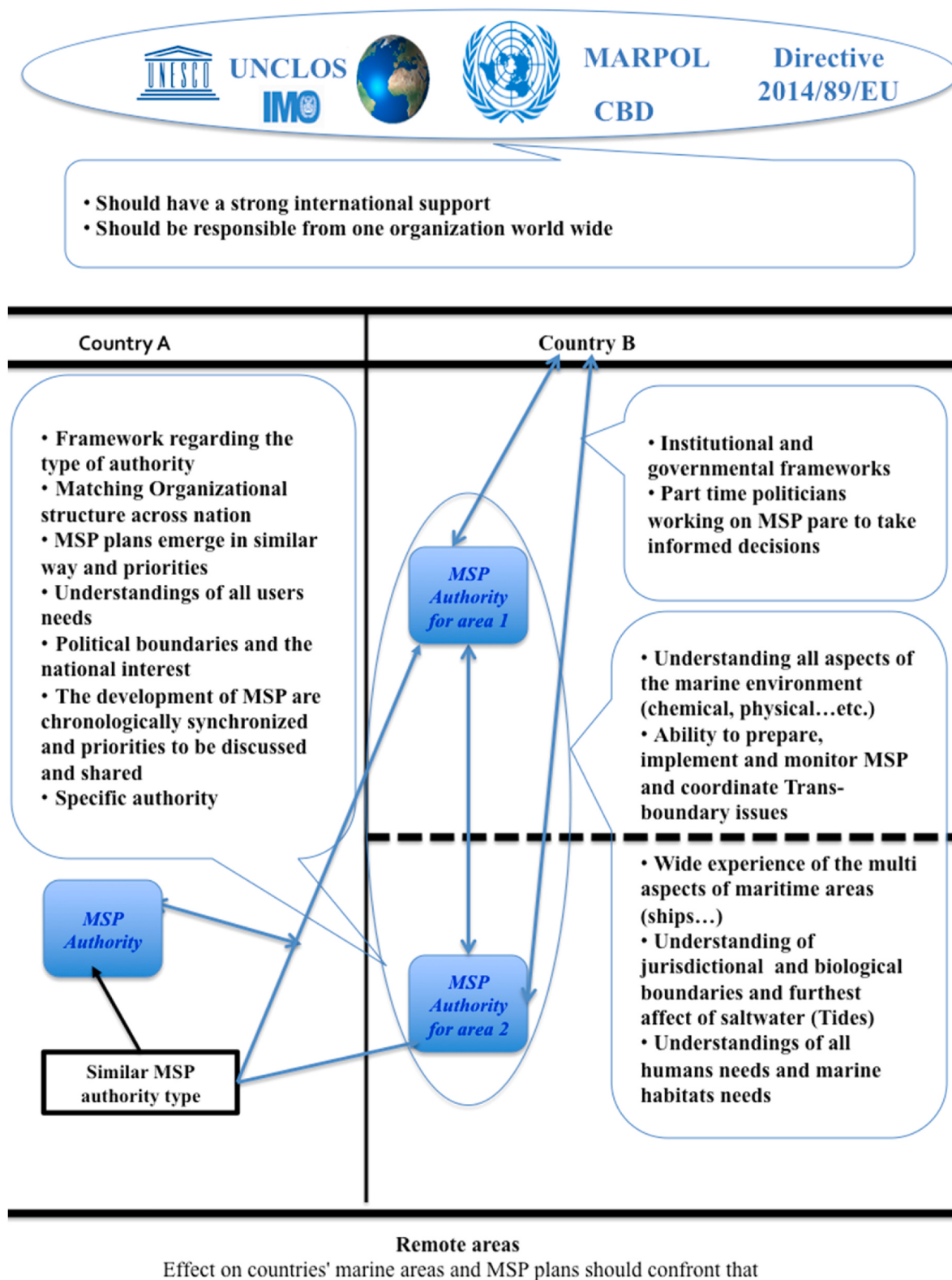


Fig. 3. Shows the conceptual model based on the root definition. It highlights the characteristics necessary of the ideal MSP management authority.

participants; informing them of the results of the characteristics ratings from Round 1 and that “Fisheries” and “Interior, Building and Community” (the lowest scoring authorities from Round 2) had been excluded from Round 3. In the questionnaire for Round 3, participants were asked to rank the four (4) remaining authorities by order of preference; with 1-Most Preferred and 4-Least Preferred (Table 7). The

results of Round 3 found that “Maritime Affairs” received the highest consensus and ranked #1, followed by “Spatial Planning”, “Environmental” and “Sustainability” in that order (Table 8).

Table 7

The results of the 17 responses to the questionnaire (Round 2) to rate each potential MSP management authority according to the characteristics that the participants had chosen in Table 6. Participants were required choose an answer from the following options: 5-Strongly Agree, 4-Agree, 3-Neither, 2-Disagree and 1-Strongly Disagree.

Authority	Round 2		
	Median	Mean	IQR
Interior, Building, and Community	3	3.41	1
Fishery	4	3.58	1
Maritime Affairs	3	4	2
Environment	4	4.17	1.5
Spatial Development	4	4.23	1.5
Sustainability	4	4.41	1.5

Table 8

Shows the results of 12 responses to the questionnaire (Round 3) that ranked the potential MSP management authorities by order of the participant's preference; with 1-Most Preferred and 4-Least Preferred.

Authority	Round 3		
	Median	Mean	IQR
Maritime Affairs	2	2.18	1
Environment	3	2.72	1
Spatial Development	2	2.36	1
Sustainability	3	2.72	1

4.5. Step 6: Recommendation

At a national level, a Maritime Authority (MA) operates under the auspices of the International Maritime Organization (IMO) and generally coordinates their regulations and initiatives with the IMO. Therefore, MAs are able to work at national levels as well as communicate and coordinate with the international community (Hassler et al., 2018). This means that two (2) neighbouring countries would be able to communicate and coordinate initiatives through the IMO.

The IMO is a specialized agency within the United Nations. It is “the global standard-setting authority for the safety, security and environmental performance of international shipping” (IMO.org., 2020). The primary purpose of the IMO, and its 174 members, is to develop “conventions, protocols, codes, and recommendations that address maritime safety, environmental protection, legal matters, technical co-operation, and the efficiency of shipping” (Silber et al., 2012). In addition to that, the IMO’s 2030 Agenda to achieve sustainable development goals (SDGs) is of paramount importance, particularly, to marine environments due to: SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Economies), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action) and SDG 14 (Life Below Water) (The Sustainable Development Agenda - United Nations Sustainable Development, 2020). Moreover, the IMO has adopted 40 conventions and 800 codes and recommendations. Although member states are not bound by these codes and recommendations, they do provide the basis for framing the regulations at the national level (Silber et al., 2012).

It bears mentioning that, in the event a member state would like to suggest an amendment to the Traffic Separation Scheme (TSS) (*maritime traffic-management route-system*) they are required to submit a proposal, with supporting justifications, to the IMO (Silber et al., 2012). Only recently the IMO enforced the use of Automatic Identification Systems (AIS) in all vessels of more than 300 Gross Tonnage (GT) to quantify vessel operations. A good example of the IMO’s fruitful intervention was evident in Norway’s Barents Sea and Lofoten integrated management plan; which proposed moving a shipping lane to reduce pollution (Olsen et al., 2007). Related examples of the IMO’s role, in conjunction with that of a MA, were the numerous regulations to redirect shipping routes

to avoid collisions with whales, the Mandatory Ship Reporting (MSR), East Coast, USA (1998–1999), the Traffic Separation Scheme (TSS): the Bay of Fundy, Canada (2002–2003), the Traffic Separation Scheme (TSS): Cabo de Gata, Spain (2005–2006), the Traffic Separation Scheme (TSS) and Recommended Speeds: the Strait of Gibraltar, Spain (2006–2008) and the Area to be Avoided: Roseway Basin, Canada (2007–2008) (Silber et al., 2012). Thus, Silber et al. (2012) observes that the IMO can be a powerful body in resolving marine environment and conservation issues.

4.6. Step 7: Implementation

This stage involves putting the recommendations identified in Step 6 into practice. In our case, this calls for an attempt at planning and implementing MSP initiatives through the Maritime Authority (MA). However, in order to implement MSP initiatives, the MAs would need the support of their respective governments in enacting laws and creating rules and regulations that empower the MA to implement MSP initiatives as well as provide them with open channels of communication at national and international levels.

5. Discussion

Although the number of the sample size may seem small, as only 17 participants agreed to participate out of the invited 104, yet, “the Delphi group size does not depend on statistical power, but rather on group dynamics for arriving at consensus among experts. Thus, the literature recommends 10 to 18 experts on a Delphi panel” (Okoli and Pawlowski, 2004).

The outputs of steps (1 through 4) were the characteristics of MSP authority. As follows.

• Understandings of all marine areas that users need • Institutional and governmental frameworks support through legislative and regulatory policy • Government entity • Strong legal bases at the national level • Strong legal bases at the regional level • Strong legal bases at international level • Matching Organizational structure with other MSP authorities at the domestic level • Matching Organizational structure with other MSP authorities at the regional level • Understanding general aspects of the marine environment	• Ability to implement and monitor MSP • Ability to coordinate trans-boundary issues • Wide experience of the multi aspects of maritime areas and domains • Understanding of jurisdictional boundaries • Understanding of biological boundaries • Understandings of all marine habitat needs • Strong understanding of international maritime regulations (IMO regulations) • Matching Organizational structure with other MSP authorities at international level • Wide experience of marine areas' chemistry • Understanding of the furthest effect of saltwater (Tides) • Understandings of all humans needs
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Those characteristics were found to be very relevant to the MSP, when shared with the participants, as nearly all of them gain higher consensus. That indicates the power of SSM and its systemic approach in extracting the characteristics of soft systems and removing their external frameworks to explore all aspects related to them. Add to that, to proceed further with the SSM, the modified Delphi method is found to be useful in solving difficult situations where it is hard to engage experts, as that would be time-consuming and nearly impossible mission in some cases.

Generally speaking, institutions and authorities are well structured to perform their tasks that meet the government goals, in our case, the characteristics of the authority revealed that the authority should be a *government entity*, and it should have the ability to implement and monitor MSP. Add to that, the characteristics themselves were centered on a

central idea that expresses an authority that has a long history in the marine field. And when it comes to legislations support, the following characteristics fulfilled this requirement (*institutional and governmental frameworks support through legislative and regulatory policy, strong legal bases at the national level, strong legal bases at the regional level, strong legal bases at the international level*). In addition to that, it must have possessed the trans-boundary nature in its work. That clearly appeared in (*understanding of jurisdictional boundaries, a strong understanding of international maritime regulations (IMO regulations), wide experience of the multi aspects of maritime areas and domains, ability to coordinate trans-boundary issues*). Further, the understanding of related issues, is, without question, mandatory feature, and that clearly appeared in (*understanding general aspects of the marine environment, understanding of biological boundaries, understandings of all marine habitat needs*). Last but not least, it is of paramount importance that the recommended authority should pose some organizational harmony, thus understanding each other terminologies and having the same, somehow, priorities. It is interesting that this requirement had been met with the following characteristics; (*matching organizational structure with other MSP authorities at the domestic level, regional and international levels*)

Add to that, the results indicate that consensus is in favour of identifying an MSP management authority entrusted to plan and implement MSP initiatives. Many authors, for example, Liu et al. (2011), have asserted that it is necessary to specify the MSP and management authority, as well as the scope of local governments. Hassler et al. (2018) argued that there is a need to “*establish more specific transnational institutions that can target specific geographic or issue areas more effectively*”.

In investigating the recommended authority (maritime authority) opposite to the proposed characteristics. It unmistakably seemed that MA has all of them. Who is better to handle trans-boundary issues and has international connections on a daily bases than MA. Though it is not specifically mentioned in previous studies, some studies have discussed related issues. For instance, Kopti et al. (2016) highlighted the importance of integration of maritime safety into the process of MSP by including it in the learning process of the higher education in the maritime field. Flannery et al. (2015), in an attempt at exploring the political and institutional factors that may facilitate effective transition to trans-boundary MSP, highlighted the need to address the role of formal trans-boundary institutions and argued that MAs could play that role. From another perspective, in the Congo, “*shipping operates in a combined area that is equivalent to 92% of the Congo’s Exclusive Economic Zone (EEZ); far exceeding the area allocated for other user groups (conservation, fisheries, and petrochemicals)*”. Therefore, it should be a part of decision-making process; otherwise, it will increase conflict among users and lead to the degradation of the environmental dimension (Metcalfe et al., 2018).

From another perspective, an MA has no limitations with regards to trans-boundary issues because it has daily interaction and responsibilities with ships and their effect on the environment in remote areas; even in neighbouring countries particularly when acting as flag state. Similarly, Westholm (2018) argued that there is no consistent interpretation of what the appropriate level of management is, or ecosystem scale when addressing MSP. Due to their extensive and daily interaction with the marine environment and its users; doing the difficult task of managing what you cannot see; makes MAs the most suitable for the task.

Having close look from another angle, Pittman and Armitage (2016) recognized six (6) factors that contribute to effective governance, namely: timely science-policy integration, strong leadership, supportive networks, socially fit, functionally fit, and temporally fit. It is plain to see that MAs can be said to possess those six (6) factors. MAs are a science and policy integrated agency with strong leadership qualities due to their many decades of experience in managing related issues. Not only that, they are linked to a wide network, at national and international levels (IMO), that makes them socially accepted because of their experience in the field. They are functionally fit as this has always been their

job and, temporally, ready.

However, it is normally observed that the introduction of new ideas (as in the case of MSP initiatives), should pass through successive phases as argued by Argyris and Kaplan (1994), “1) participants learn to understand the new ideas, 2) participants believe that the ideas are valid and useful, and 3) management encourages the implementation of the new ideas”. However, the authors of this paper believe that the steps of implementing new ideas can be organized from an acceptance perspective in the following order: 1-introducing a new general idea, 2-acceptance by the target people, 3-enforcing details of the idea because human instinct accepts new burdens little-by-little and adopts new decisions degree-by-degree. Reading the steps of MSP implementation, we can deduce that it, too, had gone through the steps suggested by Argyris and Kaplan (1994). Yet, from an acceptance perspective, the last step mentioned above (enforcing details of the idea) is at the core of this study; which is enforcing the need for an MSP management authority.

Nevertheless, the handing over of MSP planning and implementation responsibilities to an MA may require a transition phase as suggested by Diz et al. (2018) who introduced Transition Management which is based on the assumption that change is needed, and focuses on how change is inhibited or facilitated, rather than what its starting point is and whether it ends in a desirable state. In addition to the reflexive marine governance arrangement, learning the enabling and constraining conditions from others’ experiences, producing knowledge and sharing information with all stakeholders at national and regional levels and changing the MSP discourses to formulate common regional position as situations may demand are also essential in introducing changes (van Tatenhove, 2017).

6. Conclusion

To sum up, the following recommendations arise from the results of this study. First, MAs should be given a prominent role in managing marine areas. The above analysis and the analyses presented in other studies lead to the conclusion that MAs are the most appropriate institutions for managing marine areas as they are most aware of the traffic in the sea-lanes, fishing, conservation of the marine environment (marine pollution protocol (MARPOL) and SDG), cables and pipes laid on the sea bed as well as renewable energy infrastructures on the sea because all these activities must had, at some stage in their planning and development, been referred to an MA of the country in question. Secondly, the officials at the offices of an MA and the IMO have long experience as seafarers, which is sufficient to enable them to comprehend the basics of all matters related to the sea. Therefore, an MA and the IMO are best suited for this task.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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