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An analysis of the process of implementation of IMO's initial GHG strategy in Central America by using a multi-method approach

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AN ANALYSIS OF THE PROCESS OF IMPLEMENTATION OF IMO'S INITIAL GHG STRATEGY IN CENTRAL AMERICA BY USING A MULTI-METHODS APPROACH.

By

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views and are not necessarily endorsed by the University or any institution figuring hereafter.

(Signature): .....

(Date): .....2022. September 20.....

Supervised by: Prof. Dr. George Theocharidis

Supervisor's affiliation: Professor of Maritime Law & Policy

NB The supervisor's signature is not required.

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Abstract

Title of the Dissertation: **An analysis of the process of implementation of IMO's initial GHG strategy in Central America by using a multi-methods approach**

Degree: **Master of Science**

The International Maritime Organisation (IMO) has enacted an Initial IMO Strategy on Reduction of GHG emissions from ships to which political interventions should correspond. The initial strategy proposes a series of candidate measures to satisfy the aim of enhancing shipping's contribution to hold global warming. However, the main purpose of the initial strategy is to be implemented at domestic levels and it is not yet certain how Central American (CA) states have approached this issue. In the light of this, the current dissertation consists of a multi-methods approach to identify the process of the initial strategy in CA.

Correspondingly, three main questions govern the presentation of results. At first, a literature review method is utilised to understand what the initial strategy mandates to IMO members. Secondly, the methodologies of literature review and interpretative policy and legal analysis are combined to identify what CA has done as a result of the initial strategy. Thirdly, the legal and policy analysis is combined with the results of a qualitative open-ended survey to determine how exactly CA has acted with respect to the initial strategy.

The dissertation founds that the port development in the region will contribute to the reduction of maritime emissions and that the progress of CA can be described with four categories. According to their status of implementation, the countries can be categorised as follows: (1) The enforces of air pollution standards, (2) the contractors of air pollution standards, (3) the enforcers of marine protection standards and, (4) the non-contractors of environmental regulations. Nevertheless, a comprehensive description of the process is to be found in the various chapters conforming the current dissertation.

KEYWORDS: International Maritime Organisation (IMO), Marine Environment Protection Committee (MEPC), Initial IMO GHG strategy, Central America (CA), Process Evaluation.

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List of Abbreviations

CA	Central America.
CBDR	Common But Differentiated Responsibilities.
CC	Climate Change
COCATRAM	*Comisión Centroamericana de Transporte Marítimo.*
EEDI	Energy Efficiency Design Index.
EU	European Union
GHG	Green House Gases.
IMO	International Maritime Organisation.
IPCC	Intergovernmental Panel on Climate Change.
KP	Kyoto Protocol.
MARPOL	International Convention for the Prevention of Pollution from Ships.
MBM	Market-Based Measure.
MEPC	Marine Environment Protection Committee.
NAP	National Action Plans.
NDC	National Determined Contributions.
PA	Paris Agreement.
SEEMP	Ship Energy Efficiency Management Plan.
SICA	*Sistema de la Integración Centroamericana.*
SIECA	*Secretaría de Integración Económica Centroamericana.*
TOC	Theory Of Change.
UN	United Nations.
UNFCCC	United Nations Framework Convention on Climate Change.

1. Introduction

1.1 Background

The current regime of maritime governance comprises various treaties, but much of it would not be possible without the United Nations Convention on the Law of the Sea (UNCLOS). In the past, the settlement of the first sovereign states updated the legal regime governing the interactions between humans and the sea, introducing the first elements of maritime governance (Zacarias & Ardron, 2019). Currently, several elements are consolidated in UNCLOS, which provides and limits the rights and obligations of sovereign states in their jurisdictional areas. The convention details mechanisms that regulate the entitlement of flags, the competences of Port States and the obligations of Coastal States.

On the other hand, the efforts to mitigate and adapt communities and ecological systems from climatic alterations fall under a different regime. The United Nations Framework Convention on Climate Change (UNFCCC) represents a relevant step for Climate Change (CC) interventions (Zacharias and Ardron, 2019). It encourages contracting states to avoid dangerous levels of anthropogenic interference through the reduction of Green House Gases (GHGs). However, the convention is limited to encouragement and does not set specific limits on anthropogenic emissions. The Kyoto Protocol of 1997 remedies this issue by introducing mandatory emission reductions for developed states. Nonetheless, the current CC regime was only completed in 2015, when the UNFCCC parties adopted the Paris Agreement (PA). The PA emphasises voluntary efforts to address CC, requiring contracting governments to specify Nationally Determined Contributions (NDCs) as an effort to hold the increase in global temperature (Joung et al., 2020).

The combination of the two regimes [one influencing the other] allows to regulate international transport. Shipping and aviation are international by nature,

meaning that the allocation of emissions must migrate from the territory-based approach to a flag-based regulation. Therefore, rather than addressing international transport modes with NDCs, the Kyoto protocol directly assigns the leadership to the competent organisations, i.e., the International Maritime Organisation (IMO) and the International Civil Aviation Organisation.

Although IMO addresses its responsibility with a holistic regime of air pollution regulations, an enhancement is necessary. The earliest regulations tackling maritime emissions came in 1997, when the parties of the International Convention for the Prevention of Pollution from Ships (MARPOL) adopted a sixth annex. The annex encompasses various standards to minimise air pollution which are updated together with the sessions of the Marine Environment Protection Committee (MEPC). Nevertheless, shipping still accounts for 2.89% of global GHG emissions (IMO, 2021), equalling those from The United Kingdom or Germany (Chircop & Shan, 2020). In addition, in terms of sulphur and nitrogen oxides, shipping represents up to 12% of the global total (Ma, 2020).

However, decarbonising the maritime transport is not an easy task. Vessels have an approximate lifetime of thirty years, and replace entire fleets demand enormous amounts of resources, which release even bigger amounts of pollution to be obtained and processed, without mentioning the environmental impacts associated with ship recycling activities or the availability and readiness of carbon-free technologies. In addition, the emissions ships generate increase proportionally to trade growths.

Nevertheless, the first steps have been taken and early actions should follow. IMO formulated an initial strategy on reduction of GHG emissions from ships [the initial strategy] which aims to decrease the carbon intensity of ships via short-, mid-, and long-term candidate measures. However, the goals of IMO must outweigh the expected increases in seaborne trade (Metzger, 2022), without affecting the economies of Small Island Developing States and Least Developed Countries. Additionally, the incorporation of global targets into the policies of its members is yet another difficulty IMO faces. Hence, it is crucial to evaluate the process of the strategy on a continuous basis to improve current interventions with available data.

1.2 Problem statement

IMO enacted the initial strategy with a view to reducing GHG emissions from shipping to which political interventions should follow. Evaluation is critical throughout the policy cycle, and it should inform policy makers before, during and after implementation (HM Treasury, 2020). Evaluating its process allows to understand how the strategy is being or has been implemented, and the initial effects that it has had and for whom (HM Treasury, 2020). Nonetheless, particularly in Central America (CA), the process of the initial strategy is uncertain and the literature in this regard remains scarce.

1.3 Aims and objectives

In the absence of an evaluation mechanism from IMO, the current research aims to identify the process of the initial GHG Strategy in CA by using a multi-methods approach. To begin with, a literature review is presented in the second chapter with a view to understanding the initial strategy by describing the circumstances that led to its formulation and the most recent advancements. The third chapter addresses law and policy developments in the region, providing the contributions of CA at MEPC's plenary and its domestic developments. The fourth chapter contains the views of maritime administrations, following a Theory of Change (TOC) to identify advancements regarding the initial strategy. Subsequently, the fifth chapter discusses the research with a view to consolidating the overall research findings. Lastly, equally important, the sixth chapter provides a summary of conclusions and subsequent recommendations for consideration. Given these points, the literature gaps to be addressed in the current research can be consolidated in the following research questions:

1.3.1 What is required under the initial strategy?

1.3.2 Is the initial strategy being implemented in Central America as intended?

1.3.3 Is there any challenge preventing states to implement the initial strategy?

1.3.4 Which of the short-, mid-, or long-term candidate measures are already working in the Central American states and why?

2. The initial strategy

The international Maritime Organisation (IMO) is addressing new challenges on its mandate to provide machineries for cooperation regarding technical matters of shipping. IMO is the intergovernmental body ensuring quality in the shipping services through binding regulations in the fields of safety, security and environmental performance of vessels. Altogether, these regulations allow vessels to get engaged in international trade without compromising the welfare of seafarers nor the fragility of the marine environment. However, the increase in temperature levels requires IMO, and the industry it represents, to join the efforts on Green House Gas (GHG) mitigation. For this reason, IMO enacted an initial global-level strategy which intends to direct political interventions towards the reduction of maritime emissions. To further explain this, the current chapter presents a literature review of the history, the content, and the policy developments in regard to the initial strategy.

2.1 History of Formulation

The history of the initial strategy is key for its interpretation. According to the Law of Treaties, a treaty must be interpreted considering the events leading up to and immediately following its finalisation. Therefore, even though the strategy is more of a policy direction than a regulatory scheme, understanding its history retains the same relevance for appreciating what it requires from IMO members.

Firstly, the regulations of maritime emissions have several antecedents that were noted at IMO's plenary. The competences of intergovernmental organisations as regards Climate Change (CC) began in the twentieth century. The lead actions include the 1972 United Nations (UN) Conference on Human Environment, a meeting of the UN General Assembly regarding the protection of the common heritage of humankind from climatic alterations, the Montreal

Protocol on substances that deplete the ozone layer in 1987, and the constitution of the Intergovernmental Panel on Climate Change (IPCC; Chircop, 2019; Edwards & Roberts, 2015). The proliferation of such agreements resounded at IMO's General Assembly, which requested the Marine Environment Protection Committee (MEPC) to formulate binding regulations on air pollution from ships.[1]

Furthermore, IMO introduced mandatory measures on air pollution as early as 1997. By 1995, the MEPC adopted a resolution to include the precautionary approach in IMO's work, as set out by the Rio Declaration on Environment and Development.[2] The precautionary approach encourages the development of regulations based on environmental impact assessment, seeking to adapt the regulatory work of IMO in a feasible way while pursuing effectiveness of implementation. The amendment of the International Convention for the Prevention of Pollution from Ships (MARPOL) to include the regulations on maritime air pollution represents one of IMO's firsts precautionary approaches. Remarkably, the amendment of MARPOL was adopted in 1997, prior to the adoption of the Kyoto Protocol (KP).[3] Correspondingly, the KP acknowledges the work the organisation did and reaffirms the responsibilities of IMO as a catalyser of maritime exhaust.

Not surprisingly, IMO did not hesitate to strengthen the existing framework. According to Zanella (2018), the following step was the formulation of the first GHG study in 2000. The study arises from the eighth conference resolution of the parties to MARPOL, which invited the organisation to assess the global share of shipping emissions.[4] In detail, the study accounted shipping for 1.8% of 1997 emissions.[5] Moreover, the results of the study influenced IMO members, who urged the MEPC to develop additional emission reduction mechanisms, prioritising a methodology to measure the GHG efficiency of ships.[6]

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[1] Resolution A.719(17).
[2] Resolution MEPC.67(37).
[3] Protocol of 1997 to amend the MARPOL Convention, preamble.
[4] See 1997 MARPOL Conference Resolution 8 – CO2 emissions from ships.
[5] ISWG-GHG 1/2.
[6] Resolution A.963(23).

However, energy efficiency regulations would take longer to be implemented, but in the meantime significant progress was made. In 2005, MEPC adopted a new methodology based on data collection from ships to improve energy efficiency performance and to develop a comprehensive GHG index (Zanella, 2018). During the same year, the 53rd session of the MEPC agreed to revise Annex VI in view of the latest information on ship emissions and their effects.[7] This decision intensified the work of the committee, agreeing in 2006 that the energy efficiency regulations should be included by no later than 2009. Nevertheless, the goal to introduce GHG efficiency standards was premature, and more time was required to finalise the measures. Instead, 2009 presented the results of the second GHG study, in which shipping accounted for 2.7% of 2007's emissions

Eventually, some deliberations culminated in 2011 with the adoption of energy efficiency regulations as a new chapter of MARPOL Annex VI.[8] The new chapter regulates key aspects of energy efficiency, such as the Energy Efficiency Design Index (EEDI), with a mandatory phase zero for vessels over 400 tonnages constructed after 2011, and the Ship Energy Efficiency Management Plan (SEEMP), mandatory for all vessels. The energy efficiency framework became mandatory in 2013, operationalising its first progressive phase [phase one]. Additionally, the third GHG study was initiated in 2012, estimating the shipping contribution as 2.2 per cent of the global emissions (IMO, 2015).

Further, parallel developments on the CC regime enhanced the work of IMO. In 2015, the 21st conference of parties to the UNFCC adopted the PA, including the target to hold global warming below 2 degrees Celsius compared with the pre-industrial levels. Differently to the previous UNFCCC developments, the PA introduced the principle of Common but Differentiated Responsibilities (CBDR) encouraging every nation to undertake emission reduction activities. Additionally, during the 21st conference the subsidiary body for scientific and technical advice noted IMO's progress on GHG reduction and invited the organisation to continue its work and to report on future sessions.[9]

[7] ISWG-GHG 1/2.
[8] Resolution MEPC.203(62)
[9] ISWG-GHG 1/2.

Additional developments were achieved in 2016 when MEPC approved the roadmap on GHG reduction (Chircop, 2019). The roadmap welcomes the PA and schedules a series of lead actions aiming to finalise a comprehensive strategy on GHG reduction by 2023.[10] In detail, the lead actions address the adoption of a data collection system, an intersessional meeting to start discussions on a comprehensive strategy by MEPC 71, and the adoption of an initial strategy by MEPC 72. As a result of the undertaken commitments, the MEPC adopted the Initial IMO Strategy on Reduction of GHG Emissions from shipping in 2018 [The initial strategy] at MEPC 72.[11]

2.2 The Strategy

The initial strategy represents an international pathway to which IMO members should align themselves in order to achieve emission reductions in shipping. The official communication was delivered in resolution MEPC 304(72) of 2018. The parts of the initial strategy are: (1) Introduction, (2) vision, (3) ambition levels and guiding principles, (4) candidate measures, (5) barriers and supportive measures, (6) follow-up actions, and (7) periodic review of the strategy. In the light of this, the current section aims to understand what IMO mandates to its member states by analysing some of the strategy's parts.

At first, the introductory part of the strategy summarises the history and provides the context, emission scenarios, and overall objectives of the strategy. As discussed in the previous section, several events led to the formulation of the strategy including international conferences, sessions at the IMO's general assembly and roadmaps at MEPC. According to Chircop (2019), the context surrounding the strategy relies on the framework of the United Nations Convention on the Law of the Sea (UNCLOS), MARPOL and UNFCCC. To explain, the strategy depends in an effective exercise of jurisdiction from the states to give compliance over MARPOL Annex VI, harmoniously with the temperature goals of UNFCCC. As stated by Bouman et al. (2017), this approach reconciles maritime

[10] MEPC 70/18/Add.1, Annex 11.
[11] MEPC.304(72).

emissions with international commitments, treating the shipping sector as a sovereign nation under IMO's mandate.

Moreover, the strategy provides emission scenarios with a certain degree of uncertainty that were determined with the assessments of GHG emissions and serve as baselines for IMO's work. The original communication of the initial strategy provides an estimate of emissions growth in line with the results of the Third IMO GHG Study, forecasting an increase of 50 to 150 per cent by 2050 (IMO, 2018). In contrast, the results of the fourth study reduced some uncertainties, providing that the increase of maritime emissions will fluctuate around 90 to 130 per cent by 2050 (IMO, 2021). These scenarios serve as baselines for the initial strategy and the work of IMO. To put it differently, it is critical that political interventions first determine the current situation to later assess the initial impacts the strategy has had.

However, additional factors could be considered to further minimise uncertainties. On the one hand, the results of the fourth IMO GHG study do not consider the impact of the Covid-19 pandemic on maritime emissions. Certain investigations identify that the Covid pandemic occasioned a decrease in shipping emissions, which ranged in between 25% (Liu et al., 2020), 12% (Durán-Grados et al., 2020; Yang et al., 2022) and 10.68% (Ju & Hargreaves, 2021). On the other hand, current economic constraints are also likely to affect shipping emissions. As stated by Liadze et al. (2022), the conflict between the Russian Federation and Ukraine has triggered several economic recessions, such as enlarged trade links and higher fossil fuel prices. In addition, Climate Action Tracker (2022) states that the conflict has triggered investments to produce fossil fuels in new areas and that new logistics infrastructure is also being built. Therefore, although the increase in fuel costs might influence shipowners to adopt less-consumption strategies which reduce GHG, the enlargement of trade links may increase the number of vessels engaging on inter-continental shipping that currently accounts for most maritime emissions.

Furthermore, the strategy pursues three aims (IMO, 2018). Firstly, the initial strategy seeks an enhanced participation of IMO in the UNFCCC goals by further reducing emissions from international shipping. Secondly, the organisation aims to provide shipowners with additional mechanisms to reduce emissions without

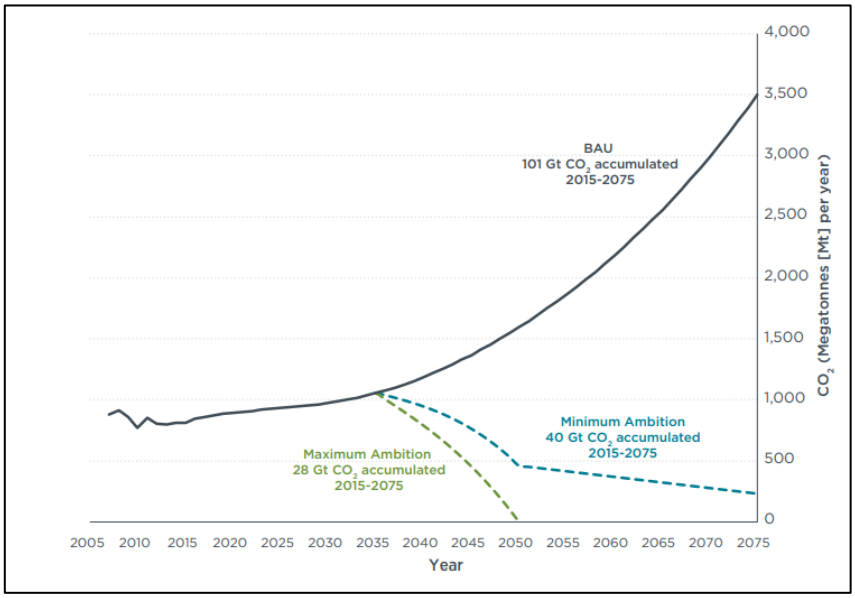
compromising their ability to serve remote areas. Thirdly, IMO sets the aim to phase emissions out as soon as possible within this century. Chircop (2019) states that the aims of the initial strategy recall IMO's journey on GHG reduction and express the commitments of the organisation with its least developed members. Equally important, the aims the strategy pursues evidence that IMO relies on the precautionary approach to identify GHG reduction mechanisms that are not only feasible to implement but also do not jeopardise trade.

The initial strategy sets three ambition levels. IMO (2018) pursues to enhance energy efficiency in order to attain a carbon intensity reduction of at least 40% by 2030, targeting a peak and decline of at least 50% by 2050. To illustrate, Rutherford and Comer (2018) combined the results of several studies to compare the ambition levels of the initial strategy with a Business-As-Usual scenario. Their results are shown in

Figure 1. Nonetheless, IMO members advocate for different ambition levels, debating between flexible or strict approaches (Healy, 2020). Earsom and Delreux (2021) state that the European Union (EU) and Pacific States are the typical claimants for higher ambitions in maritime decarbonisation, while according to Serra and Fancello (2020) the counterarguments are mainly stressed by South American States led by Brazil.

Figure 1

CO2 emissions from vessels under the initial strategy.



*Note: B*lue and green lines represent the CO2 emissions under the different ambition levels of the initial strategy whereas the black line represents the business-as-usual emissions. Source: Rutherford & Comer (2018).

Furthermore, the initial strategy establishes four principles to guide regulatory activities on GHG reduction (IMO, 2018). The strategy seeks to be cognizant with the principles figuring on IMO instruments, including *inter alia* non-discrimination and no more favourable treatment; but, without excluding the UNFCCC principles, such as CBDR and respective capabilities. In addition, the initial strategy visualises an effective implementation of mandatory requirements over each flag, ensuring the non-affectation for least developed members. Hence, IMO guarantees that every adopted measure follows a versatile approach to decision-making, balancing the precautionary approach with available evidence.

Similarly, IMO proposes short-, mid- and long-term candidate measures to guide political interventions. Firstly, short-term measures [2018 - 2023] include operational measures, regulatory measures [improvements on energy efficiency] and policy directions such as National Action Plans (NAPs; García et al., 2020), that are critical to attain the strategic goals for 2030 (Faber, 2021). Secondly, mid-term measures [2023 – 2030] target the development of bunkers and the assessment of Market-Based Measures (MBMs; García et al., 2020), mechanisms that not only achieve a broader scope of GHG reduction, but also prevent the strategy from relying solely on existing measures (Christodolou et al., 2019).

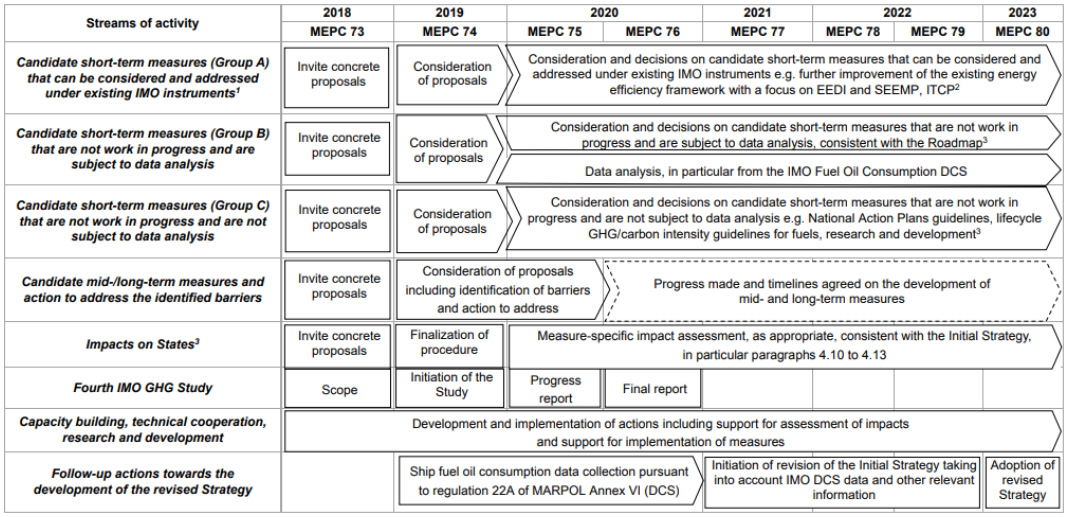
However, just as MBMs are likely to influence better development and implementation of technical and operational measures (Kachi et al., 2019), they are also likely to modify the shares of transport modes (Halim et al., 2019). Lastly, long-term measures [2030 and beyond] are as vague as uncertain the future GHG reduction mechanisms are (Chircop, 2019). The initial strategy includes two measures: (1) Development of fuels and fuel infrastructure, and (2) encourage and facilitate the adoption of innovative mechanisms. Inferably, the next task for MEPC is the assessment of feasibility of measures and to consider additional proposals with a view to finalising measures within the specified timelines.

Moreover, relevant outcomes such as the follow-up programmes were produced in subsequent meetings [MEPC 73 and 74]. As provided in

Figure 2, MEPC 73 adopted a series of follow-up programs to govern the deliberations towards MEPC 80. According to Joung et al. (2020), MEPC 74 was in line with the programme, and it considered proposals on energy efficiency and GHG reduction mechanisms with a view to developing draft amendments to MARPOL. Healy (2020) states that the outcomes were the adoption of EEDI amendments for containerships.

Figure 2

MEPC 73 follow-up programmes.



Note: Source: MEPC 73/9/Add.1, annex 9.

Respectively, MEPC 75, 76, 77 and 78 also denoted relevant progress. MEPC 75, held online, approved carbon intensity reduction as a short-term measure on GHG reduction. Correspondingly, MEPC 76 agreed to develop a carbon intensity code and invited the organisation to revise possible impacts on states.[12] Furthermore, in view of recent IPCC reports, MEPC 77 agreed to revise the ambition levels, inviting members to submit proposals for a revised GHG strategy.[13] Such deliberations continued at MEPC 78, further considering the necessity of aligning ambition levels with global temperature goals.[14] Nevertheless, not only MECP 78 addressed important elements of the strategy (e.g., NAPs), but also the deliberations promoted the adoption of a revised strategy by consensus. Although delegations' perspectives differed, the need for clear maritime decarbonisation targets was evident[15] and showed that the maritime sector is aiming for common responsibilities. In addition, MEPC 78 also agreed to continue the deliberations with one intersessional meeting before MEPC 79.

2.3 Current and future developments in GHG reduction

The current and future developments related with the IMO's initial GHG strategy are of different nature. The literature in relation to the initial strategy commonly investigates or evaluates the cost of political, technical, or operational developments. On the other hand, the literature regarding the process of CA usually addresses the evolution of the CC regime, the advancements on maritime decarbonisation, or the advancements in regional cooperation. In the light of this, the current section aims to analyse such literature with a view to identifying political developments on GHG reduction. Moreover, the current section transitions in between what is mandated under the initial strategy and what Central America (CA) has done.

Firstly, one category of studies investigates political actions targeting the reduction of maritime emissions. Christodoulou et al. (2019) consolidates the

[12] MEPC 76/15/Add.1.
[13] MEPC 77/16.
[14] MEPC 78/17.
[15] See: Specific views on the revision of the vision and levels of ambition. MEPC 78/17, para. 7.18 – 7.34.

information contained in official reports of international institutions, government websites, and official pages of classification societies, finding that the major number of interventions fall within the EU jurisdiction, followed by North America and Asia. Garcia et al. (2020) states that EU interventions began as early as 2015 with the adoption of the regulation on monitoring, reporting and verifying carbon dioxide emissions from maritime transport or the EU-MRV, a key component of EU's Emission Trading System. The system of emission trading and additional MBMs were studied by Wan et al. (2018) who compares them with operational and technical measures, finding that MBMs are necessary not only to address maritime emissions but also to enhance the effectiveness of technical and operational measures. Christodoulou et al. (2019) complement such findings stating that maritime emissions are commonly addressed with economic incentives. In the same fashion, Alamoush et al. (2022) identified various mechanisms used in ports to reduce maritime emissions. The results pointed out that most policy makers in developing countries belong to the public sector, and that most target groups [emission producers] are driven by short-term profits rather than environmental sustainability. Therefore, political actions attain better results when the typical business-scenario is compromised or when the environmental performance is rewarded. In addition, Kim et al. (2022) identifies that given the transboundary nature of air pollution, parallel interventions demonstrate more efficiency in maritime GHG reduction.

Coupled with the above, certain political interventions are directly triggered from the initial strategy. The earliest interventions fall within the EU jurisdiction, with political actions from Norway and the United Kingdom. These interventions are what IMO denominates early actions on GHG reduction and represent the first concrete instances of NAPs. Table 1 summarises the current number of interventions in this regard.

Table 1

NAPs per country

Administration	Title of NAP	Year of Adoption
Finland	Government resolution on reducing Greenhouse Gas emissions from Maritime and Inland waterway transport	2021
India	Maritime India Vision 2030	2021
Japan	Roadmap to Zero emission from international shipping	2020
Marshall Islands	Rebbelib 2050: A Catalyst for Change	2022
Norway	The Government's action plan for green shipping	2021 / 2019
Singapore	Maritime Singapore Decarbonisation blueprint: Working towards 2050	2022
United Kingdom	Clean maritime plan: Maritime 2050 environment route map	2019

Note: Adapted from the list of National Action Plans available at imo.org

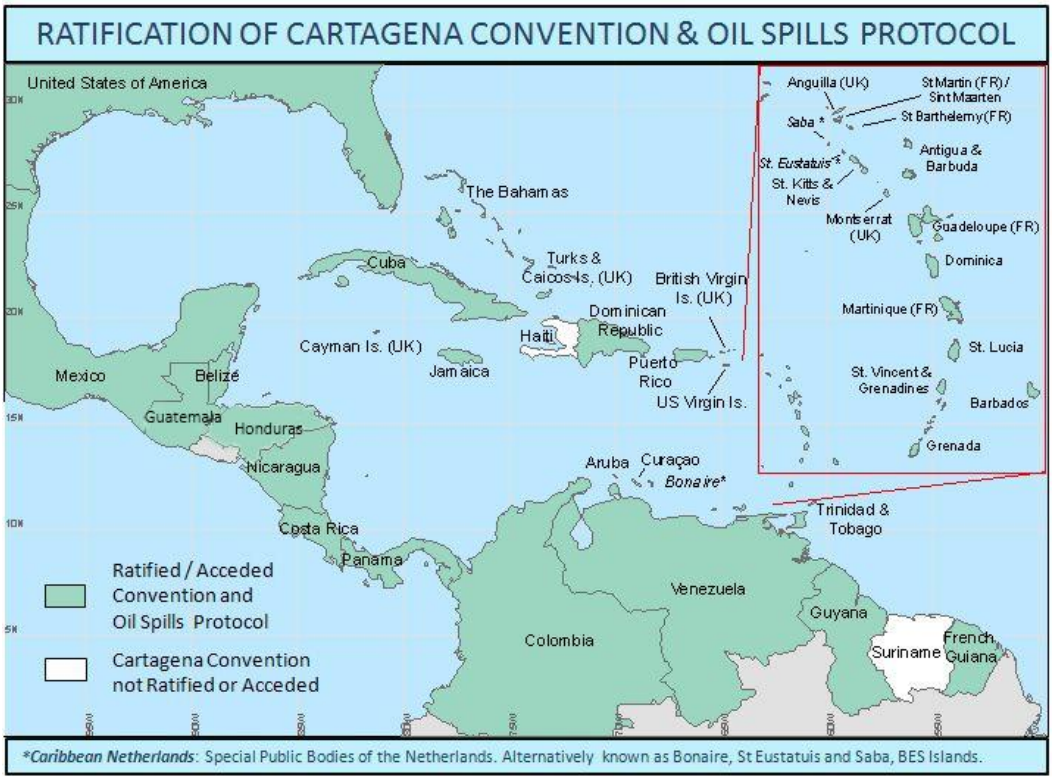
Secondly, another category of studies covers the evolution of the CC regime in CA. Den Elzen et al. (2013) provides that the UNFCCC framework is regionally complemented with the Cancún agreements, which were reverted with interventions from certain CA governments, such as Costa Rica [seeking carbon neutrality by 2021]. Similarly, Moraga and Meckievi (2016) compared several legal developments on CC, identifying important Latin American governmental institutions, legislative approaches, and policy recommendations. In the same manner, Edwards and Roberts (2015) studied the developments of CC interventions in Latin America, highlighting the efficiency of the region in terms of development generated per unit of GHG emitted; the economic and social consequences of CC; the rationale behind the differentiated responsibilities of UNFCCC; and relevant domestic developments in CC mitigation and adaptation. Moreover, it is remarked that countries such as Costa Rica, Guatemala and Panama have committed to take early action to avoid future decarbonisation costs (Edwards & Roberts 2015); or, in other words, to develop sustainably (Moraga & Meckievi 2016). However, Singh and Rambarath-Parasram (2019) state that the reports of the Economic Commission for Latin America and the Caribbean denote slow progress on interventions.

Furthermore, another category of studies provides the developments towards maritime decarbonisation, which is partly addressed in the English literature. Certain governmental practices to reduce the direct and indirect emissions of the

Latin American transport sector are provided by Erazo (2010), who identifies developments in South America, Costa Rica, El Salvador, Guatemala, Nicaragua, and Panama. Furthermore, Singh and Rambarath-Parasram (2019) provide various regional barriers to attain energy efficiency. The authors provide some considerations for policy formulation, figuring among them the heterogeneity in ships, high risks for shipowners, uncertainties on decarbonisation costs, informational problems, ineffective incentives, satisfactory [good enough] interventions rather than optimum decisions, and under-developed maritime legislation and jurisprudence. Nevertheless, Singh and Rambarath-Parasam (2019) also provide certain policy developments. As shown in Figure 3, several American states ratified the Cartagena convention, a multilateral agreement which *inter alia* mandates to ratify MARPOL to protect the marine environment from ship pollution.

Figure 3

Cartagena Convention ratification status.



Note: The Cartagena convention was adopted in 1983. Source: UN Environment Programme.

However, the Spanish literature provides additional perspectives. Caldentey (2014) highlights the significance of the Central American Integration System (*Sistema de la Integración Centroamericana,* hereafter SICA) as well as the barriers hindering a proper integration. The author states that CA and certain Caribbean administrations have been participating in a series of intergovernmental meetings denominated *Las Cumbres* within 1992 and 2011, discussing agenda items such as trade facilitation, tourism, and maritime transport. Jarque et al. (2009) states that these conferences are regional instances of high-level multilateral cooperation in political decisions, performing well in paper but unsatisfactorily in operationalisation. Tórrez Martinez and Orozco Delgadillo (2007) indagated the economic initiatives under SICA, identifying that the Secretary for Central American Economic Integration (*Secretaría de Integración Económica Centroamericana,* hereafter SIECA) serves as coordination centre for CA commercial relations. The authors state that the

Central American Commission on Maritime Transport (*Comisión Centroamericana de Transporte Marítimo,* hereafter COCATRAM) is the SIECA specialised institution in relation to CA maritime and port development.

Remarkably, COCATRAM plays a crucial role for CA. COCATRAM is one of IMO's global centres for maritime technology and cooperation. Not only the Commission assists CA administrations in adopting, ratifying and enforcing international standards of IMO instruments, but also leads capacity-building activities related to multilateral approaches on port state control: The *Viña del Mar* agreement and the Caribbean MoU (Singh & Rambarath-Parasam, 2019). Notably, the report from COCATRAM (2019a) conglomerates several legislative developments, administrative arrangements and enforcement mechanisms in CA that are addressed more comprehensively in the following chapter.

3. The initial strategy: Policy and legal developments

The International Maritime Organisation (IMO) is complying with its mandate to provide machineries of cooperation regarding technical aspects affecting ships, but what have states done? IMO adopted an initial strategy on GHG reduction at MEPC 72 with a view to decarbonising the maritime industry during the second half of the century. However, the effectiveness of the strategy will be determined by the degree of implementation by IMO Member States. The organisation has encouraged its members to take early actions on GHG reduction during the short-term period with a view to reducing emissions to meet the goals of the Paris Agreement (PA). In the light of this, the current chapter aims to identify the process of implementation of the initial strategy in Central America (CA) by covering the contributions of the region at IMO deliberations and its domestic advancements. Moreover, the information to be presented consists of an interpretative approach to policy and legal analysis, seeking to identify the contributions of CA regarding the initial strategy.

3.1 Central America as an international policy actor

Central America is highly vulnerable to the effects of Climate Change (CC). According to the Economic Commission for Latin America and the Caribbean (CEPAL; 2022), the issue of global warming accounts for several economic and climatic consequences in the region. Coupled with this, CEPAL (2015) states that these climatic alterations are more severe with economies of subsistence, accounting for 30% of the regional labour. Against this backdrop, it can be expected that CA states play as entrepreneurs in GHG deliberations. Nevertheless, to determine its contribution, the current section will provide a summary of deliberations and official communications in the context of the GHG

strategy, with a view to determining how CA has contributed to the development of IMO's strategy.

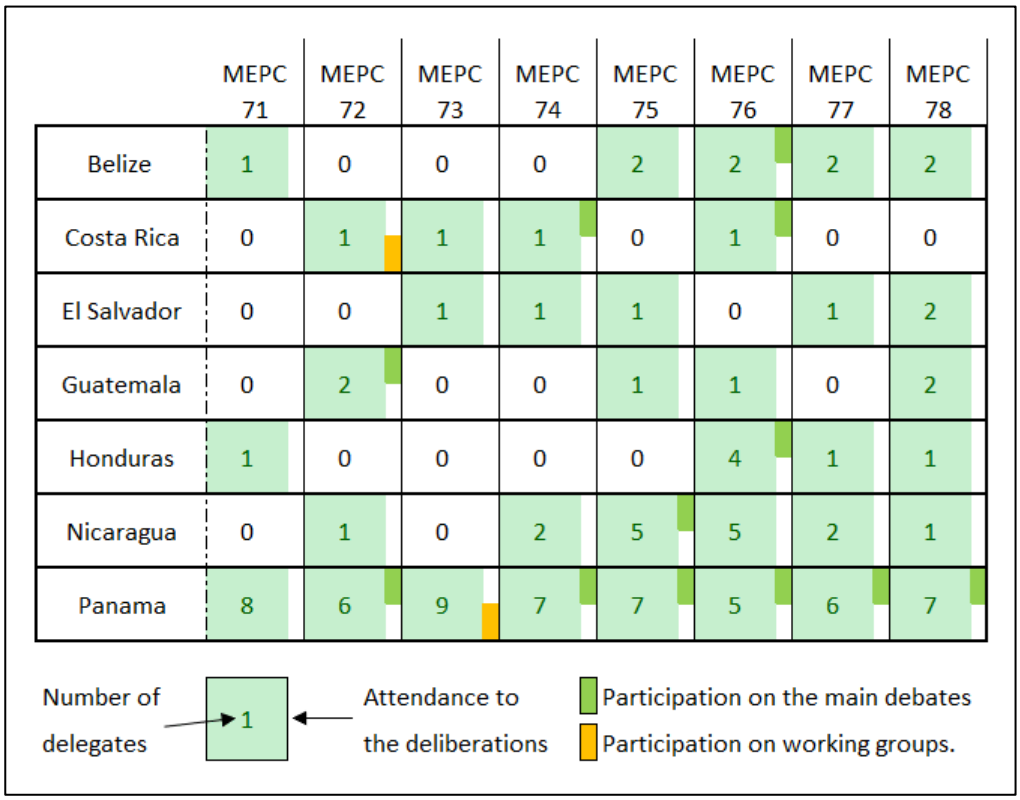
Accordingly, certain CA delegations were present during the adoption of Annex VI. The annex was adopted at the conference of the parties to the International Convention for the Prevention of Pollution from Ships (MARPOL), held in September 1997. Moreover, the conference was attended by parties to the convention, associate members, observant states, intergovernmental organisations, and non-governmental organisations; in which Belize and Panama participated as parties of MARPOL, whereas Costa Rica was present as an observant state.[1] Nonetheless, no view or perspective could be retrieved from the conference.

Additionally, several sessions of the Marine Environment Protection Committee (MEPC) counted with the participation of CA delegates. The MEPC's discussions regarding the initial strategy were in line with the Roadmap on GHG reduction and the strategic follow-up actions. The roadmap scheduled the deliberations of MEPC 71 and MEPC 72 as the forums in which the initial strategy should be formulated and adopted. Furthermore, the program of follow-up actions, which was MEPC 73's main output, guided the sessions that followed. The programme defined MEPC 74 as the plenary to discuss proposals on candidate measures. It was programmed that the firsts measures should be adopted at MEPC 75 and MEPC 76 as appropriate. Additionally, it was also programmed that MEPC 77 and 78 should hold discussions about the revision of the initial strategy, which is to be adopted at MEPC 80. Correspondingly, every session count with the attendance and oral interventions from CA delegates, as shown in Figure 4.

[1] MP/CONF.3/33/Rev.1

Figure 4

Participation and inputs from Central American delegations.



Note: Author's elaboration, participation on main debates refers to the participation during the discussions held in agenda item 7 [reduction of GHG emissions from ships], whereas participation at working groups alludes to inputs made during the deliberations of the working papers five and six [the outcomes of the working groups on GHG reduction].

Accordingly, some inputs of CA delegations during the adoption of the strategy adopted a supportive approach. At MEPC 72, a few CA states made commitments regarding maritime decarbonisation. These states include Guatemala, which urged the committee to turn commitments into actions,[2] Panama, which referred to the Paris Agreement's temperature goals,[3] and Costa Rica, whose delegation said that while greater ambition would have been ideal, consensus at the committee is much more essential.[4] In other words, CA reflected a supportive approach which is essential for consensus and demonstrates commitment with

[2] MEPC 72 (2018, April 9), 10:54:32 [Spanish Meeting Audio]
[3] MEPC 72 (2018, April 9), 10:55:24 [Spanish Meeting Audio]
[4] MEPC 72 (2018, April 13), 10:26:51 [English meeting audio].

maritime decarbonisation but does not necessarily modifies the outcome of the deliberations.

However, subsequent inputs were more persuasive. Many of these contributions were made at later MEPC meetings, not only when the candidate measures were considered but also when the ambition levels were discussed. For instance, during the discussions of potential measures, Panama stressed that speed should not be decreased but rather optimised and that the committee's focus should shift from operational measures, which lack of evidence, to the improvement of energy efficiency.[5] Costa Rica also requested the committee to prioritise one measure over the others so that the necessary impact assessments and implementation steps could begin.[6] Similar viewpoints prevailed when Costa Rica, Nicaragua, Panama, and Honduras intervened at the discussion of ambition levels. On the one hand, some inputs were based on economic, or social impacts associated with climatic alterations, such as Nicaragua, recalling the severity of atmospheric events across CA as an invitation to enhance the ambition levels,[7] or Honduras, highlighting the impacts of global warming to plead and urge immediate actions for the continuation of humankind.[8] On the other hand, some inputs were more centred on environmental protection. These inputs include Costa Rica, requesting higher ambition levels as environmental protection tools,[9] and Panama, who stressed the need for zero emissions by 2050 to keep temperature increase below alarming levels.[10]

Moreover, another category of inputs focused more on technology transfer and capacity building as tools to enhance the implementation of the strategy. The initial strategy includes capacity building activities as supportive tools to minimise barriers on implementation. Such relevance was noted by certain CA delegates, such as Belize, who highlighted that technical cooperation and technology transfer are crucial to align the efforts of developing states with those of the initial

[5] MEPC 74 (2019, May 15), 11:55:38 [Spanish meeting audio].
[6] MEPC 74 (2019, May 15), 12:17:06 [Spanish meeting audio].
[7] MEPC 75 (2019, November 17), 12:58:58 [Spanish meeting audio].
[8] MEPC 76 (2019, June 11), 13:38:04 [Spanish meeting audio]
[9] MEPC 76 (2019, June 14), 11:55:08 [Spanish meeting audio]
[10] MEPC 77 (2021, November 23), 11:33:15 [Spanish meeting audio]

strategy,[11] and Panama [although more implicitly], who stated that the impact on states, ambitions, and strategic visions should enjoy priority in the revision, but it should not in any way constitute a restriction.[12]

Undoubtedly, the biggest regional actor at IMO is the delegation of Panama, which actively take a role in GHG deliberations. The delegation consistently supports initiatives which are proven to be feasible and refuses those which do not. As an example, during the discussions held at MEPC 76, the delegation made explicit its support for the progressive reduction of carbon intensity as a short-term measure, while at the same time, the delegation indicated that a global levy (MBM) for shipping will not be supported unless it represents a finalised product.[13] Panama assumes with responsibility its role at IMO, balancing possible impacts of measures with possible outcomes of GHG reduction on every decision. These interventions can be exemplified by the intervention made at MEPC 73, in which the delegation stated that speed reduction will not be supported unless sufficient evidence proves that safety and operational range are not impaired.[14]

Hence, the participation of CA at IMO reflects certain tendencies. Initially, the region did peculiar emphasis on impacts, whether environmental or socio-economic. At some point, the stakes at the deliberations forced the countries to choose between trade disruptions or severe climate alterations, prevailing the preference over the first. However, the delegations also demonstrated their interest over key areas, such as technology transfer and evidenced-based decisions. Nevertheless, a common interest was noted regarding ambition levels, in which several delegations stressed the need for maritime decarbonisation by 2050.

3.2 Insights from regional cooperation and development

The Central American Integration System (SICA) demarks relevant progress in regional cooperation and global integration. The *Protocolo de Tegucigalpa a la*

[11] MEPC 76 (2019, June 11), 13:41:39 [English meeting audio]
[12] MEPC 78 (2022, June 8), 10:26:53 [Spanish meeting audio].
[13] MEPC 76 (2019, June 14), 13:56:13 [Spanish meeting audio]
[14] MEPC 73 (2018, October 26), 15:00:52 [Spanish meeting audio].

Carta de Organización de Estados Centroamericanos (hereafter Tegucigalpa Protocol) created SICA as an institutional framework to constitute CA as a region governed by peace, freedom, democracy, and development. The founder members of SICA are the states of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama;[15] but, in 2000 and 2013, respectively, the system incorporated Belize and the Dominican Republic as plenary members (SICA, n.d.). The system recognises the Permanent Secretary of Central American Economic Integration (SIECA) as the competent entity to promote the harmonious and sustainable development of economic, social, and politic aspects across the region (Protocolo de Guatemala al Tratado General de Integración Económica Centroamericana; hereafter Guatemala Protocol).[16] Hence, the governments of CA have built the basis for the joint development and global integration of the region, addressing primary components such as economic growth.

In a similar manner, the system envisages a joint development of maritime affairs. Maritime affairs were included in the agenda of 1980 when the council of CA ministries under SIECA institutionalised a new agency to address the development of maritime transport, thereafter known as the Central American Commission of Maritime Transport (COCATRAM). In addition, together with amendment of the SIECA constitutive instrument by the Guatemala Protocol of 1993, the legal framework governing economic affairs was modernised. Within the renewed scope, the members undertook to increase trade by developing infrastructure and services, emphasising the sectors of energy, transport, and communications,[17] enhancing the role COCATRAM should play.

To further develop the maritime sector, the council of SICA presidents mandated the commission to create a comprehensive regional strategy on maritime affairs (COCATRAM, 2008). The strategy results from several *cumbres* in which the SICA presidents communicated various mandates to COCATRAM. Accordingly, the regional strategy emphasises on the development of short sea shipping, harmonious and efficient port operations, and better seafaring.

[15] Tegucigalpa Protocol, Art 1.
[16] Tegucigalpa Protocol, Art.28
[17] Guatemala Protocol, Art 28 para. 1

Moreover, the strategy describes collective tasks towards a joint vision for development. The common vision of SICA and the vision of COCATRAM (2008) are closely related. The strategy envisions CA as a competitive and well-integrated actor in world maritime trade, establishing the common mission of developing trade in line with the codes and international standards governing shipping. The direction COCATRAM sets infers that the attention of CA interventions should pursue the implementation of international maritime standards in order to achieve competitiveness and development.

Furthermore, the strategy prioritises the areas of maritime transport, maritime administrations, marine and coastal areas, communitarian maritime policy, and ports. To bring the regional vision to life, COCATRAM (2008) suggests six action areas. Firstly, the targets pertaining to maritime transport should seek to modernise legal and administrative frameworks and to enhance the security at ports so that the conditions for the proliferation of new commercial routes can be created. Secondly, the goals related to maritime administrations intend to increase capacities among regional institutions, with a view to enhancing prevention of pollution from ships and the capabilities of human resources. Thirdly, the marine and coastal part of the strategy targets the protection and conservation of coastal zones and the sustainable use of resources. Lastly, the area of maritime communitarian policy consolidates several guidelines for the development of national policies, including *inter alia* data collection, design and development of logistic platforms, and promotion of private investments in the maritime sector. However, although each strategic area is crucial, only specific elements can be linked with IMO's strategy.

In detail, the GHG-related aspects of the strategy are included in several guidelines. For instance, the strategy invites maritime administrations to formulate specialised policies to enhance the prevention, containment, and reduction of pollution in the marine environment. In addition, the marine and coastal area intends to augment the interactions between maritime administrations and the shipping industry to improve compliance with environmental standards, inviting governments to expose their advancements at international forums [e.g., IMO]. Additionally, the strategy highlights the significance of qualified human resources for the administration of maritime affairs, encouraging governments to increase

the capacities of public functionaries, including port and flag inspectors. The goals pertaining to the maritime transport sector emphasise the ratification and adoption of international instruments related to maritime safety, security, environmental performance, and labour (COCATRAM, 2008). Hence, the aspects related to the initial strategy can be encompassed in two categories: Better administration and better ships. Nevertheless, some aspects unintentionally contribute to the reduction of emissions due to their influence on ship operations, such as the targets regarding port development and trade facilitation.

However, the strategy does not allude explicitly to maritime emissions. The marine and coastal area in the strategy makes explicit mention of certain IMO instruments, such as the Ballast Water Management Convention or the Convention on Oil Pollution Prevention and Response. In addition, the strategy directly refers to the MARPOL Convention but excludes the protocol of 1996 regarding maritime emissions. Therefore, maritime emissions are only included implicitly, addressing them altogether with the international standards regarding marine environmental protection.

3.3 Domestic developments

As aforementioned, interventions such as the initial strategy or the Central American port and maritime strategy are likely to present gaps in the implementation stage. For this reason, the current section aims to serve as an inflexion point between what has been done and how it has been done, providing the interventions of CA regarding the maritime and port strategy with an emphasis on the GHG-related aspects. In detail, the mechanism to obtain information consisted of the analysis of the constitutive instruments of maritime authorities, CC policies, maritime policies, and governance policies, with a view to identifying enforcement arrangements and current targets in GHG reduction

3.3.1 Belize

The administration of maritime affairs in Belize is conducted by the Port Authority, whose competences are stipulated in the Belize Port Authority Act and the Harbours and Merchant Shipping Act. The competences of the Port Authority

are established on the Belize Port Authority Act, including *inter alia* the administration of ports as best calculated to serve the public interest.[18] It also regulates the authority of port officials regarding ship inspections, accidents, and infringements. On the other hand, the Harbours and Merchant Shipping Act allows the Port Authority to verify international standards such as MARPOL Annex VI, which the country acceded to in 2007 but has not yet nationalised. Complementarily, the Harbour and Merchant Shipping Act includes sanctions for substandard vessels,[19] and negligent actions that damage the marine environment.[20] Therefore, the country counts with administrative arrangements governing key aspects of GHG regulation, such as a Port State Control regime sanctions, and mechanisms of certification. Nevertheless, it does not count with a specialised legislation regulating maritime emissions.

Further, Belize prepared a Comprehensive National Transportation Master Plan in 2018. The master plan seeks to enhance and preserve safety, efficiency, CC resilience and socio-economic benefits of the country's transport modes (Study Team, 2018). In addition, the plan directs current and future interventions toward predetermined short-, medium-, and long-term objectives regarding institutions, roads, ports, and airports. Nevertheless, the plan does not act entirely as a maritime strategy but rather defines the direction maritime policies should pursue (COCATRAM, 2019a). Inferably, various elements are related to the initial strategy, such as road development as a tool to decrease maritime emissions together with port congestion. However, the elements within the competences of IMO [regarding the enforcement of standards affecting shipping] are covered in chapters four, five and six. According to the plan, both acts are outdated and require amendments to fix the unclear distributions of administrative responsibilities and the antiquated fees that were established during the country's independence. The plan emphasises that the current and future interventions should mainstream CC regulations, making specific reference to the regulations on energy efficiency and GHG reduction.

[18] Belize Port Authority Act, Art.19 (3).
[19] Harbours and Merchant Shipping Act, Art. 26 (2)
[20] Harbours and Merchant Shipping Act, Art. 41 (6)

Correspondingly, some actions have commenced due to the national transportation plan. According to the Department of Environment (2014), the government began the drafting of a Marine Pollution Bill in 2013 with a view to strengthening the framework on marine pollution prevention harmoniously with international law. Moreover, the Department of Environment (2014) forecasts that to strengthen the framework, the adoption of the bill and the enhancement of pollution monitoring mechanisms should occur prior to 2025. To that end, the department proposes actions to lobby support from governmental agencies and the population in the drafting of the bill. It is also proposed to rectify that the competences of the Belize Coast Guard and the Port Authority allow to conduct surveillance and monitoring activities. Nevertheless, the original guidelines for the bill were only limited to MARPOL 73/78, excluding the regulations on air pollution. However, the tender notice issued by the Belize Port Authority (2021) may accelerate the process. The tender notice invites consultancy firms and independent legal drafters to submit proposals to include air pollution regulations in the Draft Marine Pollution Prevention Bill.

However, some challenges disturb the ongoing work. In accordance with COCATRAM (2019a), there is uncertainty on whether a port policy will ever be developed due to port privatisation. As Study Team (2018) states, the current privatization has made it impossible for the Port Authority to influence the development of projects, especially short-term interventions. As a result, the obligations under MARPOL Annex VI regarding complaint bunkers and port reception facilities are difficult to meet. In addition, the current infrastructural limitation at ports only allows one vessel at a time or, in some cases, only for the berthing of barges, meaning that the applicability of the air pollution regulations is also limited.

3.3.2 Costa Rica

The administration of maritime affairs in Costa Rica is conducted by the Maritime and Port Division (*División Marítima Portuaria*, hereafter Maritime Division). The Maritime Division was created by the *Decreto Ejecutivo No. 29547-*

MOPT, and it is responsible for the formulation of policies in the maritime sector.[21] In addition, the maritime division commands three directions dealing with management, infrastructure, and safety and navigation. It also commands two departments which are specialised in consultancy, and legal and technical consultancy. Furthermore, the Direction for Safety and Navigation (*Dirección de Seguridad y Navegación*) is the body of the Maritime Division in charge of determining and enforcing technical requirements to prevent marine pollution from ships.[22] Moreover, the complete picture of the enforcement mechanisms is provided by the *Decreto No. 19081- MOPT*. In detail, the legislation provides that vessels willing to fly the flag of the country shall be subject to initial and progressive revisions to verify the condition of the hull and machinery; also, a general revision is to be made upon the discovery of defects.[23] Nevertheless, currently no vessel flying the flag of the country gets engaged on international shipping.

Furthermore, the regulations for the prevention of marine pollution from ships are not yet in force. According to COCATRAM (2019a) the government set 2018 as the target date to ratify the MARPOL Convention. However, according to IMO's official data, neither MARPOL 73/78 nor the regulations on air pollution have been ratified by the country. The major advancement in this regard is regulated by the *Decreto 34747-MOPT* which constitutes the Interinstitutional Commission for the Prevention, Control and Response of Pollution of the Sea by Oil (*Comisión Interinstitucional para la Prevención, Control y Combate de la Contaminación del Mar Por Hidrocarburos,* hereafter the Commission). As can be seen in Table 2 the Commission is composed of various members, directed by the General Director of the Maritime Division.

[21] Decreto Ejecutivo No. 29547-MOPT, Art. 1.
[22] Decreto Ejecutivo No. 29547-MOPT, Art. 1.
[23] Decreto No. 19081- MOPT, Art. 4.

Table 2

Members of the Commission for OPCR.

Members of the Commission	Official denomination
General Director of the Port Maritime Division	*Director General de la División Marítimo Portuaria*
President of the National Commission for the Prevention of Risks and Attendance of Emergencies	*Presidente de la Comisión Nacional de Prevención de Riesgos y Atención de Emergencias*
Executive President of the Costa Rican Oil Refinery	*Presidente Ejecutivo de la Refinadora Costarricense de Petróleo*
Executive President of the Port Administration and Atlantic Economic Development Council	*Presidente Ejecutivo de la Junta Administrativa Portuaria y de Desarrollo Económico de la Vertiente Atlántica*
Executive President of the Costa Rican Institute of Pacific Ports.	*Presidente Ejecutivo del Instituto Costarricense de Puertos del Pacifico*
Principal of the Oil Direction – Ministry of Environment and Energy	*Director de la Dirección de Hidrocarburos del Ministerio del Ambiente y Energía*
Director of the National Coastguard Service – Ministry of Public Security	*Director del Servicio Nacional de Guardacostas del Ministerio de Seguridad Pública*
Director of Air Surveillance – Ministry of Public Security	*Director de Vigilancia Aérea del Ministerio de Seguridad Publica*
Director of the Centre for Marine Science Investigation and Limnology	*Director del Centro de Investigación en Ciencias del Mar y Limnología.*

Note: Author's elaboration, official denominations are provided for reference.

Furthermore, the country has a National Transport Plan to guide the interventions regarding transport modes. The national plan aims to enhance the efficiency, competitiveness, security and sustainability of transport modes with short- and long-term objectives. The short-term objectives include the ampliation of two ports, building capacities on the human resource, and the modernisation of the legal framework governing the activities of the Ministry of Transport (*Ministerio de Obras Públicas y Transporte*, 2011). However, the modernisation of the legal framework is only intended to enhance the competences of the Ministry of Transport and to develop standards for the construction of infrastructure; no objective aims to implement maritime conventions. On the other hand, such objectives do appear in the long-term goals. The country aims to be integrated into international trade by 2035, complying with all applicable standards. However, if no action is taken prior to 2030, the contribution of the country will not support IMO's work to meet the aims of the GHG strategy.

Furthermore, political directions on CC aim to mitigate emissions and adapt communities but do not set specific targets for maritime GHG. According to the Ministry of the Environment and Energy, Costa Rica seeks to become carbon neutral by 2050 (*Ministerio de Ambiente y Energía*, 2018). Hence, the country has defined ten strategic directions to undertake economy wide carbon mitigation. Since international shipping is not an economic sector in the country, no specific targets aim to enhance the governmental enforcement of air pollution standards nor to promote port collaboration in the reduction of maritime emissions.

Lastly, increasing the governmental participation with the initial strategy presents some challenges. According to the Ministry of Transport, the legal framework governing the state interactions with ports is complex and it jeopardises the development of infrastructure (*Ministerio de Obras Públicas y Transporte*, 2011). In addition, it is also common that different institutions regulate the same aspects, which in turn also create areas without enforcement. Furthermore, most of the legal reforms require great participation and willingness from the Parliament.

3.3.3 El Salvador

The administration of maritime affairs in El Salvador is conducted by the Maritime and Port Authority (*Autoridad Marítima Portuaria,* hereafter the Maritime Authority). The Maritime Authority was created by *Decreto No. 994*,[24] as the entity to be responsible for the technical and economic regulation of maritime and port activities.[25] The competences of the maritime authority include the enforcement of technical and operational aspects of vessels, the development of standards for shipbuilding activities, and, the enforcement of norms related to the protection of the marine environment.[26] According to COCATRAM (2019a), the agency has begun the analysis of its legal and administrative regimes in order to improve the compliance with international instruments while maintaining resemblances with CA developments [better administrations element]. As a result, the country has

[24] Decreto No. 994, Art. 6
[25] Decreto No. 994, Art. 2
[26] Decreto No. 994, Art. 7

established mechanisms to verify the compliance over technical standards affecting shipping.

El Salvador is a contractor of MARPOL 73/78, but Annex VI has not yet been ratified. The mechanisms to give compliance to the convention are established in Resolution No. 07/2018, which contains the regulations for the prevention, surveillance, and control of pollution from ships (*Autoridad Marítima Portuaria*, 2018). Under the resolution, the responsibility to ensure the compliance over MARPOL 73/78 in the vessels flying the flag of El Salvador lies in the Maritime Authority.[27] However, according to COCATRAM (2019a), although flag surveyors have been trained, their current level is not suitable for an inspector and more capacitation is required.

However, there is no current policy aiming to enhance the participation of the government in marine environmental protection activities nor in regard to maritime emissions. The Ministry of Transport has issued a memorial of labours which summarises the interventions in relation to the maritime field (*Ministerio de Obras Públicas y Transporte*, 2022). According to the memorial, between 2021 and 2022, the administration prioritised different measures that include increasing compliance with national and international frameworks governing maritime transport, enhancing maritime security, and adequate existing regulations to effectively address current maritime needs. The Ministry of Transport reports numerous interventions made by the maritime authority in this regard, such as the formulation of a plan and manual that update the port state regime, and a new plan and programme for research and development to monitor developments in maritime legislation and port technologies (*Ministerio de Obras Públicas y Transporte*, 2022). The report also provides that the maritime authority is currently developing mechanisms to manage IMO communications, and to exercise surveillance and verification based on a risk profile. Consequently, the interventions made by the government touched on essential areas of governance, but specialised policy direction is required to anchor a solid projection of the country's maritime affairs.

[27] Resolution No. 07/2018, Art. 8

Remarkably, the country has a national plan for CC, but it does not address maritime emissions. The Ministry of Environment (*Ministerio de Ambiente y Recursos Naturales,* hereafter the Ministry of Environment) issued a national plan to guide the political interventions within 2022 and 2026. The plan aims (1) to enhance CC adaption through advancements in governmental interaction with socioeconomic and ecological systems; (2) to foster multi-sectoral participation with a view to identifying possible interventions on CC mitigation and adaptation; (3) to create an uninterrupted process of capacity building and knowledge generation; (4) to develop and implement new mechanisms to weigh the impact of CC; and (5) to develop national climate scenarios and possible corrective pathways (*Ministerio de Medio Ambiente y Recursos Naturales*, 2022). Moreover, the national plan provides various strategic areas which are designed to achieve such objectives but, as aforementioned, none of the interventions addresses maritime transport. The plan targets the creation of various elements that figure in the initial strategy, such as the creation of monitoring reporting and verification systems by 2023, economic incentives for the adoption of green technologies by 2026, and the application of MBMs by 2026.

3.3.4 Guatemala

The administration of maritime affairs in Guatemala is conducted by several agencies coordinated under a specialised commission. According to the *Acuerdo Gubernativo No. 58-2015*, the National Commission for Maritime Administration (*Comisión Nacional de Administración Marítima*, hereafter the Commission) was created to enhance the interinstitutional coordination of maritime affairs.[28] The Commission is competent for the formulation and evaluation of maritime policies;[29] and, as shown in Table 3, it is integrated by various members presided and coordinated by the Vice-Minister of Marina.[30] Inferably, every commissioner is responsible for the coordination of activities under its competence, either regarding the enforcement of maritime standards, representation at international organisations, environmental protection, trade, or port development.

[28] Acuerdo Gubernativo No. 58-2015, Art. 2
[29] Acuerdo Gubernativo No. 58-2015, Art. 6
[30] Acuerdo Gubernativo No. 58-2015, Art. 3

Table 3

Members of the Commission for Maritime Administration.

Members of the Commission	Official denomination
Vice-minister of Marina – Ministry of Defence.	*Viceministro de Marina del Ministerio de la Defensa Nacional*
Vice-Minister of Agricultural Health and Regulations – Ministry of Agriculture, Livestock and Food	*Viceministro de Sanidad Agropecuaria y Regulaciones del Ministerio de Agricultura, Ganadería y Alimentación*
Vice-Minister of Environment – Ministry of Environment and Natural Resources	*Viceministro de Ambiente del Ministerio de Ambiente y Recursos Naturales*
Vice-Minister of Communications – Ministry of Communications and Infrastructure.	*Viceministro de Comunicaciones Infraestructura y Vivienda*
Vice-Minister of Integration and Trade – Ministry of Economy.	*Viceministro de Integración y Comercio Exterior del Ministerio de Economía*
Vice-Minister of Mines and Energy – Ministry of Energy and Mines.	*Viceministro de Energía y Minas*
Vice-Minister of Foreign Relations – Ministry of Foreign Relations	*Viceministro de Relaciones Exteriores*
Secretary of the National Council for Protected Areas – National Council for Protected Areas.	*Secretario Ejecutivo del Consejo Nacional de Áreas Protegidas*

Note: Author's elaboration, official denominations are provided for reference.

Furthermore, the enforcement of technical matters affecting shipping is regulated, but the regime does not cover maritime emissions. The *Acuerdo Gubernativo No. 130-2016* provides that it is a duty of the Vice-Ministry of Marina to ensure effective and harmonious management of the functions relating to the implementation of Flag, Port and Coastal State.[31] Moreover, the agency that verifies compliance with maritime regulations is the General Direction of Maritime Affairs (*Dirección General de Asuntos Marítimos*, hereafter Maritime Authority).[32] The Maritime Authority is also responsible to coordinate activities of Coastal and Port State enforcement through the Guatemalan Navy and the General Direction of Port Captaincies.[33] In addition, the mechanism governing port and flag inspections is established in the *Acuerdo Gubernativo No. 441-2004*. The agreement provides that the officials of the state undertaking inspections should

[31] Acuerdo Gubernativo No. 130-2016, Art. 9
[32] Acuerdo Gubernativo No. 130-2016, Art. 12(H)
[33] Acuerdo Gubernativo No. 130-2016, Art. 12 (B)

ensure that vessels calling Guatemalan ports or willing to fly the country's flag comply with all the requirements figuring on the international instruments accepted by the government.[34] Complementarily, Guatemala expressed its consent to be bound by the regulations on air pollution in 2015, but no parliamentary decree approving the convention has been issued. Similarly, there is no regime describing economic sanctions in the case of incompliance.

Furthermore, there is no current policy aiming to enhance the governmental participation in marine protection activities. In 2015, the Ministry of Defence issued a policy to enhance the security at sea. The policy is of an administrative character, and it aims to enhance the fields of maritime safety and security (*Ministerio de la Defensa Nacional*, 2015). Marine environmental protection is not set as a specific target, but the enhancement of compliance with international standards is. However, without specific targets regarding MARPOL, no advancement can be forecasted. Further, no political direction from the Ministry of Environment aims to enhance compliance with MARPOL Annex VI

As a result, although some components of the air pollution regime have been created, a short-term improvement cannot be forecasted. The government has a mechanism to verify and monitor compliance with international maritime standards. However, it has neither an act of parliament giving legal force to MARPOL Annex VI nor a sanctions regime in relation to maritime regulations. In addition, the analysis of the national policy on CC and the general governmental policy 2020-2024 identified targets for emission reduction in the transport sector, but no specific mention is made of energy efficiency nor MARPOL (*Ministerio de Ambiente y Recursos Naturales*, 2009; *Secretaría General de Planificación y Programación de la Presidencia*, 2020). Hence, no current policy aims to increase the performance of the government on this regard, meaning that no advancement can be predicted. It is also an indicator that the current administrative arrangements for policy formulation are not addressing the current maritime needs.

[34] Acuerdo Gubernativo No. 441-2004, Art. 2 (B)

3.3.5 Honduras

The administration of maritime affairs in Honduras is conducted by the General Direction of Merchant Marine (*Dirección General de la Marina Mercante,* hereafter General Direction). The competences of the General Direction are regulated in the *Decreto No. 167-94* and include maritime security, marine environmental protection, and the administration, control and coordination of activities regarding maritime transport.[35] In addition, the *Decreto No. 120-2016* [the amendment of *Decreto No. 167-94*] provides that the General Direction has the authority to perform inspections in national and foreign vessels with the purpose of verifying compliance with the standards of IMO and the International Labour Organisation.[36] Accordingly, the mechanisms to conduct flag surveillance are detailed in the *Acuerdo No. 000836-B*, which contains the regulations for inspection, recognition and expenditure of certificates to vessels. The regulations provide that a certificate should be issued upon the strict compliance over international standards appearing on maritime instruments ratified by the government. Additionally, the *Decreto No. 167-94* also contains a regime of sanctions with different levels of severity.[37]

Moreover, the government is party to the six annexes of MARPOL and has a national strategy to guide short- and mid-term interventions towards the complete implementation of the convention. The national maritime strategy of Honduras aims to guide political interventions towards predetermined actions that allow the country to enhance its maritime sector (*Decreto Ejecutivo Número PCM-040-2013*). The responsibility of implementing the strategy relies on the General Direction which will be supported by a committee on maritime administration (see Table 4). Accordingly, the strategy envisages six programmes to achieve its priorities, which include a programme to enhance marine environmental protection and integral management of coastal zones, and the improvement of legal frameworks.

[35] Decreto No. 167-94, Art. 91
[36] Decreto No. 120-2016, Art. 1
[37] Decreto No. 167-94, Title VI.

Table 4

Members of the Committee on Maritime Administration.

Members of the Committee	Official Denomination
Secretary of Public Infrastructure and Transport	Secretaría de Estado en los Despachos de Obras Públicas, Transporte y Vivienda.
Permanent Commission for Contingencies	Comisión Permanente de Contingencias
Secretary of Natural Resources and Environment	Secretaría de Estado en los Despachos de Recursos Naturales y Ambiente
Secretary of Defence	Secretaría de Estado en el Despacho de Defensa Nacional
Secretary of Finances	Secretaría del Estado en el Despacho de Finanzas
Secretary of Foreign Affairs	Secretaría del Estado en el Despacho de Relaciones Exteriores
Secretary of Labour and Social Security	Secretaría del Estado en los Despachos de Trabajo y Seguridad Social
Secretary of Indigenous and afro-Honduran population	Secretaría del Estado en los Despachos de Pueblos Indígenas y Afrohondureños
Secretary of Tourism	Secretaría del Estado en el Despacho de Turismo
National Port Company	Empresa Nacional Portuaria
ISPS Authority	Autoridad designada para la implementación del Código PBIP
National Commission for Telecommunications	Comisión Nacional de Telecomunicaciones
General Directorate of Fisheries	Dirección General de Pesca
Honduran National Autonomous University	Universidad Nacional Autónoma de Honduras
General Direction of Merchant Marine	Dirección General de Marina Mercante

Note: Author's elaboration, official denominations are provided for reference

New guidelines on strategic planning were issued in 2014, requiring the strategy to be adapted to the country's renewed vision and action plan. According to the Planning Department, the maritime strategy was revised in 2014 to align it with the new directions from the government (*Departamento de Planificación y Evaluación de la Gestión,* 2022). As a result, the merchant marine plan 2016-2021 was issued with a renewed emphasis on outcomes. The current goals of the administration are (1) to have a competitive international registry, (2) to ensure safety of life at sea and the protection of the marine environment, and (3) quality seafaring.

Accordingly, the targets regarding marine environmental protection rely on certifications and enforcement to prevent maritime pollution. The planning for 2022 aims to perform surveys in the vessels flying the national flag to verify the compliance with the standards of the Maritime Division and IMO, i.e., a certificate should be issued upon positive results. In addition, the Planning Department highlights that port captaincies complement the role of flag inspections by monitoring and enforcing compliance over international standards on the vessels navigating jurisdictional waters (*Departamento de Planificación y Evaluación de la Gestión*, 2022).

In summary, the General Direction actively verifies the compliance with air pollution regulations, but it does not have a political direction to further reduce GHG emissions. The constitutive instrument of the General Direction regulates the majority of elements in the air pollution framework. This allows the country to ensure its competitiveness before the inevitable enhancement of EEDI and SEEMP. However, a great deal of literature has forecasted that energy efficiency regulations alone will not suffice to decarbonise the maritime transport. Therefore, it would be recommended that the feasibility of additional policy directions to support IMO's strategy should be evaluated.

3.3.6 Nicaragua

The administration of maritime affairs in Nicaragua is regulated by the *Ley No. 838* [parliamentary act] and the *Decreto Ejecutivo No. 32-2013* [the regulation of the parliamentary act], which provide the competences of different institutions regarding maritime affairs. The purpose of the *Ley No. 838* is to regulate the development, administration and operation of ports and activities related to them. Accordingly, the law provides functions of public and private institutions participating in maritime affairs in order to harmonise their actions for a sound development of transport and international trade.[38] Furthermore, the regulations establish that the National Port Enterprise (*Empresa Portuaria Nacional,* hereafter Port Administration) is the responsible entity for the management of ports, the General Direction of Aquatic Transport (*Dirección General de Transporte*

[38] Ley No. 838, Art. 2

Acuático, hereafter Maritime Authority) is the responsible authority for the standardisation of technical matters regarding maritime and port affairs, and the Naval Force of the Nicaraguan Army (*Fuerza Naval del Ejército de Nicaragua,* hereafter Coastguard) is responsible to ensure the compliance of maritime law in the jurisdictional waters.[39] Besides, the *Decreto Ejecutivo No. 32-2013* states that the formulation of port policies will be led by the Port Administration, which must work together with the Maritime Authority and the Coastguard.[40]

Complementarily, the *Ley No. 399* establishes the requirements to navigate Nicaraguan waters and set the maritime authority as responsible for its enforcement; however, the requirements do not address air pollution. According to the *Ley No. 399* the maritime authority has the competence to perform inspections on ships in order to verify the compliance over national regulations and international conventions recognised by the government.[41] In addition, the law provides that no vessel can sail without complying the requirements for navigation.[42] Lastly, the *Ley No. 399* also contains a regime of sanctions against polluters, specifying that administrative sanctions will be more dissuasive whenever pollution has been made.[43] Hence, the government verifies the compliance with international standards through Flag, Port and Coastal State mechanisms that include a regime of sanctions against violations. However, although the government is contractor of MARPOL 73/78, it has not yet ratified the regulations on air pollution.

Nonetheless, the port administration has issued a national plan to strengthen the environmental performance of ports. According to COCATRAM (2019b), Nicaragua aims to reduce the environmental impact of ports through improvements on management. For instance, some objectives in the action plan include the implementation of quality standards on environmental offices, the formulation of a national-level environmental policy and the development of systems for the environmental management of ports (COCATRAM, 2019b). Hence, the current objectives in the action plan aim to enhance the interactions

[39] Ley No. 838, Art. 4.
[40] Decreto Ejecutivo No. 32-2013, Art. 6.
[41] Ley No. 399, Art. 21
[42] Ley No. 399, Art. 61
[43] Ley No. 399, Art. 119 & 120.

among port operations and the environment, signalling the directions political interventions should pursue to this end. However, the action plan does not target developments in relation to IMO's initial strategy.

Therefore, the contributions from the government to the initial strategy of IMO are only implicit on political interventions. Nicaragua counts with the administrative arrangements to verify the compliance with maritime conventions. However, the government is not yet a contractor of MARPOL Annex VI and there is no intervention targeting its ratification. On the other hand, some interventions indirectly contribute to the reduction of maritime emissions, such as the quinquennial action plan from the port administration which targets the expansion of terminals to reduce berthing times (*Empresa Portuaria Nacional*, 2012)

3.3.7 Panama

The minimum standards to entitle the flag of Panama are provided in the *Ley 57*, which also provides the enforcement arrangements of the country. The administration of maritime affairs in Panama is conducted by the Panamanian Maritime Authority (*Autoridad Maritima de Panamá*¸ hereafter Maritime Administration) whose competences allow it to act as Flag, Port and Coastal State. Firstly, the *Ley 57* stipulates that ships willing to appear on the Panamanian registry must comply with the regulations of maritime conventions in the fields of safety, marine environmental protection, security and labour.[44] According to COCATRAM (2019a), not only the country utilises the IMO model courses on Flag State Implementation to guarantee the capabilities of national flag inspectors but also it recognises various classification societies [e.g., IACS] who communicate pertaining information via electronic means. Secondly, the mechanism governing port and coastal state inspections is provided for in Article 118, which instructs the Maritime Administration to supervise compliance with international standards on vessels navigating Panamanian waters. According to COCATRAM (2019a), the country has enough Port State inspectors, and it actively contributes to the inspection goals of the *Viña del Mar* Agreement.

[44] Ley 57, Art. 5

In addition, the government is contractor of MARPOL Annex VI and relies on economic incentives to promote its application. The regulations on air pollution from ships were transposed to the national legislation in the *Ley 30*, which provides that the regulations are accepted entirely.[45] Therefore, MARPOL Annex VI figures among the international conventions that ships must comply with to fly the flag of the country. Moreover, the government fosters the application of the convention through a discount of 50 percent in administrative costs upon the existence of corporate social responsibility programmes on reduction of GHG emissions from ships (*Autoridad Marítima de Panamá*, 2016). According to the Maritime Administration, the discount is also applied when a vessel is shown to use operational efficiency indicators or when liquefied natural gas is utilised as bunker (*Autoridad Marítima de Panamá*, 2016).

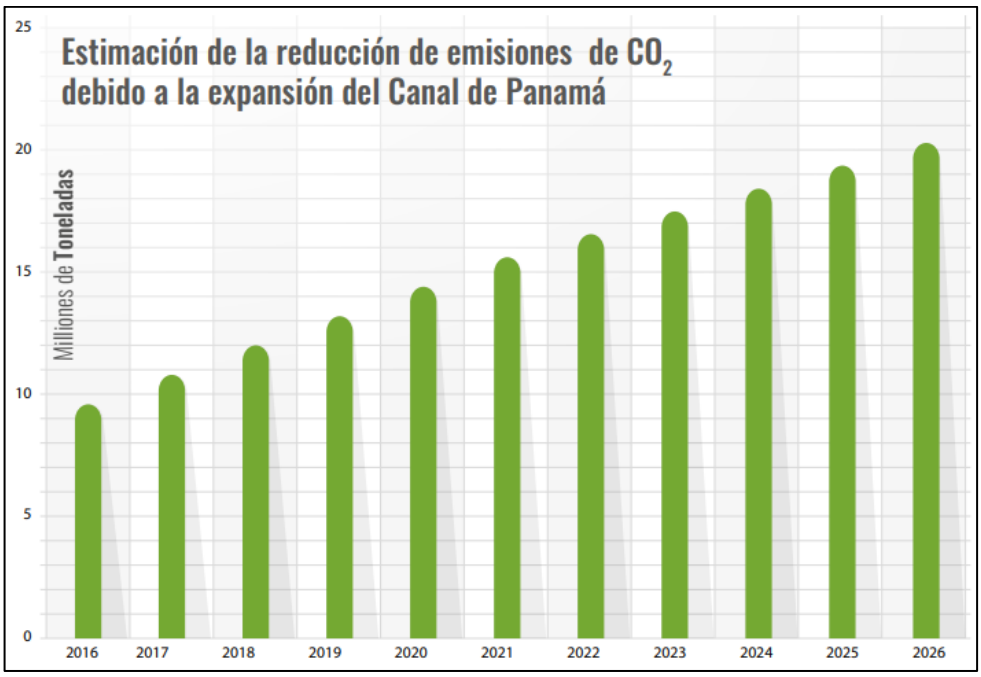
Furthermore, the maritime administration has published a quinquennial strategic plan that defines the direction of policy interventions and targets certain developments on GHG reduction. According to the Maritime Administration, the strategic plan remedies the traditional absence of clear directions for the development of the maritime sector in the country (*Autoridad Marítima de Panamá*, 2020). The plan aims to promote the compliance with national and international standards to enhance the quality of maritime services. In addition, it envisages leadership in the provision of maritime services through the promotion of investments and strategic alliances. Accordingly, to achieve such outcomes, the plan proposes five strategic axis regarding customer service, institutional development, human capabilities, technology, and sustainable development. Accordingly, the contributions to the initial strategy appear among the targets pertaining to sustainable development and institutional development. On the one hand, sustainable development includes the identification of action-areas and the subsequent development of action-projects to enhance the sustainability of the sector (*Autoridad Marítima de Panamá*, 2020), which covers climate action and life below water. On the other hand, institutional development includes the identification and formulation of directives for the maritime industry, an essential component to influence GHG reduction on shipowners.

[45] Ley 30, Art. 1 & 2.

Lastly, the country's CC policy highlights the significant contribution from the Panama Canal to reduce global GHG emissions. According to the Ministry of Environment, the expansion of the Canal allows larger vessels to transit through its locks, thus reducing their sailing distance and emissions (*Ministerio de Ambiente*, 2019). As shown in Figure 5, the Ministry of Environment forecasts that the resulting reduction will improve from 9.62 million CO_2 tonnes in 2016 to 20.36 million tonnes in 2026.

Figure 5

Forecast of CO_2 reduction due to the Canal expansion.



Note: Graphical representation of carbon reduction within 2016 and 2026. Y values display millions of CO_2 tonnes. Source: Ministerio de Ambiente (2019).

Therefore, the political and legal analysis of the country denotes various advancements in relation to the initial strategy. The government enforces air pollution regulations for ships through flag, port and coastal state mechanisms, which even aim for continuous improvement. In addition, the country also incentivises good performers in GHG reduction through reduction in administrative costs. Nonetheless, the government's biggest contribution is the reduction of GHG together with the minimisation of navigational distances through the Canal.

4. The initial strategy: A Central American perspective

The International Maritime Organisation (IMO) adopted an initial strategy to which certain Central American (CA) states have reacted, but how did they do it? Understanding the efficiency and effectiveness of the process of an intervention is crucial to attain its ultimate goals. According to HM treasury (2020), interventions should be evaluated to identify what can be improved and to estimate accurately the impacts and costs associated with them. Hence, in the light of this, the current chapter consolidates the views of mid- and low-level managers of legal departments in maritime administrations with a view to evaluating and identifying the process of the initial strategy in CA. In addition, the information to be presented was collected through open-ended surveys, which were elaborated following the Theory of Change (TOC). The current chapter begins with an explanation of how the TOC has been applied, followed by the explanation of the individual factors affecting policy environments; furthermore, the chapter will also provide various findings regarding advancements in short-, middle-, and long-term candidate measures. However, the information presented is limited by geographical, financial and time constraints, which only allowed electronic mails as a channel of communication. Not to mention, to address constrains related to human participation, the survey instrument was submitted and not started without the approval of a Research Ethics Committee.

4.1 Applying TOC to the initial GHG strategy

The TOC represents an important instrument for policy evaluation. An effective analysis requires a thorough understanding of the policy, its objectives, and the envisaged steps to achieve the final outcomes (HM Treasury, 2020). The TOC eases this process with causal analysis based on available evidence, providing evaluators with preconceptions of steps, and forecasted risks regarding the policy

process (UNDAF, n, d.). As shown in Table 5, the available evidence in this study consists of the ambition levels settled down by IMO, as well as its subsequent candidate measures. Hence, every component was subject to analysis in order to identify theoretical solution paths associated with it. The TOC analysis of the short-term candidate measures is shown in Table 6. Similarly, the mid-term and long-term candidate measures are illustrated in Table 7 and Table 8. Finally, the different elements identified in the theory of change were formulated as questions for the survey instrument figuring in AppendicesAppendix A: Consent form and Appendix B: Survey instrument

Table 5

Ambition levels and candidate measures set by IMO.

Ambition levels	Candidate measures
1. Carbon intensity of the ship to decline through further phases of the EEDI for new ships 2. Carbon intensity of international shipping to decline. 3. GHG emissions to peak and decline	Short-term measures 1. Further improvement of the existing energy efficiency framework with a focus on EEDI and SEEMP. 2. Develop technical and operation efficiency measures for ships. Including consideration of indicators in line with the three-step approach. 3. Establishment of an existing fleet improvement programme. 4. Consider and analyse the use of speed optimisation and speed reduction as a measure. 5. Consider and analyse measures to address emission of methane and further enhance measures to address emissions of VOC. 6. Encourage the development and update of national action plans to develop policies and strategies to address GHG emissions from international shipping in accordance with guidelines to be developed by the organisation. 7. Continue and enhance technical cooperation and capacity building activities under the ITCP. 8. Consider and analyse measures to encourage port developments and activities globally to facilitate reduction of GHG emissions from shipping. 9. Initiate research and development activities over marine propulsion, alternative fuels, and energy efficiency technologies. 10. Incentives for first movers on new technologies 11. Develop comprehensive lifecycle GHG/CI guidelines for all types of fuels. 12. Actively promote the work of IMO to the international community, 13. Undertake additional GHG studies and consider other studies to inform policy decisions. Mid-term measures 1. Effective uptake of alternative low-carbon and zero-carbon fuels implementation programme, include update on national plans to consider such fuels. 2. Operational energy efficiency measures for both new and existing ships including indicators in line with three-step approach that can be utilised to enhance the energy efficiency. 3. New emission reduction mechanisms, possibly including market-based measures. 4. Continue and enhance technical and capacity-building cooperation. 5. Development of a feedback mechanism to enable lessons learned on measures' implementation. Long-term measures 1. Pursue the development of zero-carbon and fossil-free fuels, as well as their provision. 2. Encourage and facilitate the general adoption of other possible and new/innovative emission reduction mechanisms.

Note: Author's table, ambition levels and candidate measures in accordance with IMO (2018).

Table 6

TOC corresponding to short-term candidate measures.

Candidate measures	Problems	Solutions
1. Improvement of existing energy efficiency measures	– EEDI/SEEMP measurement. – Compliance over energy efficiency regulations. – How to improve it.	– Implementation of MARPOL Annex VI. – Means of monitorisation and control. – Seafarer training on SEEMP (Kremk et al., 2021). – Investigation on EEDI/SEEMP improvement.
2. Develop technical and operation energy efficiency measures for ships	– Consideration of indicator in line with the three-step approach. – Technical efficiency measures – Operational efficiency measures	– Consideration of Annual Efficiency ratio – Consideration of Energy efficiency per service hour – Consideration of Individual Ship performance indicator – Consideration of Fuel Oil reduction strategy.
3. Establishment of existing fleet improvement programme	– Improvement programmes	– Technical improvements (Abramowics-Geric & Burcuy, 2019) – Automated systems – Stringency on energy efficiency certification.
4. Consider and analyse the use of speed reduction as a measure	– Regulations on innocent passage – Determination of optimal speed	– Pilot tests aimed to identify speed levels non prejudicial for safety. – Regulate navigational speed on territorial waters
5. Consider and analyse measures to address emission of methane and further enhance VOC regulations.	– Compliance over VOC regulations – Measurement of VOC – Enhance VOC regulations – Analysis of measures regarding methane	– Investigation over VOC improvement – Implementation and enforcement of MARPOL Annex VI – Pilot test aimed to methane measurement
6. Encourage the development and update of national action plans (NAP) to develop policies and strategies to address GHG emissions.	– Development of NAPs – Guidelines to be developed by the organisation. – Submission to IMO of Voluntary action plan.	– Improvement of domestic institutional and administrative arrangements for the effective implementation of IMO instruments. – Programmes over research of low-carbon and zero-carbon fuels. – Accelerate port emission-reduction activities.

		— Fostering capacity-building, awareness-raising and regional cooperation. — Facilitating the development of green shipping infrastructure (IMO-Norway GreenVoyage2050 project, 2022).
7. Continue and enhance technical cooperation and capacity-building activities under the ITCP	– Participation	— Participate in technical cooperation and capacity-building programmes
8. Consider and analyse measures for port development and activities to facilitate the GHG reduction.	– Port development measures – Port activities to facilitate GHG reduction.	— Onshore power supply — Safe and efficient bunkering of alternative fuels — Incentives promoting sustainable low-carbon and zero-carbon shipping — support for the optimisation of port calls (IMO-Norway GreenVoyage2050 project, 2022)
9. Initiate research and development activities over marine propulsion alternative fuels and energy efficiency technologies	– Research activities – Development activities	— Research over marine propulsion — Research over alternative fuels — Research over energy efficiency technologies — Pilot tests.
10. Incentives for first movers on new technologies	– Incentive first movers – Promote the use of new technologies	— Market based measures — National campaigns on technological competition — Awareness on costs reduction resulting from better carbon technologies.
11. Develop comprehensive lifecycle GHG/CI guidelines for all types of fuels.	– Current guidelines. – Mechanisms for communication with IMO	— Continuous guidelines update-process — Consideration of existing guidelines. — Alternative fuels dispatch at port facilities
12. Actively promote the work of IMO to the international community	– IMO's work promotion	— Awareness on IMO work. — Awareness of IMO's capacity building programmes.
13. Undertake addition GHG studies and consider other studies to inform policy decisions	– Compliance with emission's reporting – political decisions	— policy decisions considering the information of the GHG studies.

Note: Author's table, application of the theory of change. In-text citations within the table indicate that the theoretical solutions were taken from recommendations appearing on external sources.

Table 7

TOC corresponding to mid-term candidate measures.

Candidate measures	Problems	Solutions
1. Effective uptake of alternative low carbon and zero carbon fuels implementation programme	— Development of the programme. — Update of NAPs	— Awareness on different alternatives — Consideration for mechanisms of continuous update in political decisions and NAPs. — Assign responsibilities in regards of fuel technologies.
2. Operational energy efficiency measures for both new and existing ships	– Implementation of operational measures – Monitoring of IMO official communications	— Measurement of operational measures — Impact assessment of upcoming regulations
3. New emission reduction mechanisms, possibly including market-based measures	– Market based measures – Monitoring of IMO official communications	— Adoption of market-based measures — Mechanisms to monitor official IMO Communications
4. Continue and enhance technical and capacity building cooperation	– Technical cooperation – Participation in capacity-building programmes	— Participation on capacity building activities — Delivery of capacity building activities.
5. Development of a feedback mechanism to enable lessons learned on measures implementation	– Lessons learned on measures implementation	— Communication of information — Academic publications regarding innovations.

*Note: A*uthor's table, problems and solution pathways for candidate mid-term measures.

Table 8

TOC corresponding to long-term candidate measures.

Candidate measures	Problems	Solutions
1. Pursue the development of zero-carbon and fossil-free fuels, as well as their provision	— Development of carbon free fuels — Development of fossil free fuels — Fuel provision	— Scientific research on fuel technologies — Policies envisioning fossil-free fuels — Development of fuel-supply infrastructure
2. Encourage and facilitate the general adoption of other possible and innovative emission reduction mechanisms	— Impact of regulations. — Bureaucratic barriers on new measures implementation — Technical and financial constrains	— Impact assessments — Participate in capacity building programmes. — Create awareness on future trade disruptions arising from noncompliance with carbon regulations.

Note: Author's table, problems and solution pathways for long-term candidate measures.

4.2 Policy environment

There are no set criteria to determine what a good policy evaluation is. The quality of political evaluations is only achievable through the complete appraisal of factors affecting the policy environment. Every region, country and municipality in the world has a particular historical heritage, climatic conditions, advantages and disadvantages that shape the design and implementation of political interventions. Therefore, the more these factors are considered, the more accurate evaluations are. In the light of this, the current section aims to provide some of the factors that were considered to determine the process of the initial strategy in CA; specifically, its process in Guatemala.

Guatemalan policies inhabit an unstable environment. The country follows a democratic system in which political leaders are elected by majority once every four years. The results pointed out that policies inhabit an unstable environment mostly influenced by political priorities. Therefore, the continuance of policies could be constrained by changes in political directions.

Additionally, the scenario for maritime affairs has a similar tone. The maritime administration did not perceive that its current goals and objectives represent a political priority nor an action area for the country. However, in turn, maritime transport accounts for 78 per cent of the country's national economy. Therefore, attention is given to maritime affairs, and in particular to the components playing a relevant role for the state, having on one side the taxation of two fishing vessels figuring on the registry and on the other side the port operations. This assumption is further evidenced by the fact that policies enjoying political interest are approved within six months, whereas policies that do not, can last many years before being adopted. To emphasise this, the country does not rely on a maritime policy but, as identified in the previous chapter, it does rely on a policy regarding security at ports.

In addition, certain elements in the context of the initial strategy have been addressed but it is not the case for air pollution regulations. The initial strategy falls within a broader context, which includes elements of the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention on the Law of the Sea (UNCLOS), the Sustainable Development

Goals and the existing regime on air pollution. The results of the survey indicate that the government is a contractor of UNFCCC and that policy directions have already been issued to guide the country's contribution in Climate Change (CC) mitigation and adaptation in line with the Paris Agreement (PA). In addition, the government is a contractor of the regulations on air pollution from ships but there is no specialised legislation governing its implementation.

Nevertheless, the absence of a specialised legislation on maritime emissions can be attributed to certain factors. The survey identified two obstacles to implement the convention. Firstly, port and coastal communities carry on their daily activities without realising the amount of anthropogenic emissions generated by ships nor the negative impacts it causes for health and the environment. Secondly, the interactions within representatives of the shipping sector and maritime administrations are uncertain, which indicates that the decision-making process is not properly informed. Nevertheless, it was also noted that the decisions taken by the administration are substantiated with scientific evidence, which may minimise but not eliminate the informational problem.

However, there is awareness regarding the benefits of implementing the convention. It was perceived that the future demand for port services might decrease in the country due to the initial strategy. Strict regimes to minimise air pollution may influence shipowners to cherry-pick compliant ports, which in turn will lead to road congestion and negative effects for the country's economy. However, it was also noted that several bunker supplying companies are willing to be certified for the expenditure of authorised bunkers. Therefore, a prompt implementation of the convention will be rewarded with the creation of new markets and benefits for human health.

In conclusion, several factors disrupt the process of the country regarding the implementation of the initial strategy. Firstly, the political environment in the country is not consistent and often policies experiment the consequences. Secondly, some elements in the context of the initial strategy have been addressed, but it is not the case for air pollution regulations. Thirdly, policy directions on maritime affairs are not tailored around the needs of stakeholders, meaning that crucial information may be skipped. On the whole, these findings are to be considered, framing an environment to be immersed in, while evaluating the

performance regarding short-, mid-, and long-term candidate measures to be presented below.

4.3 Short-, mid-, and long-term candidate measures

The candidate measures are the backbone of the initial strategy. On the one hand, some measures are directly intended to minimise Green House Gases (GHG) on shipping operations, such as the enhancement of Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP). These measures are technical or operational requirements on the initial strategy and are typically labelled as measures rather than guidelines. On the other hand, the remaining category consist of those measures which support actions to reduce emissions from ships, such as the activities regarding technical cooperation and the development of additional GHG studies. The two categories will govern the presentation of results during the current section.

The administration has a mechanism to manage IMO communications, an essential component of the actions directly intended to minimise air pollution. Even though the air pollution regulations are not yet implemented, some elements have been created. The administration has a mechanism to monitor official communications from IMO, an essential tool to align national fleets with international efforts. The mechanism is conducted through administrative arrangements that ease the assessment and exchange of information among agencies. IMO communications are assessed on a weekly basis by the legal department, which categorises and forwards the information to the relevant department, institution or ministry that may be interested. Therefore, whenever a new regulation is adopted, the information from IMO will reach the governmental entity dealing with its enforcement.

In addition, pilot tests on operational measures have been initiated. The use of speed reduction as a measure to reduce GHG is one of the most popular mechanisms to attain energy efficiency. In addition, pilot tests to optimise speed play a crucial role to ensure that safety and the ability of vessels to serve remote areas are not compromised. The results of the survey point that pilot tests have been initiated, and that the administration considers feasible to regulate the navigational speed within its territorial sea. However, it was also found that the

results of evaluations are not being published, meaning that the precise *modus operandi* of the test could not be retrieved. Nevertheless, the regulation of speed as a measure is usually addressed with economic incentives, rewarding slow steamers with preferential port tariffs.

Furthermore, the administration cooperates on the activities which support actions on GHG reduction. The activities that support actions on GHG reduction are crucial to ensure a consistent and smooth implementation of the strategic direction of IMO. In addition, those activities enhance the ability of IMO to undertake additional studies on GHG reduction and directly contribute to increase its participation with global efforts to mitigate CC. The result of the survey indicates that the maritime administration supports these activities by collaborating with capacity building and technical cooperation programmes. Additionally, the administration also recognised the relevancy of IMO's GHG studies, expressing that the information they contain is considered during the formulation of policies and national plans.

Lastly, apart from certain advancements regarding Market-Based Measures (MBM), no further progress can be described. The result of the survey indicate that the country is initiating discussions on MBMs, and that concrete policies in this regard may surge soon. Therefore, the support regarding MBMs deliberations at MEPC can be expected. However, no further advancements can be described. However, the results point out that energy efficiency regulations may take several years before being enforced by the country, meaning that the initial strategy might not be implemented satisfactorily.

In summary, there is progress regarding short-, mid-, and long-term candidate measures, but it will not contribute to minimise GHG emissions from ships in the short-term. The administration relies on essential mechanisms that only require a feasibility assessment and relatively minor modifications to be applied to air pollution regulations. Moreover, the communications are forwarded to the relevant authorities, but not to the representatives of the maritime industry. Pilot tests also occur but the information they generate is not being communicated. Hence, the administration could enhance its contribution with global efforts by performing minor adjustments. Furthermore, there is a possibility that MBMs will soon be implemented, which entails that support in IMO can be foreseeable. Lastly, the

administration is loyal participant of the activities that support actions on GHG reduction. This implies that enhanced capacity building and technical cooperation will play a crucial role to support developing countries in the implementation of the strategy. Nevertheless, as mentioned earlier, the findings of the precedent section should be considered while evaluating the current section. This section ends together with the question of how it has been done and introduces the merger and discussion of findings in the following chapter.

5. The process of the initial strategy in Central America

The role of the International Maritime Organisation (IMO) in creating a level playing field for all its members depends to a great extent on uniform and effective implementation of IMO instruments. In the context of the initial strategy, a member state is expected to align its actions with those intending to decarbonise the sector. In other words, the national interventions should be aimed to improve national fleets with global objectives, allowing vessels to get involved at a competitive level on international trade. Accordingly, as can be inferred from the previous chapters, Central America (CA) has already taken the first steps in this process. Nevertheless, a proper assessment requires a consolidated perspective, which the current chapter aims to satisfy by directly contrasting findings with the problems, aims and objectives in the first chapter.

Although scarce, the literature pertaining to the initial strategy in CA is highly relevant. At first, certain studies identify political interventions targeting the reduction of Green House Gas (GHG) emissions from vessels, such as the global database of Christodoulou et al. (2019) or the conglomerate of port policies of Alamoush et al. (2022). Secondly, another category of studies covers the evolution of the Climate Change (CC) regime in CA, such as the investigations of Den Eltzen et al. (2013), who highlights the role of multilateral treaties to promote adaption and carbon mitigation across the region or Edwards and Roberts (2015), who explain the different roles of Latin America regarding global deliberations on CC. Thirdly, some studies address the evolution of maritime decarbonisation in CA, such as the report of domestic advancements in maritime affairs from the Central American Commission of Maritime Transport (COCATRAM; 2019a), or the considerations in light of the imminent carbon neutrality of shipping from Singh and Rambarath-Parasram (2019). Lastly, certain studies provide the advancements in regional cooperation, such as Candeltey (2014) or Jarque et al.

(2009), who denote the significance the Central American Integration System (SICA) plays for the region's development.

Moreover, the findings this research identifies are harmonious with previous studies.

The database of Christodoulou et al. (2019) is congruent with the policy and legal developments in CA. The authors identified that most interventions in developing nations are of an administrative character, aiming to strengthen the existing regulatory frameworks to either constituting or enhancing the competences of maritime authorities. Accordingly, such targets are found on the strategic direction of COCATRAM and were consistently transposed in the domestic policies of the region.

Additionally, the historical perspectives described by Edwards and Roberts (2015) regarding CC deliberations were evidenced at the plenary of the Marine Environment Protection Committee (MEPC). The background of CA interventions at IMO was mainly a combination of the vulnerability of the region, the Common But Differentiated Responsibilities (CBDR), and the commitment to develop sustainably. Hence, as Edwards and Roberts (2015) state, despite being one of the most affected regions in the American continent, CA states demonstrate commitment with climate change interventions at international deliberations.

However, the promises and commitments are not being translated into actions. At the deliberations of MEPC, almost every CA nation stressed its support and urged states to undertake actions on GHG reduction. Nevertheless, many of them have not ratified, acceded or nationalised the regulations. This fact may be counterargued with the absence of strong tonnages in most CA registries, but it is not an excuse to minimise the significant role Port State Control could and will have to decarbonise the sector.

Further, specific findings might also contradict the arguments of Jarque et al. (2009). Jarque et al. (2009) state that many results from *Las Cumbres* perform unsatisfactorily in operationalisation. However, the same does not apply to COCATRAM, which has acted according to the mandates of the presidents of SICA. The strategic direction of COCATRAM has satisfactorily aligned several CA interventions with the objectives set out by SICA in the fields of maritime security

and the implementation of maritime conventions. However, at the domestic level of implementation, most interventions follow the trend described by the author.

Nevertheless, the main contribution of this study is to augment existing literature regarding the process of the initial strategy in CA. This study provides various components of maritime governance in the region, such as administrative arrangements, policymakers, specialised departments for the enforcement of environmental standards of ships, usual challenges, and current targets of political interventions. In addition, the study generates new literature regarding the contributions of CA delegations at the IMO plenary and the perspective that the initial strategy creates in policymakers. Hence, the information of this study is useful to forecast current and future political scenarios and their possibilities for investment.

Overall, the aims of this study were met, but the process of implementation of the initial strategy in CA is not outstanding. On the one hand, maritime nations among the region [Panama] demonstrated supremacy among the countries conforming the isthmus. While most CA nations plead political interest to comply its mandates, Panama has already implemented tactics to minimise maritime emissions in line with the initial strategy. However, it should be noted that the country has repeatedly participated in regional projects and that it serves as a Marine Technology and Cooperation Centre for Latin America and the Caribbean. This combination highlights that IMO is extremely cost-efficient to create a level playing field for shipping, allocating capacity-building resources where they create higher impacts. On the other hand, the rest of nations also achieved relevant progress. Maritime transport is increasingly being included in governmental policies and countries are aware of the decarbonisation trajectory. Along with this, most administrations in the region are undertaking reforms to their maritime regimes to ensure a proper enforcement of international standards.

Nevertheless, uncertainties domain the question of whether the strategy is being implemented as IMO intends. The organisation seeks to phase emissions out as soon as possible within the second half of the century and to increase its participation with UNFCCC; encouraging its members to undertake early actions on GHG reduction prior to the finalisation of the short-term period. However, the final verdict awaits MEPC 80. The deliberations of the 78th session evidenced that

the delegations do not aim for the same ambitions and that consensus might not be reached, but the ambition of the revised strategy will be higher. To put it differently, including the principles of CBDR, and no more discrimination is shaping the outcome of MEPC towards a sufficient rather than an optimum direction for GHG reduction. Firstly, traditional actors, such as the European Union (EU), lobby the IMO to align the world with the Green Deal, but no initiative has emerged from the European Commission to develop National Action Plans (NAPs). On the other hand, emerging economies express discontent with higher ambitions, emphasising one of the findings of Edwards and Roberts (2015). The authors remark that a portion of the Latin American participation in UNFCCC was centred in different responsibilities for GHG reduction, as the countries did not occasion CC. Not to mention, the participation of developing countries [CA] evidenced a supportive approach on GHG reduction, but neither wrong nor meritorious, the issue of environmental conservation on national policies is more of a complement for economic development than a mere target.

Certain actions on early GHG reduction have commenced at CA. The biggest displayer is Panama, enforcing the regulations on air pollution and incentivising shipowners to adopt less consumption strategies. Nonetheless, Honduras also demonstrates relevant progress not only by enforcing the regulations on air pollution but also by targeting the enhancement of effectiveness in this regard. Furthermore, Belize and Guatemala fall in the category of states which are contracting governments of MARPOL Annex VI but have not yet nationalised its provisions. However, contrarily to Guatemala, Belize has already commenced the progress of nationalisation and targets regarding its finalisation have been set. El Salvador and Nicaragua compose the following category, which consist of the parties to MARPOL 73/78 that enforce the convention. Lastly, the remaining categorisation consist in the non-contractors of environmental standards for vessels, occupied by the government of Costa Rica.

However, there are several challenges preventing the region to implement the initial strategy. At the regional level, it is imperative to highlight that the achievements of multilateral cooperation through SICA are widely ignored. The scarcity of literature and the absence of media coverage denote that the integration system lacks general awareness. Furthermore, climatic alterations are

yet another challenge preventing states to comply with the strategy. The occurrence of catastrophic events has multiplied in the region occasioning various economic implications which force political decisions to divert the attention towards infrastructure restoration rather than the enforcement of environmental standards on vessels. Despite its minimisation with the adoption of quality management standards, several studies pointed out corruption as a challenge affecting states. In addition, as highlighted by Empresa Portuaria Nacional (2012), the occurrence of geopolitical conflicts in foreign nations is likely to jeopardise the availability and costs of fuels in the region, meaning that interventions seeking the provision of complaint bunkers must supersede this challenge. Lastly, it has been found that unilateral progress is likely to jeopardise neighbours. To put it differently, if the region does not advance at the same pace, the countries that are lagging behind will witness vessels calling neighbouring ports and cargo entering from the borders.

In addition, some challenges are not shared as a region, but impede the implementation of the strategy for several countries. An unexhaustive list includes port privatisation, political willingness, outdated maritime law, unclear delimitation of competences among governmental institutions, deficient capabilities of flag and port inspectors, lack of maritime policies, scarce interactions between maritime authorities and the maritime sector, and low awareness on port pollution. However, these challenges do not have the same level of impact on all the countries that conform the isthmus.

Nonetheless, political directions in the region may affect the implementation and efficiency of the initial strategy. Complaint vessels can freely steam between ports and nations adopting their preferred strategy to attain energy efficiency. However, a shipowner refusing to recycle its energy inefficient vessel may find shelter in short-sea shipping, sailing through non-compliant CA ports where port authorities do not enforce air pollution regulations. Complementarily, the likeliness of this scenario can be assessed in regions where short-sea shipping is a reality.

This study identifies certain developments regarding the candidate measures of the initial strategy. The analysis of political interventions and the perspectives of maritime administrations points out that countries will be ready to adopt Market-Based Measures (MBM) together with the entry-into-force of mid-term candidate

measures. In addition, the modernisation of maritime regimes in the region might arrive with demurrage for the entry-into-force of the short-term measures, but it is likely to be implemented and contribute to meeting the 2030 objectives of the strategy.

Complementarily, some of the candidate measures have been implemented already. The only measure that countries share is the development of ports to ease the reduction of maritime emissions. However, the development is merely port expansion rather than the introduction of cold ironing facilities. On the other hand, some developments vary depending on the country and can be categorised according to the four categories. Accordingly, why these measures are working can be attributed to various factors, such as the Central American Port and Maritime Strategy, port congestion, trade increases, political willingness in maritime administrations, and the race for economic development.

6. Conclusions and Recommendations

6.1 Conclusions

IMO's initial strategy invites member states to take actions at both international and national levels. On the one hand, IMO invites members to submit proposals on candidate measures for its adoption and impact assessment at the international level. IMO members are also invited to submit their proposed revised strategy for its consideration at the Marine Environment Protection Committee (MEPC). On the other hand, the strategy encourages states to take early domestic actions to further reduce maritime emissions during the short-term period, as well as to develop their National Action Plans (NAPs).

Furthermore, certain elements of the initial strategy have been implemented in Central America (CA). The enhancement of energy efficiency standards is the most practical measure IMO has for the minimisation of air pollution, but it depends to a large extent on proper implementation and enforcement by Flag, Port and Coastal States. Accordingly, four categories describe the performance of the region: (1) The enforcers of air pollution regulations, (2) the contractors of air pollution regulations, (3) the enforcers of marine pollution prevention standards and (4) the non-contactors of environmental regulations.

Additionally, the regional port development will contribute to reducing maritime emissions not by providing cold ironing facilities but by minimising port congestion. Firstly, the region is pursuing the implementation of essential instruments to increase port efficiency such as the Convention on Facilitation of International Maritime Traffic (Central American Commission for Maritime Transport [COCATRAM], 2008; 2019a). Secondly, several policy directions across the region envisages the enlargement of port facilities as a tool to minimise congestion and increase trade. Lastly, the possible surge of short sea shipping may act as an

indirect minimiser of maritime GHG, reducing the number of vessels that undertake intercontinental navigation.

However, implementing the revised strategy must supersede specific challenges in the region. On the one hand, certain challenges are shared, such as the lack of general awareness in governance arrangements, climatic alterations, and geopolitical conflicts in foreign nations. Altogether, these challenges affect states' capacity or political willingness to implement elements of the initial strategy. On the other hand, some challenges are not shared regionally but affect many states, such as port privatisation, political willingness or outdated maritime legislation.

Additionally, it has been found that early actors will be rewarded with the creation of new markets. The impact measures could provoke on states is one of the biggest concerns and major obstacles for the decisions of the Marine Environment Protection Committee (MEPC). In the context of CA, the short distances allow disembarking cargo in neighbouring nations, threatening ports where substandard bunkers are provided with possible declines in port operations. Hence, ports where complaint bunkers are supplied not only allow local companies to enter new markets but also allow the continuance and growth of port operations.

Moreover, the revision of the initial strategy could pose new challenges for IMO. Complaint vessels can freely engage in international shipping but together with enhancement of South-South cooperation, substandard vessels may follow. In other words, the proliferation of commercial relations among developing countries may jeopardise the aims of the initial strategy. In CA, the development of short sea shipping may allow substandard vessels to freely navigate among non-compliant ports where authorities do not enforce air pollution regulations.

If no consensus is reached, stringency in regulations may disrupt the achievements of tacit amendment. The adoption of the revised strategy is yet another challenge for IMO’s governance. In other words, the adoption of a revised strategy by majority might trigger the proliferation of exemptions in regulations. Adopting net zero as decarbonisation target may remind developing nations and emerging economies that they and their vessels enjoy of differentiated responsibilities in Climate Change (CC) mitigation and, therefore, reject the

decisions of MEPC. If such fashion reaches a considerable tonnage, new regulations might take longer to be implemented.

6.2 Recommendations

The revised strategy necessitates qualified port and flag inspectors to be achievable. The regional and domestic targets of CA seek to enhance the capabilities of human resources so that a proper enforcement can be performed. However, the entry-into-force of the revised strategy in 2023 leaves CA maritime administrations with a margin of a few months to build the required capacities. Therefore, it is recommended that CA policy makers should nationalise the provisions of the code for Recognised Organisations so that qualified flag inspections can be performed more promptly. The recognition of classification organisations will not only save costs in capacity building for maritime administrations but also is a tool of great help to gain the attention of the industry.

It is noteworthy that economic incentives for early actors on GHG reduction can be used as tools to attract shipowners. Political interventions that incentivise GHG reduction or reward first movers are not a novelty and even figure as candidate measures on the initial strategy. However, these attractions can also be utilised as tools to gain the attention of shipowners and increase the national tonnage. Therefore, it is recommended that CA policy makers should analyse the feasibility of implementing economic incentives at national level, not only to ensure that countries remain competitive but also to increase the region’s contribution to maritime decarbonisation.

Moreover, although the reason why some candidate measures are already working in the region can be attributed to a variety of factors, COCATRAM has certainly played a major role in this regard that should be maintained. The CA Port and Maritime Strategy achieved relevant steps to harmonise the activities of maritime administrations in the region. Therefore, it is recommended that the Commission should commence assessments in order to set the development of national action plans as part of the targets of CA. It is also suggested that COCATRAM should harmonise the claims of CA delegations at IMO with a view to reflecting those of an integrated region in maritime affairs.

Lastly, open-ended surveys are not recommended for further replications of this study. The utilisation of open-ended surveys did not achieve the desired engagement from maritime administrations. In fact, the perspectives this study reflects are only those of the General Direction of Maritime Affairs. Therefore, it is recommended that replications of this study should be carried out with different instruments, either interviews or a different type of surveys.

7. References

Acuerdo Gubernativo No. 58-2015 (Gua). https://www.dgam.gob.gt/BV/cp_directivas/archivos/Libro_58.pdf

Acuerdo Gubernativo No. 130-2016 (Gua). http://www.dgam.gob.gt/ACUERDO%20130-2016.pdf

Acuerdo Gubernativo No. 441-2004 (Gua). https://leyes.infile.com/index.php/klimaschutz/visualizador_demo/visualizador_demo/visualizador_demo/index.php?id=182&id_publicacion=43071

Alamoush, A. S., Ölçer, A. I., & Ballini, F. (2022). Port greenhouse gas emission reduction: Port and public authorities' implementation schemes. *Research in Transportation Business & Management, 43,* 100708. https://doi.org/10.1016/j.rtbm.2021.100708

Autoridad Marítima de Panamá (2016). *Resolución No. 106-91-DGMM.* Autoridad Marítima de Panamá. https://www.sijusa.com/pdf/res106-91-DGMM.pdf

Autoridad Marítima de Panamá (2020). *Plan Estratégico Quinquenal 2020 – 2024.* Autoridad Marítima de Panamá. https://amp.gob.pa/wp-content/uploads/2020/03/P.E.-Q-AMP-2020-2024.pdf

Autoridad Marítima Portuaria (2018). *Reglamento para la Prevención Vigilancia y Control de la Contaminación por los Buques.* Resolución No. 07/2018. Autoridad Marítima Portuaria. https://www.transparencia.gob.sv/institutions/amp/documents/262043/download

Belize Port Authority (2021). *Legal Drafter – MARPOL Annex VI regulations* [Tender notice]. Belize Por Authority. https://portauthority.bz/tender-notice-for-legal-drafter-marpol-annex-vi-regulations/

Belize Port Authority Act (Bz). V.13, CAP.233 (&233s). https://portauthority.bz/wp-content/uploads/2017/12/Cap_233_Belize_Port_Authority_BPA_Act_2011_Substantive.pdf

Bouman, E. A., Lindstad, E., Rialland, A. I., & Strømman, A. H. (2017). State-of-the-art technologies, measures, and potential for reducing GHG emissions from shipping, A review. *Transportation Research Part D: Transport and Environment, 52*, 408-421. https://doi.org/10.1016/j.trd.2017.03.022

Caldentey, P., P. (2014). Los desafíos estratégicos de la integración centroamericana. *Estudios y perspectivas (156).* https://repositorio.cepal.org/handle/11362/37135

Chircop, A. (2019). The IMO initial strategy for the reduction of GHGs from international shipping: A commentary. *The International Journal of Marine and Coastal Law, 34(3), 482-512*. https://doi.org/10.1163/15718085-13431093

Chircop, A., & Shan, D. (2020). Governance of International Shipping in the Era of Decarbonisation: New Challenges for the IMO? *Maritime Law in Motion, 8*, pp. 97-113. Springer.

Christodoulou, A., Gonzalez-Aregall, M., Linde, T., Vierth, I., & Cullinane, K. (2019). Targeting the reduction of shipping emissions to air: A global review and taxonomy of policies, incentives and measures. *Maritime Business Review 4(1*). http://dx.doi.org/10.1108/MABR-08-2018-0030

Climate Action Tracker (2022). *Global reaction to energy crisis risks zero carbon transition.* Climate Action Tracker. https://climateactiontracker.org/documents/1055/CAT_2022-06-08_Briefing_EnergyCrisisReaction.pdf

Comisión Centroamericana de Transporte marítimo [COCATRAM] (2008). *Estrategia Marítima Portuaria Regional Centroamericana.* COCATRAM. http://www.cocatram.org.ni/Estrategia_Maritima_Portuaria_Regional_Centroamericana.pdf

Comisión Centroamericana de Transporte Marítimo [COCATRAM] (2019a). *Informe Final, Diagnóstico y Plan de Acción Consensuado por Autoridades Marítimas y Portuarias.* COCATRAM. http://www.cocatram.org.ni/Diagnostico%20y%20Plan%20Accion%20EMPRC%20Dic%2012%202019_.pdf

Comisión Centroamericana de Transporte Marítimo [COCATRAM] (2019b). *Fortalecimiento de la Gestión Ambiental Portuaria en Centro América y República Dominicana.* COCATRAM. http://www.cocatram.org.ni/fogap/PLAN%20DE%20ACCION%20FOGAP%20EPN.pdf

Comisión Económica para América Latina y el Caribe [CEPAL] (2015). *The economics of climate change in Latin America and the Caribbean: Paradoxes and challenges of sustainable development* (LC/G.2624). CEPAL. https://repositorio.cepal.org/bitstream/handle/11362/37311/S1420655_en.pdf?sequence=4&isAllowed=y

Comisión Económica para América Latina y el Caribe [CEPAL] (2022). *Una década de acción para un cambio de época* (LC/FDS.5/3). CEPAL. https://repositorio.cepal.org/bitstream/handle/11362/47745/S2100985_es.pdf?sequence=4&isAllowed=y

Decreto Ejecutivo No. 29547-MOPT (CR). https://repositorio.uned.ac.cr/reuned/bitstream/handle/120809/184/DE.29547.ReformaOrganizativaFuncionalMOPT.pdf?sequence=1&isAllowed=y

Decreto Ejecutivo No. 32-2013 (NI). Gaceta No. 200. http://legislacion.asamblea.gob.ni/NormaWeb.nsf/3133c0d121ea3897062568a1005e0f89/c5caa038beb8a7f806257c3e0058f933?OpenDocument#:~:text=838%20establece%20para%20las%20autoridades,por%20las%20disposiciones%20establecidas%20en

Decreto Ejecutivo Número PCM-040-2013 (HN). https://www.tsc.gob.hn/web/leyes/Estrategia_Maritima_honduras_OMI_2013.pdf#:~:text=La%20Estrategia%20Mar%C3%ADtima%20de%20Honduras%20est%C3%A1%20dirigida%20al,protecci%C3%B3n

%20ambiental%2C%20aspectos%20jur%C3%ADdicos%20y%20de%20facilitaci%C3%B3n%20naviera.

Decreto No. 120-2016 (HN). https://marinamercante.gob.hn/wp-content/uploads/2019/02/Decreto-120-2016.pdf

Decreto No. 167-94 (HN). https://marinamercante.gob.hn/wp-content/uploads/2019/01/Ley-Org%C3%A1nica-de-la-Marina-Mercante-Nacional-Reglamentos-Reformas-y-Anexos.pdf#:~:text=DECRETO%20No.%20167-94%20El%20Congreso%20Nacional%2C%20CONSIDERANDO%3A%20Que,Nacional%20y%2C%20en%20general%2C%20de%20las%20actividades%20mar%C3%ADtimas.

Decreto No. 19081- MOPT (CR). https://repositorio.uned.ac.cr/reuned/bitstream/handle/120809/203/RE.19081-MOPT.pdf?sequence=1&isAllowed=y

Decreto No. 994. (SV). https://elsalvador.eregulations.org/media/LEY%20GENERAL%20MARITIMO%20PORTUARIA-REFORMADA.pdf#:~:text=Art%C3%ADculo%201%20La%20presente%20Ley%20tiene%20por%20objeto,y%20mantenimiento%20de%20los%20puertos%20nacionales%20en%20general.

Den Elzen, M. G., Hof, A. F., & Roelfsema, M. (2013). Analysing the greenhouse gas emission reductions of the mitigation action plans by non-Annex I countries by 2020. *Energy Policy, 56*, 633-643. https://doi.org/10.1016/j.enpol.2013.01.035

Departamento de Planificación y Evaluación de la Gestión (2022). *Plan Estratégico Orientado a Resultado de Dirección General de la Marina Mercante Al 2022.* Dirección General de la Marina Mercante. Honduras. https://portalunico.iaip.gob.hn/portal/ver_documento.php?uid=MTMyOTAxMjg5MzQ3NjM0ODcxMjQ2MTk4NzIzNDI

Department of Environment (2014). *Belize's National Environmental Action Plan 2015-2025.* DOE. http://extwprlegs1.fao.org/docs/pdf/ blz175590.pdf

Durán-Grados, V., Amado-Sánchez, Y., Calderay-Cayetano, F., Rodríguez-Moreno, R., Pájaro-Velázquez, E., Ramírez-Sánchez, A., Souza, SIV., Nunes RAO., Alvim-Ferras, MCM. & Moreno-Gutiérrez, J. (2020). Calculating a drop in carbon emissions in the Strait of Gibraltar (Spain) from domestic shipping traffic caused by the COVID-19 crisis. *Sustainability, 12(24)*, 10368. https://doi.org/10.1016/j.scitotenv.2021.151657

Earsom, J., & Delreux, T. (2021). A nice tailwind: The EU's goal achievement at the IMO initial strategy. *Politics and Governance*, *9*(3), 401-411. https://doi.org/10.17645/pag.v9i3.4296

Edwards, G., & Roberts, T. (2015). *A Fragmented Continent: Latin America and the Global Politics of Climate Change.* The MIT Press. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=nlebk&AN=1107070&site=eds-live&scope=site&custid=ns056238&ebv=EB&ppid=pp_ii

Empresa Portuaria Nacional (2012). *Plan Quinquenal 2012-2016.* Empresa Portuaria Nacional. Nicaragua. https://www.epn.com.ni/docs_2016/quinquenal.pdf

Erazo, R. (2010). Low-carbon transport infrastructure: Experiences in Latin America. *Bulletin FAL, 11/2010(291).* https://repositorio.cepal.org/bitstream/handle/11362/36358/1/FAL-291-WEB-ENG_en.pdf

Faber, J. (2021). *The Initial IMO GHG Strategy-Impacts on shipping companies*. CE Delft. https://cedelft.eu/wp-content/uploads/sites/2/2019/03/The-Initial-IMO-GHG-Strategy.pdf

Garcia, B., Foerster, A., & Lin, J. (2020). The shipping sector and GHG emissions: The initial strategy for a zero-carbon pathway. *NUS Law Working Paper 2020/013* https://dx.doi.org/10.2139/ssrn.3587166

Halim, R. A., Smith, T., & Englert, D. P. (2019). Understanding the Economic Impacts of Greenhouse Gas Mitigation Policies on Shipping: What Is the State of the Art of Current Modelling Approaches? *World Bank Policy Research Working Paper, (8695).* https://ssrn.com/abstract=3320893

Harbours and Merchant Shipping Act (BZ). V.13, CAP.234. https://portauthority.bz/wp-content/uploads/2017/12/Cap_234_Harbours_and_Merchant_Shipping_Act_2011_Substantive_Laws.pdf

Healy, S. (2020). *Grenhouse gas emissions from shipping: Waiting for concrete progress at IMO level (PE 652.754).* Policy Department for Economic, Scientific and Quality of Life Policies Directorate-General for Internal Policies. http://ace-cargadores.com/wp-content/uploads/2020/10/Boletin_963/GEIs%20OMI.pdf

HM Treasury (2020). *Magenta Book*. Central Government guidance on evaluation. HM Treasury. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/879438/HMT_Magenta_Book.pdf

International Maritime Organisation [IMO] (2015). *Third IMO GHG study 2014.* Executive summary and final report. IMO. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Third%20Greenhouse%20Gas%20Study/GHG3%20Executive%20Summary%20and%20Report.pdf

International Maritime Organisation [IMO] (2018). *Initial IMO strategy on reduction of GHG emissions from ships.* Resolution MEPC.304(72). IMO.

International Maritime Organisation [IMO] (2021). *Fourth IMO GHG Study 2020*. Full Report. IMO. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Fourth%20IMO%20GHG%20Study%202020%20-%20Full%20report%20and%20annexes.pdf

IMO-Norway GreenVoyage2050 Project (2022) *National Action Plan to address GHG emissions from ships. From decision to implementation* https://greenvoyage2050.imo.org/wp-content/uploads/2022/03/NAP-from-decision-to-implementation_compressed.pdf

Jarque, C. M., Ortiz, M. S., & Quenan, C. (2009). *América Latina y la diplomacia de cumbres*. Secretaría General Iberoamericana. https://segib.org/wp-content/uploads/Diplomaciaweb.pdf

Joung, T. H., Kang, S. G., Lee, J. K., & Ahn, J. (2020). The IMO initial strategy for reducing Greenhouse Gas (GHG) emissions, and its follow-up actions towards 2050. *Journal of International Maritime Safety, Environmental Affairs, and Shipping, 4(1*), 1-7. https://doi.org/10.1080/25725084.2019.1707938

Ju, Y., & Hargreaves, C. (2021). The impact of shipping CO2 emissions from marine traffic in Western Singapore Straits during COVID-19. *Science of The Total Environment, 789*, 148063. https://doi.org/10.1016/j.scitotenv.2021.148063

Kachi, A., Mooldijk, S., Warnecke, C., & BMU, N. S. (2019). *Carbon pricing options for international maritime emissions* (818008). New Climate-Institute for Climate Policy and Global Sustainability gGmbH. https://www.researchgate.net/profile/Aki-Kachi/publication/332343964_Carbon_pricing_options_for_international_maritime_emissions/links/5cc80ce692851c8d220e875b/Carbon-pricing-options-for-international-maritime-emissions.pdf.

Kim, S. K., van Gevelt, T., Joosse, P., & Bennett, M. M. (2022). Transboundary air pollution and cross-border cooperation: Insights from marine vessel emissions regulations in Hong Kong and Shenzhen. *Sustainable Cities and Society, 80*, 103774. https://doi.org/10.1016/j.scs.2022.103774

Ley 30 (PAN). 2003, March 26. https://docs.panama.justia.com/federales/leyes/30-de-2003-apr-2-2003.pdf

Ley 57 (PAN). 2008, August 6. https://amp.gob.pa/wp-content/uploads/2019/03/LEY-DE-MARINA-MERCANTE.pdf

Ley No. 399 (NI). Gaceta No. 166. http://legislacion.asamblea.gob.ni/normaweb.nsf/d0c69e2c91d9955906256a400077164a/ec7878be0c89e16e062570a10058121b?OpenDocument

Ley No. 838 (NI). Gaceta No. 92. http://extwprlegs1.fao.org/docs/pdf/nic138497.pdf

Liadze, I., Macchiarelli, C., Mortimer-Lee, P., & Juanino, P. S. (2022). *The economic costs of the Russia-Ukraine conflict.* NIESR Policy Paper, 32. https://www.niesr.ac.uk/wp-content/uploads/2022/03/PP32-Economic-Costs-Russia-Ukraine.pdf

Liu, Z., Ciais, P., Deng, Z., Lei, R., Davis, S. J., Feng, S., Zheng, B., Cui, D., Dou, X., Zhu, B., Guo, R., Ke, P., Sun, T., Lu, C., He, P., Wang, Y., Yue, X., Wang, Y., Lei, Y., Zhou, H., Cai, Z., Wu, Y., Guo, R., Han, T., Xue, J., Boucher, O., Boucher, E., Chevallier, F.,Tanaka, K., Wei, Y., Zhong, H., Kang, C., Zhang, N., Chen, B., Xi, F., Liu, X., Bréon, FM., Lu, Y., Zhang, Q., Guan, D., Gong, P., Kammen, DM., He., K & Schellnhuber, H J., (2020). Near-real-time monitoring of global CO2 emissions reveals the effects of the COVID-19 pandemic. *Nature communications, 11(1),* 1-12. https://doi.org/10.1038/s41467-020-18922-7

Ma, S. (2020). *Economics of Maritime Business* (First Edition.). Routledge. ISBN: 978-1-138-99964-0

Metzger, D. (2022). Market-based measures and their impact on green shipping technologies. *WMU Journal of Maritime Affairs, 21(1)*, 3-23. https://doi.org/10.1007/s13437-021-00258-8

Ministerio de Ambiente (2019). *Estrategia Nacional de Cambio Climático, 2050.* Ministerio de Ambiente. Panamá. https://www.undp.org/sites/g/files/zskgke326/files/migration/pa/EstrategiaNacionalCambioClimatico2050.pdf

Ministerio de Ambiente y Energía (2018). *Plan Nacional de Descarbonización 2018 – 2050.* Ministerio de Ambiente y Energía. Costa Rica. https://cambioclimatico.go.cr/wp-content/uploads/2019/11/PLAN-NACIONAL-DESCARBONIZACION.pdf

Ministerio de Ambiente y Recursos Naturales (2009). *Política Nacional de Cambio Climático.* Ministerio de Ambiente y Recursos Naturales. Guatemala. https://www.marn.gob.gt/download/96/politicas-ambientales/8519/politica-nacional-de-cambio-climatico-oficial.pdf

Ministerio de Ambiente y Recursos Naturales (2022). *Plan Nacional de Cambio Climático, 2022 – 2026.* Ministerio de Ambiente y Recursos Naturales. El Salvador. https://cidoc.marn.gob.sv/por-categoria/?cat=cambio-climatico#

Ministerio de la Defensa Nacional (2015). *Política de Seguridad Marítima.* SEGEPLAN. Guatemala. http://ecursos.segeplan.gob.gt/CAPP/documentos/53/Pol%C3%ADtica%20de%20Seguridad%20Mar%C3%ADtima.pdf

Ministerio de Obras Públicas y de Transporte (2011). *Plan Nacional de Transportes de Costa Rica 2001-2035.* Ministerio de Obras Públicas y Transporte. Costa Rica. https://www.mopt.go.cr/wps/wcm/connect/a86ca326-d0c2-403f-9166-259c356f4783/Memoria.pdf?MOD=AJPERES

Ministerio de Obras Públicas y de Transporte (2022). *Memoria de Labores Junio 2021 – Mayo 2022.* Ministerio de Obras Públicas y de Transporte. El Salvador. https://www.amp.gob.sv/ampweb/wp-content/uploads/2021/08/11-ML-Obras-Pu%CC%81blicas_compressed.pdf

Moraga, P., & Meckievi, S. (2016). *Análisis comparativo de legislación de cambio climático*. Centro de la Ciencia del Clima y la Resiliencia. http://biblioteca.cehum.org/bitstream/CEHUM2018/1665/1/Moraga%2C%20Meckievi.%20An%C3%A1lisis%20comparativo%20de%20legislaci%C3%B3n%20de%20cambio%20clim%C3%A1tico.pdf

Protocolo de Guatemala al Tratado General de Integración Económica Centroamericana. https://www.sica.int/documentos/protocolo-Guatemala_1_116843.html

Protocolo de Tegucigalpa a la Carta de Organización de Estados Centroamericanos. https://www.sica.int/documentos/protocolo-de-tegucigalpa-a-la-carta-de-la-organizacion-de-estados-centroamericanos_1_-88.html

Rutherford, D., & Comer, D. (2018). *The international maritime organisation's initial greenhouse gas strategy.* International Council on Clean Transportation. https://theicct.org/sites/default/files/publications/IMO_GHG_StrategyFInalPolicyUpdate042318.pdf

Secretaría de Planificación y Programación de la Presidencia (2020). *Política General de Gobierno 2020-2024.* SEGEPLAN. Guatemala https://portal.segeplan.gob.gt/segeplan/ wp-content/uploads/ 2022/08/PGG-2020-.pdf

Serra, P., & Fancello, G. (2020). Towards the IMO's GHG goals: A critical overview of the perspectives and challenges of the main options for decarbonizing international shipping. *Sustainability*,*12*(8), 3220. https://doi.org/10.3390/su12083220

Shi, Y. (2014). Greenhouse gas emissions from international shipping: The response from China's shipping industry to the regulatory initiatives of the International Maritime Organization. *The International Journal of Marine and Coastal Law, 29(1)*, 77-115. https://doi.org/10.1163/15718085-12341303.

Singh, S., & Rambarath-Parasram, V. (2019). Considerations for the Latin American and Caribbean Region in Light of the Global Move Towards Low Carbon Shipping. In: García Alcaraz, J., Rivera Cadavid, L., González-Ramírez, R., Leal Jamil, G., Chong, M. (eds) *Best Practices in Manufacturing Processes*. Springer, Cham. https://doi.org/10.1007/978-3-319-99190-0_3

Sistema de integración Centroamericana [SICA]. *El SICA en Breve.* SICA. https://www.sica.int/breve#bottom

Study Team (2018). *Final Report, Comprehensive National Transportation Master Plan for Belize.* The department of Public-Private Sector Dialogue. https://edc.gov.bz/wp-content/uploads/2020/12/5.-CNTMP-Final-Report-April-201807220714.pdf

Tórrez Martínez, O. A., & Orozco Delgadillo, L. E. (2007). *El SICA y la regulación de contratos en materia de transporte marítimo: situación particular en la República de Nicaragua* [Grade dissertation, Universidad Nacional Autónoma de Nicaragua UNAN-LEÓN].

United Nations Convention on the Law of the Sea, December 10, 1982, https://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf

United Nations Development Group [UNDAF]. *Theory of Change*. UNDAF campanion guidance. https://unsdg.un.org/sites/default/files/UNDG-UNDAF-Companion-Pieces-7-Theory-of-Change.pdf#:~:text=A%20theory%20of%20change%20is%20a%20method%20that,change%2C%20drawing%20on%20a%20causal%20analysis%20based%20on

Wan, Z., El Makhloufi, A., Chen, Y., & Tang, J. (2018). Decarbonising the international shipping industry: Solutions and policy recommendations. *Marine pollution bulletin, 126*, 428-435. https://doi.org/10.1016/j.marpolbul.2017.11.064

Yang, M., Chen, L., Msigwa, G., Tang, K. H. D., & Yap, P. S. (2021). Implications of COVID-19 on global environmental pollution and carbon emissions with strategies for sustainability in the COVID-19 era. *Science of the Total Environment*, 151657. https://doi.org/10.1016/j.scitotenv.2021.151657.

Zacharias, M., & Ardron, J. (2019). *Marine policy: an introduction to governance and international law of the oceans* (Second edition.). ISBN 9780815379270.

Zanella, T. (2018). Ships and Air Pollution: A Study on the Regulation of Atmospheric Emissions by Vessels. *Revista Da Escola de Guerra Naval, 24(2)*, 301–328. https://doi.org/10.22491/1809-3191.v24n2.p301-328

8. Appendices

8.1 Appendix A: Consent form

Dear Participant,

Thank you for agreeing to participate in this research survey, which is carried out in connection with a Dissertation which will be written by the interviewer, in partial fulfilment of the requirements for the degree of Master of Science in Maritime Affairs at the World Maritime University in Malmo, Sweden.

The topic of the Dissertation is The IMO initial GHG strategy, a process evaluation in Central America.

The information provided by your institution in this survey will be used for research purposes and the results will form part of a dissertation, which will later be published online in WMU's digital repository (maritime commons) subject to final approval of the University and made available to the public. **Your personal information will not be published**. You may withdraw from the research at any time, and your personal data will be immediately deleted.

Anonymised research data will be archived on a secure virtual drive linked to a World Maritime University email address. All the data will be deleted as soon as the degree is awarded.

Your participation in the survey is highly appreciated.

Student's name	Edgar Alberto Micheo Navas.
Specialization	Maritime Law & Policy
Email address	w1011216@wmu.se

* * *

I consent to my institutional data, as outlined above, being used for this study. I understand that all personal data relating to participants is held and processed in the strictest confidence and will be deleted at the end of the researcher's enrolment.

Name: ……
Signature: ……
Date: ……

Rev August 2021.

Estimado participante,

Gracias por aceptar participar en esta encuesta de investigación que se lleva a cabo en relación con una Disertación que será escrita por el entrevistador en cumplimiento parcial de los requisitos para el grado de Maestría en Ciencias en Asuntos Marítimos en la Universidad Marítima Mundial en Malmo, Suecia.

El tema de la Disertación es: La estrategia inicial de la OMI en materia de gases de efecto invernadero, una evaluación del proceso en Centroamérica.

La información proporcionada por su institución en esta encuesta se utilizará con fines de investigación y los resultados formarán parte de una disertación, que posteriormente se publicará en línea en el repositorio digital de la UMM (*maritime commons*) sujeto a la aprobación final de la Universidad y se pondrá a disposición del público. **Sus datos personales no se publicarán.** Puede retirarse de la investigación en cualquier momento, y sus datos personales se eliminarán inmediatamente.

Los datos anonimizados de la investigación se archivarán en una unidad virtual segura vinculada a una dirección de correo electrónico de la Universidad Marítima Mundial. Todos los datos se eliminarán en cuanto se conceda el título.

Se agradece su participación en la encuesta.

Nombre del estudiante: Edgar Alberto Micheo Navas.
Especialización: Derecho y Política Marítima
Dirección de correo electrónico: w1011216@wmu.se

* * *

Doy mi consentimiento para que mis datos institucionales, tal y como se ha indicado anteriormente, sean utilizados para este estudio. Entiendo que todos los datos personales relativos a los participantes se mantienen y se procesan con la más estricta confidencialidad, y se eliminarán al final de la inscripción del investigador.

Nombre: .....
Firma: .....
Fecha: .....

Rev. agosto 2021

8.2 Appendix B: Survey instrument

* * *

Encuesta

Survey

Sección Primera

Consideraciones iniciales. / *First section: Initial considerations.*

No existen criterios precisos que determinen la calidad de una evaluación. La calidad de una evaluación de política depende en gran medida de la consideración de los factores individuales que puedan afectar el entorno en el que la política se desarrolla. A razón de esto, dichos factores deben de considerarse desde el momento en el que se planea la evaluación, para luego ser utilizados en la evaluación final de resultados.

There are no set criteria to define a good policy evaluation. The quality of political evaluations depends, to a great extent, on the complete appraisal of factors affecting the policy environment. Hence, these factors should be considered from the beginning of the planning process and be utilised in the final evaluation of findings.

1. ¿Consideras estable el entorno político del país? / *Would you say that the political environment of your country is stable?*

2. ¿Consideras que los asuntos marítimos representan una prioridad política? ¿Por qué? / *Would you say that the maritime affairs represent a political priority, why?*

3. ¿Cuántas personas trabajan para la administración marítima? / *How many people work for the maritime administration?*

4. ¿Cuántos años lleva la administración marítima en funcionamiento? / *How many years has been functioning the maritime administration?*

5. ¿Cuáles son los actuales objetivos de la administración marítima? / *What are the current goals of the maritime administration?*

6. ¿Cuál es el rol del transporte marítimo en la economía nacional? / *What role does the maritime industry plays for the national economy?*

7. ¿Qué tiempo toma usualmente formular una política? / *Usually, how many time does it take to develop a policy?*

8. ¿Cuántos de los buques autorizados para enarbolar tu pabellón están involucrados en comercio internacional? / *How many of the vessels flying your flag get engaged on international shipping?*

9. ¿Cuenta tu país con una política nacional de transporte marítimo? / *Does your country have a national maritime transport policy?*

Sección Segunda

Bases de la estrategia inicial de la OMI sobre los gases de efecto invernadero

Second section: Basis for IMO's initial GHG strategy

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10. ¿Cuáles estrategias, políticas o planes de acción nacional han sido promulgados en tu país como resultado del Acuerdo de París? / Which strategies, policies or national action plans have been enacted as a result of the Paris Agreement?

11. ¿Es tu país un gobierno contratante del Anexo VI del Convenio MARPOL? / Is your country a Contracting government to Annex VI of the MARPOL Convention?

12. ¿Qué medios legales se emplearon para su implementación? / Which legal means were utilised for its implementation?

13. ¿Esta implementado satisfactoriamente?... ¿por qué? / *is it implemented satisfactorily?... why?*

14. ¿Qué mecanismos se emplean para verificar su cumplimiento?, ¿Cómo crees que se puedan mejorar? */ Which mechanisms are in place to monitor the compliance with the regulations, ¿how can they be improved?*

15. ¿Qué efectos (positivos o negativos) tuvo la implementación del anexo VI de MARPOL? / *Which effects (whether positive or negative) did the implementation of MARPOL annex VI have?*
16. ¿Consideras que tu país es consciente de la cantidad de emisiones de efecto invernadero que la industria marítima genera? / *Would you say that your country is aware of the amount of GHG emissions generated by the maritime industry?*

17. ¿Ha habido alguna discusión con los representantes del sector marítimo con respecto a este problema? / *Has there been any discussion within the representatives of the maritime sector in regard to this issue?*

18. ¿Se ejecuta o se fomenta la investigación científica dentro de la administración marítima? / *Does the maritime administration promotes or performs scientific research?*

Sección Tercera

Posibles medidas a corto, mediano y largo plazo

Third section: Short, middle, and long-term candidate measures.

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19. ¿Cómo consideras que las regulaciones en materia de gases de efecto invernadero puedan afectar al comercio marítimo internacional en el futuro? / *How do you think that GHG regulations can affect maritime trade in the future?*

20. ¿Consideras que tu estado está preparado para implementar medidas comerciales buscando la reducción de gases de efecto invernadero?, ¿Por qué? / *How prepared do you think that your state is for the implementation of market-based measures seeking for GHG reduction, why?*

21. ¿Cómo describirías el desempeño de país con relación a las medidas de eficiencia energética (EEDI & SEEMP)? / *How would you describe the performance of your country in regard to energy efficiency measures (EEDI/SEEMP)?*

22. ¿Brindan tus centros de educación y entrenamiento capacitación sobre el seguimiento a planes de gestión de la eficiencia energética del buque (SEEMP)? /

Does your maritime education and training centres prepare seafarers in regard to ship energy efficiency management plans (SEEMP)?

23. ¿Alguna vez se han efectuado mediciones de eficiencia energética operacional (E.g., Razón de eficiencia anual, eficiencia energética por hora de servicio, indicador de rendimiento especifico de buque)? / *Have there been any measurements in regard to operational energy efficiency (E.g., Annual efficiency ratio, energy efficiency per service hour, individual ship performance indicator)?*

24. ¿Existe algún plan, política o estrategia para incrementar el desempeño de tu flota en la reducción de gases de efecto invernadero? / *Is there any plan, policy or strategy seeking to improve the performance of your fleet in regard to GHG reduction?*

25. ¿Se ha tomado en cuenta la información de los estudios de la OMI en materia de gases de efecto invernadero para la formulación de estos planes, políticas o estrategias?, ¿considerarías tomarlo en cuenta? / *Has it been considered the information of the IMO's GHG studies for the development of these plans, policies or strategies, would you consider to do so?*

26. ¿Cómo se organiza la administración marítima para monitorear los comunicados oficiales de la OMI? / *How does your administration manage to monitor official IMO communications?*

27. ¿Ha conducido o aprobado la administración marítima pruebas piloto enfocadas en optimización de velocidad de los buques? / Has the maritime administration conducted or approved pilot tests on vessel speed optimisation?

28. ¿Consideras factible regular la velocidad de navegación dentro de tu mar territorial? / *Do you consider that is feasible to regulate the navigational speed within your territorial sea?*

29. ¿Existe en proceso alguna investigación científica orientada a mejorar el rendimiento de la industria marítima en respecto a compuestos orgánicos volátiles o a la reducción de metano? / *Is there any research aimed to identify methods to*

enhance shipping performance in regard to volatile organic compounds or methane reduction?

30. ¿Existe alguna investigación enfocada en las nuevas tecnologías de combustible? / *Is there any research focused on fuel technologies?*

31. ¿Existe alguna investigación o programa orientado a la reducción de gases de efecto invernadero en puertos? / *Is there any research or programme seeking to reduce port's GHG emissions?*

32. ¿Se publican los resultados de las investigaciones llevadas a cabo por la administración marítima? / *Are the results of investigations carried out by the maritime administration published?*

33. ¿Existe algún plan, política o estrategia que considere proveer a los buques que visitan sus puertos con combustibles alternativos? / *Is there any plan, policy or strategy seeking to adapt your ports for the provision of alternative fuels?*

34. ¿Existe algún incentivo o programa nacional que fomente las iniciativas en materia de reducción de gases de efecto invernadero? / *Is there any incentive or national campaign fostering initiatives on GHG reduction?*

35. ¿Participa tu estado en los programas internacionales para el desarrollo de capacidades o cooperación técnica? / *Does your state participates on international programmes for capacity building or technical cooperation?*