The Influence of Sovereign States Interests on the Development of International Environmental Law: A Comparative Analysis of the Montreal and Kyoto Protocols

Hamel, Juliette

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Faculty Governance and Global Affairs

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Abstract

This thesis examines structural tensions in the formulation of measures in Multilateral Environmental Agreements (MEAs), through a comparison between the Montreal Protocol and the Kyoto Protocol. Using the Most Similar Design approach, it questions the influence of strategic compatibility between the measures of these protocols and the strategic interests of the U.S., on the level of success of the latter. Two qualitative indices are developed: the Strategic Compatibility Index, which measures the alignment of the protocols' commitments with the interests of the US; and a Success Index, which assesses the scientific and legal ambition of the measures adopted. These indices are based on binary coding carried out using the MAXQDA tool, supplemented in part by semi-structured interviews with experts in international environmental law. A correlation between strategic compatibility and the level of success of MEAs can be observed in both case studies. This calls for further exploration of this issue and application of this method to a broader corpus. In this context, a conceptual framework is proposed: the Compatibility Trade-Off Dilemma, which refers to the tension between legal ambition and the strategic adjustments made to preserve the interests of hegemonic powers. This concept needs to be explored further in future research in the field of international environmental governance. This work aims to contribute to the deconstruction of the subordination of international environmental law to sovereign interests, at a time when environmental issues should be conceived as universal interests.

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Acronyms

Abbreviation	Explanation
CFC	Chlorofluorocarbon
CH_4	Methane
CO_2	Carbon Dioxide
EIA	United States Energy Information Administration
EPA	United States Environmental Protection Agency
GHG	Greenhouse gas
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
MEA	Multilateral Environmental Agreement
MSD	Most Similar Design
N_2O	Nitrous Oxide
ODP	Ozone-Depleting Potential
ODS	Ozone-Depleting Substance
PFC	Perfluorocarbon
R&D	Research & Development
SF_6	Sulphur Hexafluoride
TEAP	Technology and Economic Assessment Panel
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
U.S.	United States
VCLT	Vienna Convention on the Law of Treaties

Chapter 1 - Introduction

1. Research Topic

Since the beginning of the 20th century, over 2,000 international environmental agreements, both bilateral and multilateral, have come into force worldwide (Ecolex, 2025). However, the global average temperature has risen to 1.1°C compared with 1850-1900, global carbon dioxide (CO_2) emissions have increased significantly over the past two centuries, and extreme climatic events are set to multiply over the coming decades (IPCC, 2023). The climate crisis we are currently experiencing is therefore at its height, as seems to be the development of international environmental law. At a time when global warming is posing unprecedented challenges, multi-level climate governance is developing and is structured primarily around the foundations of international environmental law, built on a succession of multilateral and bilateral agreements and global, regional, and national declarations. It is therefore interesting to understand the structure of climate governance in place, to understand the response we are collectively formulating to this unprecedented climate crisis. One aspect of particular interest to us is understanding the legal foundations of this climate governance. As with any international legal framework, the development of the various Multilateral Environmental Agreements (MEAs) is subject to the principle of state sovereignty. MEAs are considered as such if "*they seek, as one of their primary purposes, to manage or prevent human impacts on natural resources; plant and animal species (including in agriculture); the atmosphere; oceans; rivers; lakes; terrestrial habitats; and other elements of the natural world that provide ecosystem services*" (IEADP, 2025). This designation covers all treaties, protocols, conventions, or charters with three or more parties (ibid.). Indeed, in international environmental law, as in all other forms of international law, it is the states that shape the establishment of legal rules, by deciding on the legal norms to which they agree to submit (VCLT, 1969). While the absence of any supra-state entity is a fundamental principle of international relations, it can be seen as a significant obstacle to the elaboration and development of international environmental law. In the face of a climate and environmental crisis requiring a global, multi-level response (IPCC, 2023), this reliance on sovereign interests seems to condition the evolution of the current legal framework, as

sovereign motivations do not always seem to converge with global environmental interests (Young, 2010). Moreover, while not all states have the same powers of influence, they do not all carry the same weight in the development of international legal standards. The dynamics of negotiating legal frameworks often reveal asymmetrical power relations between parties, influenced by economic, political, and strategic considerations (Andresen & Agrawala, 2002). Certain actors play a central role in environmental negotiations (ibid.), which raises the question of their impact on the level of constraint and ambition of the agreements adopted. Hegemonic states in particular, which control raw materials, sources of capital, and competitive advantages, by definition, have a decisive influence on international regimes (Keohane, 1984). If their strategic priorities play a role in structuring the latter, it remains to be seen to what extent they influence international law, and in particular the capacity of treaties to establish legally binding and ambitious commitments. Understanding these dynamics is essential for adapting international environmental law to contemporary challenges and ensuring more effective implementation of climate commitments. Based on an in-depth analysis of the functioning of international environmental law and the normative principles of the "climate regime" (Bourban, 2017), the aim is to shed light on the dynamics that influence the development of MEAs. Studying the *climate regime*, which by definition encompasses all the political arrangements that structure the international chessboard in terms of climate (ibid.), provides a better understanding of the levers and constraints that determine the development of MEAs, as well as that of climate governance.

2. Motivating Observation and Empirical Puzzle

Since the beginning of the 20th century, environmental law has undergone various development trends. The 1970s were a decisive period in the development of environmental law on an international scale, particularly after the Stockholm United Nations Conference, paving the way for unprecedented international cooperation on environmental matters (Sands et al., 2018). States, the architects of international law, are now working collectively to develop an environmental legal framework, which has been constantly evolving ever since. However, despite the growing scientific consensus on the urgency of the contemporary environmental crisis, consensus on an international legal framework regulating human activities to curb this trend is struggling to take hold. Contemporary MEAs seem to struggle

to impose binding legal commitments and ambitious targets, in part, it would seem, because of divergent interests between states (Keohane & Victor, 2010). This observation is borne out by the disappointment of many scientists with the contemporary international legal framework, which has failed over the decades to formulate meaningful agreements to respond adequately to this unprecedented climate and environmental crisis (Lakhani, 2025). However, this trend contrasts with the development of some earlier agreements, which demonstrated that it was possible to adopt meaningful and binding rules (Mäder et al., 2010). We thus observe two opposing trends: the climate and environmental urgency has never been greater, while the international community seems to be producing increasingly flexible agreements, based on voluntary commitments rather than firm obligations. This empirical puzzle raises an obvious question: how can we explain this evolution? Here, we seek to identify the underlying dynamics that influence the ability of governments to formulate MEAs that are far removed from scientific recommendations, failing to respond significantly to this environmental emergency. Several contemporary trends could provide interpretative clues to this paradoxical observation. We could, for example, reflect on a growing trend towards protectionism, turning countries in on themselves and weakening the *climate regime*. Furthermore, the individualism and populism of contemporary societies could be studied as sociological trends with a potential impact on states' investment in formulating global responses to this environmental crisis. However, all things being equal, these dynamics alone do not seem to explain the variation in the success of MEAs. The contrast between certain agreements calls for particular attention to be paid to national motivations, and more specifically to how they influence the position of states in climate governance. The tension between the need for effective global climate governance and the reluctance of states to adopt binding commitments highlights the need for an in-depth analysis of the structural factors that condition the effective development of international environmental law.

3. Research Question

Here, we seek to understand why some MEAs succeed in imposing ambitious, legally binding measures, while others fail to do so despite a global recognition of the environmental stakes and the urgency of collective action. Observing these contradictory trends raises a central question: *To what extent does the compatibility between the measures provided by an MEA and the strategic interests of hegemonic states explain the variation in the success of its*

development? In other words, we seek to understand whether the protection of the strategic interests of hegemonic states, which therefore have a greater capacity to influence international negotiations than more vulnerable states, predominates over scientific recommendations when formulating MEAs. Although the latter are always assertive about the need to adopt significant measures (IPCC, 2023), they are often not sufficiently applied, and therefore seem to clash with other priorities. This tension between science and geopolitical priorities finds particular resonance with the hegemon, whose attitude seems to largely shape the normative architecture of the international scene. This tendency to shape regimes according to their preferences appears to be a constant in the projections of hegemonic states, including in the *climate regime*. This study will thus contribute to a better understanding of the dynamics shaping the effectiveness of international environmental law and the conditions likely to foster the adoption of more binding and ambitious rules.

4. Academic and Societal Significance

First and foremost, this research aims to contribute to the academic debate on how societies can adapt to the climate emergency. While the natural sciences have largely documented the multiple causes of environmental degradation, the aim here is to enrich this understanding by mobilizing an approach based on the social sciences. More specifically, this study proposes to use the scientific method to analyze the geopolitical phenomena influencing the trajectory of the climate and environmental crisis we are experiencing. Indeed, these dynamics of power and strategy partly structure the field of possibilities for human activity, and thus the concrete repercussions of the environmental crisis on societies. By analyzing the processes by which international environmental law is formulated, this research aims to gain a better understanding of the dynamics between national sovereignty and international cooperation, and their role in climate governance. The aim is to understand how international environmental law is shaped, whether or not it is influenced by power relations, negotiations, and compromises that seem to reflect the geopolitical priorities of states. A better understanding of these underlying processes is also enabled by the chosen interdisciplinary approach, highlighting the interactions between the political, economic, and legal dimensions that shape the mechanisms of environmental cooperation. This research is also socially relevant. By identifying the conditions for a successful MEA, it contributes to rethinking negotiation processes at both national and international levels. Indeed,

understanding the national interests that come into play and influence legal frameworks also makes it possible to conceive international law differently, by becoming aware of these potential structural biases and thus reflecting on ways of overcoming them. In a context where environmental governance increasingly revolves around multi-level dynamics, it is essential to better understand decision-making mechanisms to extract the most effective and ambitious elements, while freeing ourselves from practices that hinder environmental action. At a time when the urgency of climate change calls for an acceleration of environmental policies, this research can provide analytical tools to overcome institutional and political blockages. In short, the aim is to gain a better understanding of the constraints linked to state sovereignty, to make it a lever rather than an obstacle to climate action.

Chapitre 2 - Existing Literature and Theoretical Underpinnings

1. Overview of Existing Research on the Influence of Hegemonic States

International law and geopolitical dynamics in general have been the subject of much academic research, providing a solid theoretical framework for this study. The neo-realist hypothesis that states' strategic interests shape international cooperation has been widely supported (Coicaud & Wheeler, 2008). We are therefore interested in research on the borderline between neo-realism and neo-institutionalism. This research asserts that international cooperation does not imply the erasure of state interests, but rather their strategic articulation within a negotiated framework. States appear to cooperate when it is in their interest to do so, and this without calling into question their sovereignty or their fundamental priorities (Keohane, 1984). Certain compromises become conceivable when, after rational calculation, the expected gains from cooperation exceed the costs associated with the concessions induced by cooperation (Axelrod & Keohane, 1985). This tendency towards strategic national priority is all the more evident in the case of the great powers, which have, in Raymond Aron's definition, the power to do, to make do, to prevent doing, and to refuse to do (Aron, 1962). This power to influence the structure of the international scene does not, of course, apply to all states and is dependent on a hegemonic international order. Indeed, the less powerful states, which are often the most vulnerable to the effects of climate change (Anderson, 2007), are therefore less influential in international negotiations aimed at establishing a legal framework. Paradoxically, however, they are the ones who would have the greatest interest in investing heavily in the establishment of independent international environmental law. This contradiction highlights the logic of power that underlies international rule-making, including in the environmental field. Many researchers have analyzed the role of the major powers in structuring the international legal order and in defining the global *climate regime* (Andresen & Agrawala, 2002), even though they are the most resilient to the effects of this crisis. Existing research thus shows that climate governance is largely shaped by the states most resilient to the climate crisis, due to a structural asymmetry of influence. The United Nations Framework Convention on Climate Change (UNFCCC) *climate regime* appears to marginalize developing countries' claims to climate justice, in favor of the interests of developed states (Okereke, 2010). It therefore seems legitimate to assume that, if states have an impact on the level of constraint and

ambition of multilateral environmental agreements, it is primarily the hegemonic states that exert this influence.

2. Overview of Existing Research on Barriers to the Development of MEAs

More broadly, this trend is part of an international scene where cooperation commitments struggle to be considered absolute political priorities in the face of economic interests that seem to dominate (Okereke, 2010). This approach to international law is particularly relevant in the field of the environment, which remains a recent and constantly evolving construct (Sands et al., 2018). Much research initially analyzed the main obstacles to the development of truly binding international treaties, including the issue of state sovereignty, which hinders the adoption of legally enforceable norms and limits the ability of international environmental law to impose binding objectives on states (Albakjaji & El Baroudy, 2024). However, the contemporary challenges faced by environmental legal frameworks are not reduced solely to the notion of sovereignty, but also by a lack of unified implementation, insufficient funding, and weak institutional frameworks (ibid.). Indeed, neo-liberalism's reduction of the role of the state in favor of market liberalization has profoundly weakened the power of public environmental protection agencies (Mattei, 2024), contributing to a weakened implementation of legal commitments. Influential economic players and lobbies hinder the unified implementation of environmental measures stemming from MEAs in each of the States Parties (ibid.). This same economic influence on environmental legal frameworks makes them more market-friendly and therefore reduces their normative scope by limiting them to simplified indicators, such as CO_2 emissions (ibid.). While the international scene is today fragmented by growing economic competition between the major powers (Picciau, 2024), economics prevails, and the use of soft law in environmental matters makes it possible to subordinate the law to the economic interests of each (Mattei, 2024). Finally, international environmental law also seems to be limited by the legal conception of nature, which, not being recognized as an actor, is regulated in a sectoral and growth-oriented manner (Mayrand, 2018). This biased legal conception is also a major obstacle to the development of effective global climate governance (Carlarne, 2008). Obstacles to the development of international environmental law, be they geopolitical, economic, or conceptual, have therefore been widely studied, and the need for far-reaching reforms of the current environmental governance framework has been formulated in various

academic works (Picciau, 2024; Cassotta, 2019). Faced with this fragmentation and these logics of interest, several authors are calling for a rethinking of the normative and institutional foundations of international cooperation. This research is therefore part of this approach, attempting to explain the factors contributing to the establishment of ambitious and binding measures, while drawing on a very rich academic base.

3. Identification of Research Gaps

While this research is based on a solid theoretical framework, it also aims to fill certain persistent gaps in the academic literature. Firstly, this research will seek to analyze more precisely the capacity of hegemonic states to act as normative gatekeepers, i.e., to guide the production and formulation of international norms. Indeed, while their influence on international cooperation, and more specifically on the *climate regime*, is now widely documented, their direct role in the formulation of normative content itself remains relatively unexplored. This study, therefore, aims to help fill this gap by examining the extent to which hegemonic states influence the very formulation of norms, and not just their adoption or implementation. Moreover, although there is a great deal of academic research on MEAs, it is mainly technical and legal. A neo-institutionalist approach that considers both normative content and the architecture of power would enrich our understanding of the dynamics of climate governance by exploring the extent to which the strategic compatibility of an MEA's measures can shape its formulation. Finally, a comparative study of two protocols, comparing their success as well as the investment of States Parties according to the strategic compatibility of their measures, is quite innovative in the environmental legal framework. In particular, the relationship between the compatibility of sovereign interests and the level of ambition and constraint of a treaty remains insufficiently explored. While numerous studies have highlighted sovereignty and national interests as obstacles to environmental cooperation, they rarely consider them as explanatory variables for the success or failure of international agreements. This study, therefore, seeks to measure how specific strategic factors influence the development and effectiveness of treaties, adopting a structured comparative perspective that allows a trend to emerge. Ultimately, this research does not call into question existing theoretical contributions but proposes to refine the analysis by introducing a comparative dimension and providing a more nuanced reflection on the consequences of the realistic behaviors already observed in environmental negotiations.

Chapitre 3 - Theory and Concepts

1. Neo-realist and Neo-institutionalist Approaches & Concepts

In order to establish the observable variables for this research, it is first necessary to consolidate the theoretical and conceptual framework within which the analysis is developed. The theoretical framework of this study lies at the frontier between two currents in international relations: neo-realism and neo-institutionalism. Neo-realism is defined by its state-centric reading, in which states are the main actors on the international agenda, and international cooperation is completely dependent on these actors and their rationality (Viotti & Kauppi, 2012). Neo-institutionalism does not distance itself from this anarchic reading of the international scene, nor from the central role of states in pursuing their interests, but this movement argues that cooperation is possible if strong institutions structure interactions and mutual commitments (Keohane, 1989). The theoretical concepts derived from these two currents thus provide a highly complementary reading of this subject of study. Indeed, it is at the crossroads of these two currents of thought that this research is articulated around various key concepts that structure the analysis. Firstly, this research adopts a neo-realist approach to international environmental governance, emphasizing the primacy of national interests in states' commitment to MEAs. While cooperation is possible, it remains conditioned by economic and strategic considerations rather than a genuine commitment to collective action. International cooperation is often shaped by strategic considerations (Coicaud & Wheeler, 2008), a phenomenon that could be described as *selfish solidarity*, illustrating the dynamics of global governance, where states display a commitment to international cooperation while shaping the rules to suit their national interests. This logic of conditioned solidarity seems to weaken the effectiveness of MEAs, particularly in the absence of binding measures (Picciau, 2024). Secondly, the neo-realist analysis of the role of hegemonic states in shaping the global *climate regime* is particularly relevant here (Andresen & Agrawala, 2002). Finally, this study draws on the concept of Institutional Fit (Young, 2002), often integrated into institutionalist approaches to environmental governance, according to which the institutional adequacy of a treaty determines its viability, as its success depends on its alignment with national policies and interests (ibid.).This theoretical positioning will serve as the basis for the elaboration, in the following section, of a conceptual framework mobilizing various key notions establishing a reading grid for analyzing the functioning of MEAs.

2. Variables and Conceptual Framework

This potential link between the hegemonic power of influence and normative production in MEAs therefore needs to be studied using a qualitative approach. The aim here is to assess the success of MEAs, as well as their compatibility with the strategic interests of hegemonic states. This study is therefore based on a structured analysis of key variables. We establish two variables: a dependent variable (Y), representing the "success" of MEA development; and an independent variable (X), representing the "strategic compatibility" of MEA measures with the interests of hegemonic states. To measure these two qualitative variables, indices have been developed. Initially based on a neo-realist reading bordering on the neo-institutionalist, the Success Index (Y) was developed, along with the Strategic Compatibility Index (X), which is deeply rooted in realist theories of international relations.

Assessing the success of MEAs and their compatibility with the strategic interests of states is based on several conceptual frameworks that help explain the mechanisms underlying the variations observed. Firstly, Rational Design theory (Koremenos et al., 2001) postulates that the flexibility of an MEA directly influences the decision of states to adhere to it. An agreement that is too strict, with inflexible obligations and severe sanctions, could dissuade certain states from joining, whereas a more flexible framework, including, for example, flexibility and renegotiation mechanisms, without scientific obligation, can facilitate cooperation by reducing the perceived political and economic costs of international commitment. This perspective, therefore, justifies taking into account the ambition of the MEA's measures, as well as the number of signatory states to the treaty, as indicators of the Success Index, since the balance between flexibility and constraint seems to be a determining factor in international commitment. Secondly, the Compliance Theory (Chayes & Handler Chayes, 1993) sheds light on the dynamics of compliance with international commitments. According to this approach, state compliance depends not only on the presence of effective control mechanisms and sanctions but also on international normative pressure. It is therefore clear that an ambitious agreement will only have a real impact if it includes binding provisions and monitoring instruments to guarantee its application, and that it therefore implies international normative pressure. This framework justifies the addition of a variable relating to the presence of clear and binding formulations of commitment in the Success Index. Finally, the concept of Institutional Fit (Young, 2002) is essential to understanding

why some treaties fit better than others into national policies. A treaty will be more easily implemented if it is compatible with the economic interests and institutional frameworks of states. This perspective justifies the inclusion of compliance costs, sectoral impact, and the existence of viable technological alternatives as variables in the Strategic Compatibility Index. The more costly and structural transformations a MEA imposes, the more likely it is to meet with resistance from states.

3. Defining and Measuring the Success Index

The Success Index, representing the dependent variable, is coded in a binary manner, establishing two categories of treaties: “Successful” or “Unsuccessful”. This index determines the “success” of an MEA by considering three precise criteria, the analysis of which enables us to qualify the development of the treaties to be studied. The first criterion is based on an analysis of the number of States Parties to the MEA under study. A high number of signatory states is considered to be characteristic of a “successful” MEA, according to Rational Design theory (Koremenos et al., 2001). The second criterion is based on the ambition of the measures adopted in the MEA concerned. Based on Rational Design Theory (Koremenos et al., 2001), innovative, quantified commitments, including trade clauses, but also the legal obligation to provide a scientific basis for the formulation of future amendments, are considered to be a criterion of a “successful” MEA. Finally, the last criterion is based on the binding quality of the commitments made in the MEA concerned. Indeed, a MEA whose commitments are not very flexible, asserting heavy and clearly formulated constraints, is considered a characteristic of a “successful” MEA, based on Compliance Theory (Chayes & Handler Chayes, 1993). These elements comprehensively define the extent to which a MEA achieves its objectives in terms of ambition, constraint, and level of participation, which are the main characteristics of its success.

	Successful Treaty	Unsuccessful Treaty
Number of States Signatories	High number of state signatories	Low number of state signatories
Ambition of the Treaty's measures	Innovative, quantified commitments and the need for scientific underpinning	Unquantified commitments and no scientific obligations
Binding Quality of Commitments	Inflexible commitments and heavy constraints clearly formulated	Flexible commitments and few constraints

Table 1. Summary table of Success Index synthesized criteria.

The Success Index is therefore calculated using a binary coding system, based on a weighted dichotomization of the selected criteria. Each criterion is coded dichotomously (1 if the criterion is met /0 if it is not), and a point is awarded for each criterion met. The final score is therefore the sum of the points obtained for all the criteria making up the index.

In this logic, if an MEA is widely ratified, it gets one point. An MEA is considered widely ratified if the number of States Parties is greater than two-thirds of the sovereign states recognized on the international scene, i.e., greater than two-thirds of 195 (UN, 2025). This threshold generally represents, in international relations, the minimum threshold for generating a strong normative effect (Koremenos et al., 2001), as it brings together, by definition, states from all regions and different forces of influence. Therefore, if the number of states taking part in an MEA is less than two-thirds of the sovereign states recognized on the international scene, i.e., less than 130, the MEA in question has no points. What's more, if the MEA presents quantified and innovative targets (i.e., imposing substantial changes in industrial or energy processes) and asserts the obligation of scientific foundations for the formulation of future amendments, it gets a point for the "ambition" of its measures. Otherwise, no points are awarded. Finally, an MEA is only considered "legally binding" if it includes both inflexible commitments (including monitoring mechanisms) and significant sanctions, such as commercial sanctions and mandatory deadlines. In this case, it is awarded one point for its binding dimension. Otherwise, if its commitments are flexible (existence of flexibility mechanisms, absence of control mechanisms) and not very binding (assistance measures only and procedural flexibility), it gets no points. These three criteria are equally weighted in the calculation of the index. We now need to establish a threshold of points to finalize the coding of the dependent variable. In this logic of additive aggregation, an MEA is

considered “successful” only if it meets all three criteria. This methodological choice reflects a demanding definition of success, consistent with the conceptual framework used. Therefore, this threshold reflects the minimum level of legal ambition, constraint, and state participation required for the creation of a “successful” MEA.

4. Defining and Measuring the Strategic Compatibility Index

The Strategic Compatibility Index, representing the independent variable, is coded in a binary manner, establishing two treaty categories: “Compatible” or “Incompatible”. Strategic Compatibility is defined as the degree to which the obligations of an MEA align with the economic and industrial priorities of the hegemonic States Parties. This index considers three specific criteria, the analysis of which helps to qualify treaty drafting, based on the concept of Institutional Fit (Young, 2002), according to which a treaty will be more easily implemented if it is compatible with the economic interests and institutional frameworks of hegemonic states. The first criterion is based on the sectoral impact that the MEA measures concerned have on the States Parties. A low sectoral impact on the major industries of hegemonic states is characteristic of an MEA that is “compatible” with states’ interests. The second criterion is based on the availability of alternatives to the gases banned or restricted by an MEA. Indeed, if there are numerous, easily accessible alternatives to the gases covered by the MEA, the latter is considered to have a “compatible” characteristic with states’ interests. Finally, the last criterion is based on an analysis of the cost of compliance with the MEA measures. A low cost of adaptation to MEA measures is considered a characteristic of a MEA “compatible” with hegemonic states’ interests. These elements comprehensively define the extent to which a MEA satisfies a state’s strategic interests in terms of adaptation cost, sectoral impact, and accessibility of alternatives.

	Compatible Treaty	Incompatible Treaty
Sectoral Impact	Low sectoral impact on major industries	Strong sectoral impact on major industries
Availability of Viable Alternatives	Existence of easily accessible alternatives	Absence or limited existence of alternatives
Cost of Compliance	Low adaptation costs	High adaptation costs

Table 2. Summary table of Strategic Compatibility Index synthesized criteria.

The Strategic Compatibility Index is therefore calculated using binary coding, based on a weighted dichotomization of the selected criteria. Each criterion is coded dichotomously (1 if the criterion is met /0 if it is not), and a point is awarded for each criterion met. The final score is therefore the sum of the points obtained for all the criteria making up the index.

In this logic, if the MEA measures affect marginal or less strategic sectors, the latter is awarded a point, as it will be deemed "compatible" with the interests of the States Parties. An analysis of the sectoral perimeter impacted by the MEA clauses is carried out, and it is observed whether the major sectors, notably agriculture, industry, and transport, face significant disruptions. These sectors are selected because of their strategic importance, as recognized by international institutions such as the World Economic Forum (WEF, 2022, p.26). If these sectors are heavily impacted, the MEA concerned receives no points, as it does not fully satisfy the interests of the States Parties and is therefore considered to have an "incompatible" characteristic. However, if secondary sectors are more affected, the MEA gets a point, as it is considered to be "compatible" with states' interests. In addition, if the MEA's bans and restrictions allow the use of already available and economically viable alternatives, the MEA concerned is awarded one point, as it is deemed "compatible" with the interests of the States Parties. A technological and industrial analysis of the alternatives available at the time the MEA is drawn up is carried out to assess whether alternative gases make it possible to easily circumvent the planned bans or restrictions, without disrupting existing economic and strategic activities. If there are very few alternatives and subsidiary solutions that do not have a major impact on the economic activities of the hegemonic states, the MEA in question is not awarded any points, as it is considered to be "incompatible" with their interests. Finally, the adaptation costs associated with MEA measures are assessed, whether in terms of

the price of alternative gases or the investment required to transform production structures. This analysis takes into account the technical requirements of the MEA, as well as budget estimates provided by national agencies. If a MEA implies low or moderate costs for states in their adaptation process, i.e., few industrial changes required, it is awarded a point as being "compatible" with the interests of hegemonic states. Conversely, if the costs of adaptation are high, involving heavy investment and profound sectoral transformation according to national agencies, it gets no points. These three criteria are equally weighted when calculating the index. We now need to establish a threshold of points to finalize the coding of the independent variable. Indeed, in this logic of additive aggregation, an MEA is thus considered "compatible" with states' interests only if it meets all three of the preceding criteria. This methodological choice reflects a demanding definition of strategic compatibility, consistent with the application of neo-realist theories. Therefore, this threshold reflects the minimum level of sectoral impact, availability of viable alternatives, and cost compliance required for the creation of a strategically compatible MEA.

5. Hypotheses and Central Argument Advanced

This study hypothesizes that the success of an MEA (Y), measured by the number of states signatories, legal constraints, and the measure's ambition, depends on the compatibility of its provisions with the strategic interests of hegemonic states (X). The model follows a qualitative comparative approach, based on the analysis of MEAs through case studies, to identify the conditions under which their development is most effective. From a neo-realist point of view, it is expected that MEAs involving gases that are difficult to replace, imposing significant sectoral disruption and high compliance costs, will meet with greater resistance from party states, particularly the hegemonic states, who would therefore tend not to work towards the formulation of ambitious and binding measures. However, MEAs that involve gases with accessible and cost-effective alternatives, and where the transition does not upset the economic interests of these hegemonic states, would be more likely to be formulated with legally binding commitments and ambitious measures, and widely adopted. Moreover, in today's international legal order, where state sovereignty remains the foundation of treaty-based cooperation, the existence of binding and ambitious enforcement mechanisms seems to depend largely on the harmonization of treaty provisions with the interests of dominant economic players. Indeed, as their consent is a prerequisite for the creation and

development of these legal mechanisms, it is the determining factor in cooperation, and states must therefore be convinced and satisfied for it to be given, and for cooperation to take place. However, this hypothesis remains to be supported by this research. This hypothesis does not claim to apply uniformly to all signatory states. Indeed, economic and strategic motivations vary from one state to another, which can lead to differences in their commitment to and compliance with international obligations. To avoid overgeneralization and better understand these dynamics, this research focuses on hegemonic states, whose power of influence is the most decisive, and will therefore probably be the most evident in the processes of formulating, structuring, and modulating standards within MEAs. By examining their positioning concerning different treaties, we will be able to better understand whether and how the strategic interests of a hegemonic state influence the level of constraint and ambition of environmental agreements.

Chapitre 4 - Research Design

1. Research Focus

This research focuses on the influence of hegemonic states on the level of constraint and ambition of MEAs, studying the tendency of the latter to be more successful when they do not jeopardize the strategic interests of the States Parties. This study is part of a theoretical framework that borders on neo-realism and neo-institutionalism, in that it postulates that international cooperation is not based on a normative ideal of solidarity, but on the convergence of strategic interests. Nevertheless, like neo-institutionalists, it recognizes that international institutions, and legal regimes in particular, play a structuring role in the organization of this cooperation by influencing the normative dynamics of the contemporary *climate regime*. In this sense, this research pays particular attention to the concrete functioning of legal systems in the *climate regime*, with the aim of better understanding their workings and identifying the levers that can strengthen their normative effectiveness. This qualitative analysis is based on a case study comparing two MEAs. The study uses the Most Similar Design (MSD) to compare two MEAs with similar structural characteristics, but seemingly divergent trajectories. Finally, two qualitative indices are created: the Success Index, assessing the degree of ratification, constraint, and ambition of an MEA; and the Strategic Compatibility Index, measuring the alignment of a treaty's measures with the interests of hegemonic states. To explore the hypothesis within a coherent empirical framework, it is now necessary to select two cases presenting both structural similarities and differences in terms of strategic compatibility, i.e., which would hypothetically have a different independent variable.

2. Comparative Analysis and Case Selection

To formulate the criteria of my comparative analysis, we first establish the definition of the unit of analysis. The level of analysis of this study is the international legal system, more specifically the "climate regime" (Bourban, 2017). Indeed, this research focuses on the international scale to better understand the core mechanisms of global climate governance. The unit of analysis, that is the main subject of this study, is primarily MEAs. Hegemonic

states and their strategic interests are also examined as key actors, but they do not constitute the primary unit of analysis. Finally, the units of observation, that is the sources from which data is collected, are the legal provisions within MEAs, for assessing the dependent variable. National agency reports and policy documents will also be used to assess the independent variable. Moreover, this research establishes a structure-focused comparison, making it possible to evaluate, via a cross-case comparison, a significant hypothesized correlation, with a causal explanatory intention. The structure-focused aspect of this comparison makes it possible to select relevant cases, as it guarantees that the differences observed in the results can be attributed to the main explanatory variable, as the basic structures are similar. Although this variable is probably not the only explanatory factor, it is considered here as potentially influential in the variation observed.

Subsequently, the case selection follows a structured approach to ensure methodological rigor and minimize selection bias. The full population considered here is all MEAs, i.e., all multilateral agreements whose primary aim is to regulate the impact of human activity on natural resources, and which include three or more member states (IEADP, 2025). To reduce the selection, we will focus on a subpopulation made up of all the agreements built within the UN framework, bringing together almost 195 member states (UN, 2025). Then, to highlight agreements with a similar legal structure, we will focus solely on protocols established within the UN framework. This precise reduction of the field of analysis reduces the influence of external factors on the observation of a potential divergence of results. As this research applies MSD, the next step is to establish a hypothetical difference between two categories of protocols that are structurally similar. Therefore, within this subpopulation, the protocols established by the UN are first categorized based on their hypothesized compatibility with states' strategic interests, dividing them into two categories: compatible protocols and incompatible protocols. Indeed, it is important to emphasize that this selection of cases is built on a hypothesis that will need to be verified as the analysis progresses, according to which certain protocols are compatible with the strategic interests of the states involved, and others are not. This makes it possible to study cases that are structurally identical but potentially differ on the independent variable (X). Applying a MSD model, two cases are selected that share institutional similarities but seems to differ in the independent variable: the Montreal Protocol, considered compatible with the strategic interests of states because it bans emissions such as chlorofluorocarbons (CFCs) and halons (UN, 1987), which seem easily substitutable, and the Kyoto Protocol, considered incompatible because it aims to

reduce carbon emissions in general (UN, 1998) which seem difficult to replace and strategically essential for the States Parties. Both protocols were negotiated within UN-led environmental frameworks and have the same legal structure, ensuring a comparable institutional structure while allowing for variation in treaty compatibility. This selection allows for a controlled comparison, isolating the impact of treaty compatibility on success and ensuring methodological robustness. The selection of these cases is therefore based on the hypothesis of a variation in the independent variable, i.e., a variation in strategic compatibility between the two cases, while ensuring that these two protocols are comparable because they are similar in their institutional structure. This selection then enables us to observe whether this potential difference in the independent variable produces an effect on the dependent variable, i.e., the level of "success" of each. It is important to specify that, for the purposes of this analysis, the agreements will be considered in their initial version, as adopted at the time of their respective adoption, without taking into account subsequent amendments or revisions, to ensure consistent temporal and institutional comparability.

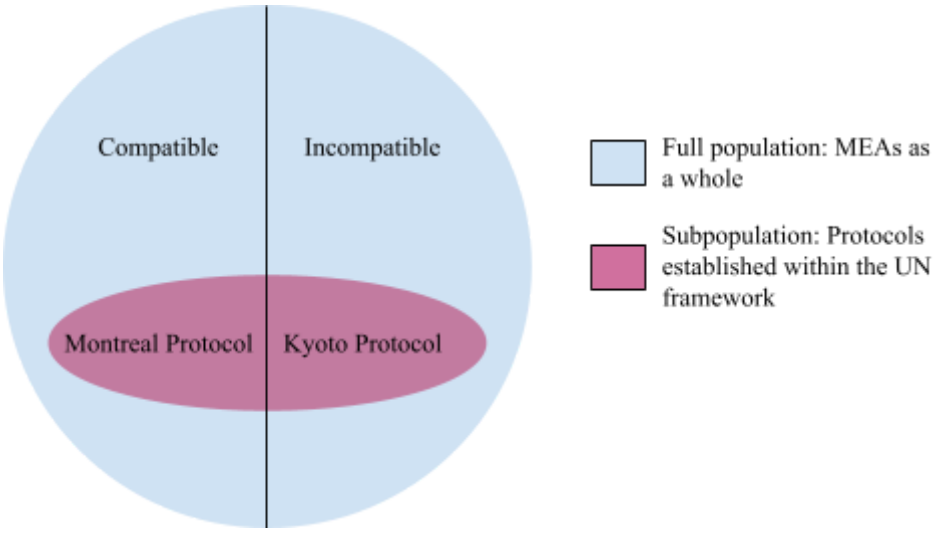

Figure 1. Conclusive diagram of the selection of cases studied

Finally, we turn to hegemonic states as our main research topic. Stephen Krasner (1982) defines hegemonic states as states that combine three different characteristics. Firstly, according to him, they have the capacity to provide collective goods, but also to influence the creation of regimes serving their own interests, as well as to influence the behavior of other actors (Krasner, 1982). Using the comparative approach of MSD, this research will focus on the analysis of a single constant hegemonic actor to isolate its economic and strategic

interests, which may vary from one hegemonic state to another. This singular designation will therefore make it possible to form a constant index of strategic compatibility, and thus create solid variables to test the hypothesis of an influence of this compatibility on the "success" of the protocols considered. In this context, particular attention will be paid to the United States (U.S.), since it corresponds perfectly to the criteria previously established according to Stephen Krasner's definition. Indeed, the U.S. played a crucial role in the provision of international collective goods (Keohane, 1982), notably for economic stability and global security after the Second World War. In addition, the U.S. has repeatedly demonstrated its ability to influence international regimes to serve its interests, as in the case of the Bretton Woods agreements (Krasner, 1982). Finally, the ability of the U.S. to influence the behavior of other actors is reflected in several dimensions, but notably in the form of U.S. soft power, having benefited from high-resolution information control, as well as organizational and institutional skills (Nye, 1990). Therefore, particular attention will be paid to the U.S. throughout this study, as this state satisfies all the criteria of a hegemonic state. Moreover, given its influence in international negotiations and its central role in the drafting of environmental treaties (Falkner, 2014), hegemony is here operationalized through the role of the U.S., then designated as a representative variable. An examination of their commitment and positioning vis-à-vis various agreements will enable us to assess the extent to which the strategic interests of a hegemonic player can influence the direction and ambition of international commitments. Although the U.S. did not ultimately ratify the Kyoto Protocol, its central involvement in its negotiation and design (Depledge, 2005), prior to its domestic political rejection, justifies its analytical inclusion. For the purposes of this study, their hegemonic positioning and active participation during the formative stages of the agreement are considered sufficient to assess their strategic compatibility with the regime.

Nevertheless, it should be noted that the international politico-economic context had evolved considerably between the adoption of the Montreal Protocol in the late 1980s and that of the Kyoto Protocol in the late 1990s. By the time of Kyoto's negotiation, the hegemonic position of the US vis-à-vis emerging powers, most notably China, was less clear-cut, as China had already begun to exert significant influence in climate negotiations, particularly following the adoption of the Berlin Mandate in 1995 (Bjorkum, 2005). Furthermore, broader shifts in the global economy during this period altered the balance of power and the strategic calculations of major actors. While these dynamics will not be examined in detail here for reasons of concision, it is important to keep them in mind when comparing the two cases.

3. Standards for Causal Inference

The next step is to establish the standards for the causal inference applied in this research. First of all, the hypothetical relationship between the dependent and independent variables is as follows: the greater the compatibility between the provisions of an environmental protocol and the strategic interests of the U.S. (X), the more "successful" the protocol will be (Y). This is the causal link to be tested, recognizing that strategic compatibility is hypothetically a *necessary* factor for success, but is probably not a *sufficient* factor to observe this outcome. In other words, without such compatibility, "success" is unlikely to be observed, although its presence alone may not guarantee it. This inference is supported by a controlled comparison of two otherwise similar cases, the Montreal and the Kyoto Protocols, differing primarily in their level of alignment with U.S. strategic interests. The aim is to support the idea that strategic compatibility is a key factor in the success of a protocol, even though it may not be *sufficient*.

To establish and evaluate this hypothesis, we need to establish the criteria for causal inference. We will therefore refer to the three major criteria of causal inference concerning covariation, temporal order, and exclusion of alternative causes (Gerring, 2007). First of all, we observe a potential perfect covariation between the selected variables. Indeed, when strategic compatibility (X) seems to be present, so does protocol "success" (Y). However, when strategic compatibility (X) seems to be absent, so does protocol "success". According to Gerring, this is the minimum condition for testing the hypothetical causal link. Next, to establish that any reversal of causality is impossible, we assert that U.S. strategic interests pre-exist protocol formulations, and thus that the success of the latter cannot influence a posteriori the degree of strategic compatibility. Finally, although the use of MSD allows us to control for the vast majority of context variables, and thus to attribute a high probability of change to the strategic compatibility factor in isolation, it is important to recognize that the strategic compatibility factor is probably not a *sufficient* factor to observe the outcome of "success".

To test the hypothesized causal link, the two indices are formulated using a coding grid, each composed of 3 criteria. If the results of this research indicate that a protocol that is

“strategically incompatible” with U.S. interests manages to meet the characteristics of a “successful” agreement, then the hypothesis formulated will be refuted. Finally, it is important to establish the limits of causal inference. First of all, with the study of only two cases, the generalization of results will be fragile, as we can never exclude the possibility of a contextual coincidence. However, this research first seeks to establish the plausibility of a causal link in a controlled environment, so the use of MSD allows us to isolate a particular variable. Finally, while a consistent correlation between a treaty’s strategic compatibility and its success supports the hypothesis, it does not establish direct causality, as other variables may also influence the results. This approach provides a structured framework for assessing the explanatory power of the strategic compatibility of treaty measures with state interests in treaty success.

4. Data Sources

Firstly, this research adopts a positivist approach to analyzing the two protocols. This study aims to identify structural patterns in the relationship between environmental legal frameworks and U.S. strategic interests, to ensure an objective view of how these interests influence treaty adoption. The primary sources studied are the two complete texts of the Montreal Protocol and the Kyoto Protocol, in their original form when they were adopted, i.e., without taking into account any subsequent amendments. This choice was made to highlight only the issues represented at the time the protocols were adopted, as future amendments and their impact on U.S. interests could not be foreseen. These two protocols are observed using the Content Analysis method. Firstly, it is important to point out that the ratification status for each of the treaties is also used as a primary source, but does not need to be analyzed by a coding method, as they are the only quantitative variable quantified directly. MAXQDA software is then used to ensure consistency of approach and data management. A predefined deductive coding grid is therefore applied to both protocols, in order firstly to measure the ambition of their measures, as well as the binding quality of their commitments. These codes are not intended to reduce the regimes to a rigid binary opposition, but to identify the dominant logic in the design of compliance mechanisms. Each regime combines constraint and cooperation, but we want to observe how their structural equilibrium differs. The software is used to quantify recurrences of the characteristics of the dependent variable (Y). The two indicators are coded as follows: Innovative measures detected by existence of

quantified targets, commercial clauses, and implications of substantial changes (= 1 point)/ Lack of innovative measures detected by unquantified targets and approximate measurements (= 0 point); Scientific basis required for formulation of future amendments (= 1 point)/ Scientific basis not required for formulation of future amendments (= 0 point); Inflexible commitments detected by the use of the imperative “Party/ies shall” and by the existence of monitoring and control mechanism (= 1 point)/ Flexible commitments detected by the existence of flexibility mechanism and mention of exemptions (= 0 point); Commercial sanctions, graduated constraints, mandatory deadlines (= 1 point)/ Assistance measures, procedural flexibility, cooperative follow-up (= 0 point). The software can therefore identify the recurrence of these elements in each of the protocols and, by adding the qualitative ratification data, can then evaluate the Success Index value for each of the two protocols. After coding the texts of the two protocols via MAXQDA according to the predefined deductive grid, each variable is evaluated by applying a majority rule. Specifically, for each indicator, if a majority of the elements coded for a protocol correspond to a positive evaluation (1 point), then the protocol obtains one point for this indicator. Conversely, if a majority of coded elements correspond to a negative assessment (0 points), no points are awarded. This method of aggregation is justified by the fact that items are coded in binary form, and that the software can precisely count the frequency of each type of coding. This approach guarantees methodological consistency between the qualitative analysis and the final construction of the Success Index.

Scientific reports from U.S. agencies such as the U.S. Environmental Protection Agency (EPA) and the U.S. Energy Information Administration (EIA), as well as reports from technical committees following the implementation of the protocols, such as the Technology and Economic Assessment Panel (TEAP) reports, are also studied as primary sources. MAXQDA software is again used to ensure consistency of approach and data management. A predefined deductive coding grid is applied to the various reports to measure the sectoral impact of the protocol measures, the availability of alternatives, and the cost of compliance. The software is used to quantify and dissociate the criteria presented above for the independent variable (X). The three indicators are coded as follows: Secondary Sectors Affected (= 1 point)/ Major Sectors Affected (= 0 point); Existence and Accessibility of Substitute Gases (= 1 point)/ Absence or Limited Accessibility of Substitute Gases (= 0 point); Low Cost of Adaptation: few industrial changes required (= 1 point)/ High Cost of Adaptation: heavy investments required (= 0 point). The software identifies the recurrence of

these elements in each of these reports and then evaluates the Strategic Compatibility Index value of each of the two protocols. After MAXQDA has coded the various reports according to the predefined deductive grid, each variable is evaluated by applying a majority rule. Specifically, for each indicator, if a majority of the elements coded for a protocol correspond to a positive assessment (1 point), then the protocol is awarded one point for this indicator. Conversely, if a majority of coded elements correspond to a negative assessment (0 points), no points are awarded. This method of aggregation is justified by the fact that items are coded in binary form, and that the software can precisely count the frequency of each type of coding. This approach guarantees methodological consistency between the qualitative analysis and the final construction of the Strategic Compatibility Index.

Index	Data	Data Collection and Analysis
Success Index	Number of States Signatories	Quantitative data is directly quantified *(not codified)*.
	Ambition of Treaty's Measures	Innovative measures: existence of quantified targets, commercial clauses, and implications of substantial changes (= 1 pt) Lack of innovative measures: unquantified targets and approximate measurements (= 0 pt) Scientific basis required for formulation of future amendments (= 1 pt) Scientific basis not required for formulation of future amendments (= 0 pt)
	Binding Quality of Commitments	Inflexible commitments: mention of "Party/ies shall" and existence of control and monitoring mechanism (= 1 pt) Flexible commitments: existence of flexibility mechanism and mention of exemptions (= 0 pt) Commercial sanctions, graduated constraints, mandatory deadlines (= 1 pt) Assistance measures, procedural flexibility, cooperative follow-up (= 0 pt)
Strategic Compa-tibility Index	Sectoral Impact	Secondary sectors affected (= 1 pt) Major sectors affected (= 0 pt)
	Availability of Viable Alternatives	Existence and accessibility of alternative gases (= 1 pt) Absence of alternative gases (= 0 pt)
	Cost of Compliance	Low cost of adaptation: few industrial changes required (= 1 pt) High cost of adaptation: heavy investments (= 0 pt)

Table 3. Data Collection and Analysis Summary Table

These numerous primary sources make it possible to assess the ambition and legal constraints of the treaties, as well as their strategic compatibility with U.S. interests. Thus, the coded indicators derived from primary sources enable a systematic comparison between the two protocols, directly serving the objective of testing the central hypothesis within an MSD framework: that greater strategic compatibility with U.S. interests would increase the treaty's chances of "success".

In addition, a wide range of secondary sources is mobilized to build on existing academic research and strengthen the theoretical and empirical foundations of this study. These secondary sources include peer-reviewed academic articles and institutional reports from international organizations. These sources were systematically collected and reviewed. These documents were selected based on their scientific credibility, their relevance to international environmental governance, and their empirical richness. Secondary sources were mobilized to frame the theoretical anchoring of this study, to contextualize the cases studied, and to support the interpretation of the results. These sources were not used to construct variables directly, but to provide a broader understanding of the legal, political, and economic dynamics surrounding the Montreal and the Kyoto Protocols. Their use reinforces the internal coherence and external validity of the study by embedding the empirical results in existing scientific debates and contemporary institutional discourses.

In addition, semi-structured interviews were conducted with professionals and researchers specializing in international environmental law. These interviews, conducted via Zoom to take account of the geographical dispersion of the participants, were recorded with their consent and faithfully transcribed to guarantee the integrity of the data. It is important to point out that numerous ethical considerations are taken into account, with the use of a consent form allowing interview participants to give their written agreement to be interviewed, recorded, and to have their names quoted. Conversely, if participants had chosen anonymity, their identity would have been protected, and their name and profession would not have been revealed. Finally, transcripts and recordings are stored securely, and their contents are used only within the defined framework of this research. Two experts were interviewed for this study. The first one, Jean-Frédéric Morin, is a researcher and full professor of political science at Université Laval. He specializes in international institutions, with a particular focus on the interplay between regimes in the environmental field. The second, Sébastien Duyck, is a Senior Attorney at the Center for International Environmental

Law, and his work focuses on international climate governance. These participants were approached because of their in-depth expertise and long-standing academic and professional involvement in the structures and dynamics of international environmental agreements. Their perspectives offer high-quality primary data of direct relevance to the research question concerning the strategic design and compatibility of MEAs. Their perspective brings not only empirical depth but also conceptual clarity to the analysis.

Together, these multiple sources enable a methodological triangulation, combining legal, economic, and expert perspectives. This triangulation validates the results and mitigates the biases inherent in the use of a single type of data or method, reinforcing the internal validity and robustness of the analysis. Although the interviews were transcribed in full, their content was not formally coded. Instead, a selective analytical reading was applied, allowing expert perspectives to contextualize and enrich the interpretation of legal and strategic issues identified through primary document analysis. This approach reflects the auxiliary role of interviews in this study, aimed at reinforcing the overall coherence and plausibility of findings rather than generating stand-alone empirical categories.

5. Validity and Potential Limitations

Finally, the strength of this Research Design lies in the demonstration of its internal and external validity. Firstly, internal validity is affirmed by a potential correlation link between the independent variable (X) and the dependent variable (Y). In addition, the use of the MSD ensures maximum control of the impact of other contextual variables. Indices are also standardized, with the establishment of a precise coding grid and the use of software to ensure a certain methodological rigor. Finally, methodological triangulation also contributes to reinforcing the internal validity of the research, as it avoids interpretive bias produced by a single source. Secondly, the external validity of this research is supported by the use of variables and methods potentially applicable to the study of other MEAs. Thus, although this study does not aim to be universal in scope due to the limited number of cases compared, it does enable us to observe a hypothetical trend. This trend could shed light on other international treaty-making processes, suggesting lessons about the influence of the great hegemonic powers in the formulation of international law.

Finally, the potential limitations of this research lie in the quantitative aspect of the chosen method, which implies, despite the use of analysis software, a certain interpretative bias. Indeed, there is a risk of subjectivity to be taken into account, and particular care is taken to reduce the use of oversimplification. Moreover, the case selection imposes a certain confirmation bias right from the research design stage, which we need to be aware of and try to deconstruct. Moreover, despite the use of an MSD, it's important to remember that uncontrolled factors can influence the success of the treatments studied, and that the variable studied alone does not have a decisive power of influence. Finally, retrospective biases may also come into play, and particular attention is paid to these, so as not to imply that our current knowledge of the subject changes the interpretation of past facts.

6. Summarize Expectations

Protocole	Strategic Compatibility Index (X)	Success Index (Y)	Expectation according to the hypothesis
Montreal	3/3 (Compatible)	3/3 (Successful)	Confirms hypothesis
Kyoto	1/3 (Incompatible)	1 /3 (Unsuccessful)	Confirms hypothesis

Table 4. Table of Summarized Expectations

Chapitre 5 - Analysis

1. Findings

This part forms the core of the comparative study, aimed at establishing the degree of "success" and "strategic compatibility" of the two selected protocols. To avoid any selection bias, the analysis begins by examining the independent variable to check the validity of the case selection carried out previously. Only then is the "success" of the protocols analyzed. To establish these indices, a qualitative analysis was carried out based on the coding of official documents from the two protocols via MAXQDA, supplemented by examination of subsidiary legal documents, reports from U.S. environmental agencies, and other institutional monitoring sources.

a. Montreal Protocol

The Montreal Protocol is a follow-up MEA to the Vienna Convention on the Protection of the Ozone Layer. It was signed on September 16, 1987, and came into force on January 1, 1989. It has now been ratified by 198 States Parties (UNEP, 2024), including the different legal values linking states to the Protocol (Ratification, Accession, Acceptance, Approval, and Succession). This protocol concerns the progressive reduction of ozone-depleting substances (ODS), notably chlorofluorocarbons (CFCs) and halons, with high ozone-depleting potential (ODP). The Protocol aims to gradually eliminate these substances from the atmosphere, thereby helping to preserve the ozone layer. Although there are now five amendments to the protocol, all of which have been built up over the last few decades, for the sake of brevity, we have chosen to concentrate on the first version. This first version concerns only the following gases: CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, halon-1211, halon-1301, halon-2402 (UN, 1987), although various ODS have subsequently been added to these over the decades. The sub-hypothesis that the Montreal Protocol is in part a "successful" treaty, and "compatible" with U.S. strategic interests, seeks support here. To do this, we calculate the score of the different Montreal Protocol indices, through the coding of different documents on MAXQDA. First, to calculate the score for its Strategic Compatibility with U.S. interests, we study a report published by the United Nations Environment Programme (UNEP) in 2014, presented by the U.S. government at the 26th

Meeting of the Parties to the Protocol. This report offers useful insights into the industrial transitions associated with phasing out substances covered by the original Protocol, as well as the costs, alternatives, and strategic interests of the parties. In addition, a 2007 report by the U.S. Environmental Protection Agency (EPA) looks at key stages in the implementation of the Montreal Protocol in the U.S., highlighting industrial adaptation efforts and substitution strategies. Finally, a report by the Technology and Economic Assessment Panel (TEAP), published in 2009, allows us to observe the implementation of the Montreal Protocol, examining in particular changes in the use of regulated substances and the adoption of alternatives. All three documents are technically neutral, allowing us to manually code the criteria that correspond to our different code lines. Finally, to calculate the Success Index of the Montreal Protocol, we look at three different legal documents. Firstly, the official version of the Montreal Protocol, as agreed in 1987, specifies the substances concerned, the mechanisms for progressively reducing their production and consumption, as well as the monitoring, technical cooperation, and control mechanisms. It forms the legal basis of the Agreement. The second legal document is Annex II to the Montreal Protocol, adopted in 1998, which defines the Non-Compliance Procedure. This text sets out the monitoring, assessment, and response mechanisms in the event of a State failing to meet its obligations under the Protocol. Finally, the last legal document mobilized is Annex V of the Montreal Protocol, adopted at the fourth Meeting of the Parties, which proposes an indicative list of measures that can be taken in the event of non-compliance. These six documents, selected for their analytical complementarity and institutional rigor, form the empirical basis for MAXQDA coding, from which we now proceed to calculate the two Montreal Protocol evaluation indexes.

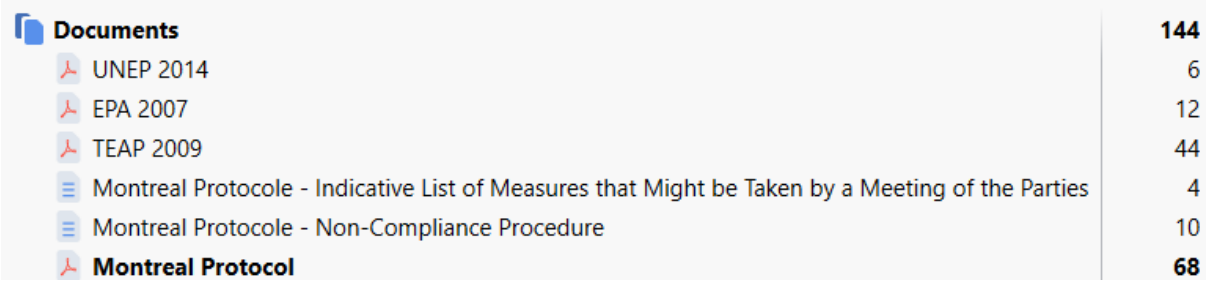

Figure 2. Distribution of Coded Segment by Source Document

i. Strategic Compatibility Index - Montreal Protocol

To check whether our sub-hypotheses can be supported, we first seek to calculate the Strategic Compatibility Index of the Montreal Protocol, which we have so far estimated to be positive, justifying the case selection. To support this sub-hypothesis, three characteristics are considered: the sectoral impact of the protocol's measures, the availability of viable alternatives to the substances covered by the protocol, and the cost of compliance for the U.S.. Each of these codes is not automated for these three indicators, as the segments that make them up may depend on an interpretation that cannot be identified by coding a recurrence of terms.

First of all, an analysis is made of the U.S. sectoral perimeters impacted by this protocol. This makes it possible to observe whether these measures have a considerable impact on the major sectors, established here as agriculture, industry, and transport (WEF, 2022, p.26), or whether it is more the secondary sectors, understood as the other less strategic economic and societal sectors, that are impacted. To this end, the coding of selected documents enables an overall assessment of the sectors affected. CFCs and halons were used extensively in refrigeration and air conditioning, identified as the main consumption sectors (UNEP, 2014). While the U.S. is slightly affected by the impacts on food retailing and automotive air conditioning (ibid.), these measures mainly impact warmer regions, where dependence on CFCs is higher (TEAP, 2009). Sectors using aerosols, solvents, or sterilization systems, notably the medical and pharmaceutical sectors, also appear to be affected (ibid.). However, the rapid availability of substitutes has limited their impact in the U.S. (UNEP, 2014). Finally, the security sector, which is heavily dependent on halons, is affected by these measures to regulate fire protection tools such as extinguishers, including in aerospace (EPA, 2007; TEAP, 2009). Although the substances concerned by these measures are ubiquitous in the various levels of value chains in the U.S., the sectors affected are not those considered here as major sectors for U.S. strategic interests. The reports also note that these measures have had a significant impact on the building sector, particularly with regard to the use of insulating foam (TEAP, 2009; EPA, 2007). All the occurrences, positive and negative, identified for each document are summarized in the coding table below.

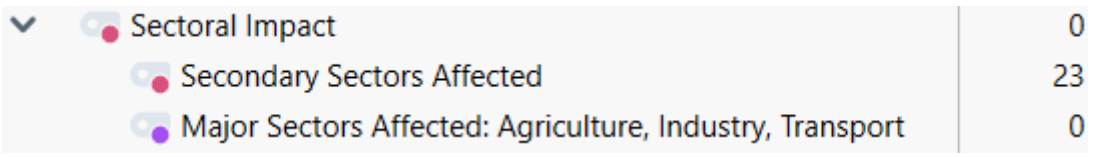

Figure 3. Distribution of Coded Segment by Sectoral Impact

It can be seen that 23 segments in these documents refer to secondary sectoral impacts. Conversely, there are no segments referring to strategic U.S. sectors. The three documents converge on this conclusion, while acknowledging significant effects on U.S. activities, without, however, really threatening domestic industries. We therefore perform a weighted dichotomization. Considering the absence of any segments for the "Major Sectors Affected" coding line (n = 0), and the existence of significant occurrences in the "Secondary Sectors Affected" coding line (n = 23), we establish that the Montreal Protocol scores 1 point for the strategic compatibility of its sectoral impact, with U.S. interests (See Table 5).

Secondly, a technological and industrial analysis of the alternatives available at the time the agreement was signed was carried out. These documents first confirm the availability of affordable alternatives for refrigeration methods, which were therefore able to adapt to such measures without major disruption (EPA, 2007). Hydrofluorocarbons (HFCs) rapidly replaced the use of CFCs in refrigeration, notably with the use of HFC-134a (EPA, 2007). This alternative substance, available when the Montreal Protocol was signed, is also rapidly being used in automotive air conditioning (ibid.). In the building sector, water-blown foam and hydrocarbons such as propane and butane are used, and their use is presented as technically accessible (TEAP, 2009). In addition, dry chemicals and water are rapidly replacing halons in fire extinguishing systems (EPA, 2007). Finally, aerosol operating methods are being rethought and are rapidly moving towards the use of hydrocarbons (ibid.). The UNEP report points out that, although some alternatives to CFCs already existed at this time, they did not yet cover all uses, and their adoption remained limited before international regulation was put in place. Indeed, some uses, although marginal, are struggling to be replaced (TEAP, 2009, P. 118). All the occurrences, positive and negative, identified for each document are summarized in the coding table below.

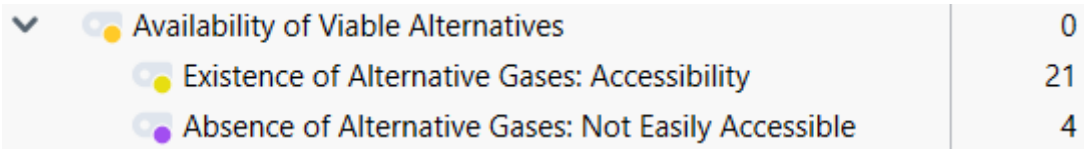

Figure 4. Distribution of Coded Segment by Availability of Viable Alternatives

We note that 21 occurrences refer to the existence of accessible alternatives to the gases regulated by the Montreal Protocol. Conversely, 4 segments refer to the absence of alternatives or their limited access, depending on the context of use. Overall, the three documents under review converge on the observation that alternatives are technically available in the majority of cases, while noting certain sector-specific limitations. We have therefore carried out a weighted dichotomization. Given the significant imbalance between positive segments (n = 21) and negative segments (n = 4), we assign a score of 1 to the criterion "Availability of Viable Alternatives" in the composition of the Strategic Compatibility Index (see Table 5). The existence of a majority of methods for circumventing prohibitions, so that U.S. activities do not face significant disruption, contributes to the compatibility of this protocol with U.S. interests.

Lastly, the costs of adapting to the Protocol's measures are assessed, whether in terms of replacement gas prices or the investment required to transform production structures. First of all, we note that the transition was smooth overall and that the elimination of ODS did not represent a high cost for U.S. businesses (EPA, 2007). The use of hydrocarbons enabled industries producing insulating foams or aerosols to maintain their activities at reduced cost (TEAP, 2009). U.S. companies made the conversion without major disruption, and consumers didn't face any significant cost increases either (ibid.). Although in most cases of adaptation, the costs are not very high, some rearrangements in production chains involve major investments, particularly in mass retail (UNEP, 2014). Indeed, while many segments claim that "hydrocarbon propellants were more economical and that [...] customers preferred products that were more protective of the ozone layer" (EPA, 2007, P.15), some mention industry regulatory obstacles. Although transition costs are often marginal and do not necessarily imply major structural changes, these segments are coded negatively to avoid interpretation bias. All the occurrences, positive and negative, identified for each document are summarized in the coding table below.

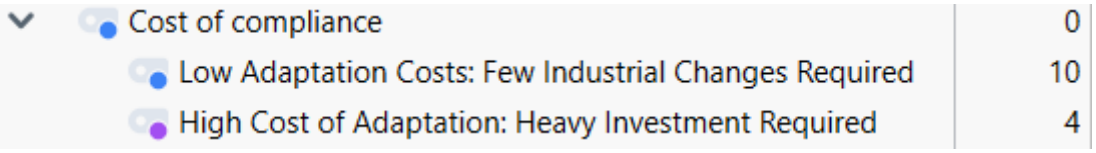

Figure 5. Distribution of Coded Segment by Cost of Compliance

We note that 10 occurrences refer to low adaptation costs and the need for few industrial changes. Conversely, 4 segments refer to high adaptation costs and heavy investments required for the transition. Although positive segments are by far the majority, the presence of negative segments invites us to qualify the analysis and avoid an overly categorical reading of the cost of compliance. Overall, the three documents studied converge on the observation that adapting to the new regulations is not very costly, while pointing to some heavy investments in adaptation, although these are not the majority. Based on these results, we have carried out a weighted dichotomization. Given the significant imbalance between positive segments (n = 10) and negative segments (n = 4), we assign a score of 1 to the criterion "Cost of Compliance" in the composition of the Strategic Compatibility Index (see Table 5). Indeed, the low costs generated by these regulatory changes contribute to the compatibility of this protocol with U.S. interests.

The calculation of these three characteristics, which make up the Strategic Compatibility Index, enables us to assign a positive score to the Montreal Protocol, which is structurally compatible with U.S. strategic interests. The measures established by the Montreal Protocol show a real tendency not to compromise U.S. interests, having a relatively low sectoral impact, allowing accessible alternatives, and relatively low adaptation costs. Indeed, the notion of Institutional Fit (Young, 2002), which measures the compatibility of a treaty with the strategic interests and institutional framework of the States Parties, enables us to legitimize the calculation of this positive strategic compatibility. In addition, the sub-hypothesis that the Montreal Protocol is compatible with U.S. interests is now supported, allowing us to deconstruct the biased aspect of case selection.

	Segments (Positive and Negative)	Dichotomization	Assigned Points
Sectoral Impact	23 positive segments 0 negative segment	23 > 0	1 point
Availability of Alternatives	21 positive segments 4 negative segments	21 > 4	1 point
Cost of Compliance	10 positive segments 4 negative segments	10 > 4	1 point
Total			3/3
Strategic Compatibility Index Value			1

Table 5. Summary of Strategic Compatibility Index Coding and Scoring

ii. Success Index - Montreal Protocol

Then, to test our general hypothesis, we now seek to calculate the Success Index of the Montreal Protocol. To support the sub-hypothesis that the Montreal Protocol is "successful", three characteristics are considered: the number of signatory states, the ambition of the Protocol's measures, and its binding dimension. The first characteristic, being purely quantitative, is not coded and evaluated as such. The segments concerning the ambition of the measures are not coded automatically, as they depend on an interpretation that cannot be identified by coding a recurrence of terms. However, the binding dimension of the measures is partly coded automatically, around the recurrence of the term "Party/ies shall", but also manually according to the existence of control and monitoring mechanisms.

Firstly, to assess whether the Montreal Protocol meets the first criterion of a "successful" international agreement, i.e., broad ratification, we rely on the number of States Parties that have signed up to the Protocol. To do this, we adopt a longitudinal approach, examining the evolution of the number of ratifications over time, using the most recent official reports. This perspective enables us to better appreciate the Protocol's capacity to generate growing and lasting adherence, an essential indicator of its normative legitimacy. Although the Montreal Protocol counted just 49 signatories in the first year following its adoption (UN, 1987), in November 2024, at the time of the latest Status Ratification update,

it had 198 States Parties (UNEP, 2024). This figure includes all the legal forms of accession recognized by international law (Ratification, Accession, Acceptance, Approval, Succession, and Provisional Application). As previously established, an MEA is considered widely ratified if the number of States Parties is greater than two-thirds of the sovereign states recognized on the international scene, i.e. greater than 130 out of 195 recognized states (UN, 2025), as it represents the minimum threshold for generating a strong normative effect (Koremenos et al., 2001). The Montreal Protocol far exceeds this threshold and is therefore awarded a point for this criterion. It is important to note, however, that although the Protocol achieved near-universality in the decades following its conclusion, initial ratification was relatively modest. Thus, had the evaluation been carried out at an earlier stage, this criterion might have been interpreted differently, or even regarded as an indicator of failure. The methodological choice of adopting a longitudinal perspective, while open to challenge, nonetheless enables us to better grasp the protocol's ability to generate growing adherence over time, which is in itself a relevant indicator of institutional success.

Secondly, to establish whether or not the Montreal Protocol's measures involve scientific and legal innovations, a linear analysis of the protocol is carried out, and the analysis of ambition is divided into two categories. Firstly, in general terms, the treaty implies a progressive reduction of the following ODS: CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, halon-1211, halon-1301, halon-2402 (UN, 1987), which have a high ODP ranging from 0.6 to 10.0 (ibid.). In particular, it implies a gradual reduction in the use of substances, limiting states' consumption and production to 50% of their respective 1986 levels by 1998 (UN, 1987, P.31). This dynamic of innovative measures can be found in several similar segments identified throughout the treaty. However, this trend is partially mitigated by Article 10.1, which formulates an obligation to cooperate in general terms, without a clear mechanism or quantified targets, although it appears to be the only segment of limited normative scope in this protocol. Furthermore, the obligation to refer to scientific grounds can be seen in Article 6 of the Protocol, which implies that the Parties undertake to reassess the Protocol's measures and formulate amendments in the light of available scientific information. Nothing in the Protocol qualifies this interpretation. The elements presented here illustrate the positive and negative types of coded segments, the recurrences of which are summarized in the table below.

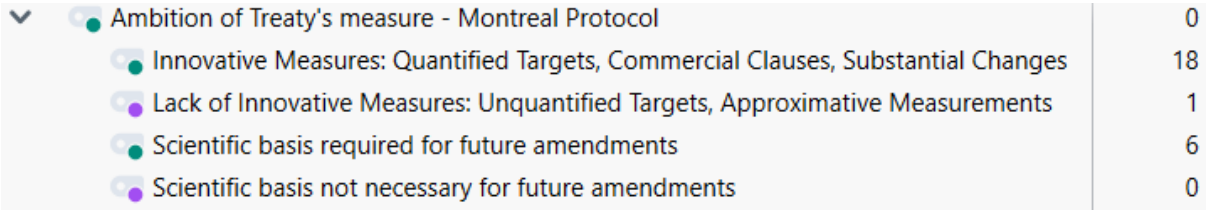

Figure 6. Distribution of Coded Segment by Ambition of Treaty's Measures

We note that 18 occurrences refer to innovative, quantified measures, involving commercial clauses and substantial changes. In contrast, 1 segment refers to unquantified and approximate measures. In addition, the analysis also reveals that 6 occurrences refer to the need for scientific foundations in the future development of the protocol, but no segment testifies to the absence of such a need. We then perform a weighted dichotomization. Given the significant imbalance between positive segments (n = 18) and negative segments (n = 1) for the first category, but also observable in the second category, which has only positive segments (n = 6), the protocol then scores half a point in each category. Therefore, we assign a score of 1 to the criterion "Ambition of Treaty's Measures" in the composition of the Success Index (see Table 6). The Montreal Protocol's legal and scientific innovations give it a characteristic associated with MEA considered "successful" here.

Finally, to establish whether the Montreal Protocol's measures imply rather binding commitments or not, a linear analysis of the protocol is carried out, and the analysis of constraints is divided into two categories: flexibility of commitments and procedural flexibility for the formulation of sanctions. Generally speaking, the documents analyzed contain 28 mentions of the words "Party/ies shall", so we can observe a significant use of the imperative. In addition, there is a high prevalence of binding provisions, structured around precise control and monitoring mechanisms. Among these, Article 12.C, which entrusts the Secretariat with a central supervisory role (UN, 1987, P.37), clearly illustrates the presence of institutionalized monitoring, while Article 4.1. and Annex V impose trade constraints, mandatory deadlines, and graduated sanctions, reinforcing the treaty's binding scope (UNEP, 1992). Limited forms of legal flexibility do exist however, such as the exception provided for countries with very low consumption (< 0.3 kg/capita) (UN, 1987, P.34), but these remain marginal. Similarly, the assistance measures identified in Annex II, Article 9, fall under the heading of assistance with implementation (UNEP, 1998), but do not imply procedural flexibility. The elements presented here illustrate the positive and negative types of coded segments, the recurrences of which are summarized in the table below.

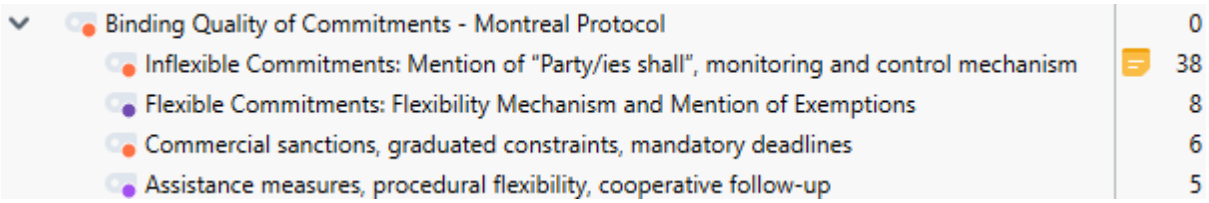

Figure 7. Distribution of Coded Segment by Binding Quality of Commitments

We note that 38 occurrences refer to monitoring and control mechanisms, or mention the term "Party/ies shall". On the other hand, 8 segments mention flexible commitments, notably referring to exceptions in obligations. The analysis also reveals that 6 segments refer to trade sanctions, graduated constraints, or mandatory deadlines, while 5 segments refer to assistance measures. In view of these results, we perform a weighted dichotomization. Given the significant imbalance between positive segments (n = 38) and negative segments (n = 8) for the first category, but also observable in the second category, which has more positive segments (n = 6) than negative segments (n = 5), the protocol then counts half a point in each category. The discrepancy between positive and negative segments suggests a slight predominance of restrictive measures, although assistance mechanisms are also present. These do not, however, reveal procedural flexibility, but only an accompanying mechanism that does not exclude legal inflexibility. Therefore, we assign a score of 1 to the criterion "Binding Quality of Commitments" in the composition of the Success Index (see Table 6). Indeed, the majority of legal commitments under the Montreal Protocol are inflexible and binding, giving it a characteristic associated with the MEA considered here as "successful".

The calculation of these three characteristics, which make up the Success Index, enables us to attribute a positive score to the Montreal Protocol, bringing together all the components of a "successful" MEA as we have defined it. The measures established by the Montreal Protocol demonstrate a real trend towards innovation and constraint in regulating ODS. The notion of Compliance Theory (Chayes & Handler Chayes, 1993), according to which compliance with commitments by states depends not only on the presence of effective control mechanisms and sanctions, but also on international normative pressure, legitimizes the calculation of the "success" of the Montreal Protocol.

	Segments (Positive and Negative)	Dichotomization	Assigned Points
Number of States Signatories	198 signatory states	198 > 130	1 point
Ambition of the Treaty's Measures	18 positive segments 1 negative segment	18 > 1	0,5 point
	6 positive segments 0 negative segments	6 > 0	0,5 point
Binding Quality of Commitments	38 positive segments 8 negative segments	38 > 8	0,5 point
	6 positive segments 5 negative segments	6 > 5	0,5 point
Total			3/3
Success Index Value			1

Table 6. Summary of Success Index Coding and Scoring

iii. Triangulation and Discussion

The results of coding the selected documents show that the Montreal Protocol meets all the criteria for Strategic Compatibility with U.S. interests, as well as those established to identify a "successful" treaty. It combines near-universal ratification, a high degree of legal constraint, and ambitious commitments from a scientific point of view, while being compatible with U.S. sectoral and economic interests. To confirm the validity of this trend observed by the indices constructed, we seek to compare different theoretical contributions to validate or qualify the interpretation of these scores.

First of all, the trend towards strategic compatibility observed, is also supported by various academic and scientific works, asserting that the benefits these measures represented for the U.S. (over $3,000 billion), far outweighed the costs involved (approximately $20 billion) (Sunstein, 2006, P.15). It is first important to consider the public health implications of these process changes, which prevented 443 million cases of skin cancer and 2.3 million deaths from skin cancer between 1890 and 2100 (EPA, 2020). In a realistic reading, where

economic motivations appear to be more influential than societal ones, it is important to point out that the Protocol measures involved an estimated $4.2 trillion in public health-related economic benefit for the U.S. over the period 1990 to 2165 (EPA, 2007, P.13). In addition, some major U.S. firms, such as DuPont, argued for strict rules during the Protocol negotiations, as they had invested heavily in Research & Development (R&D) for the production of ODS substitutes (Epstein et al., 2014). The conclusion of the Montreal Protocol therefore truly served U.S. interests, giving them a significant place in the dominance of substitute markets. These interpretations are also supported by the words of Jean-Frédéric Morin, a specialist in international environmental law interviewed as part of this research, who asserts that U.S. firms are the ones that have largely benefited from the implementation of this protocol (Morin, personal communication, 2025).

Moreover, the Montreal Protocol's tendency to meet the criteria of a "successful" treaty is also supported by various scientific and academic works. The specialist Jean-Frédéric Morin argues that the Protocol is the result of scientific activism (ibid.), which justifies and supports the observed trend towards the formulation of clear and innovative quantified measures. According to him, the high number of signatory states, as we have interpreted it, is a clear criterion of its success, representative of its ability to have "evolved over time" (ibid. [*translated by the author]).* Moreover, according to this specialist, the Protocol's trade clauses constitute its real success, as they have created a real incentive effect, its attractiveness deriving from the commercial exclusion imposed by its measures. These trade clauses, clearly identified in our coding as binding measures, are identified by Jean-Frédéric Morin as the main elements of its attractiveness. Excluding non-parties from trade has generated a powerful incentive effect, particularly for developing countries (ibid.). This observation is also shared by international environmental law specialist Sébastien Duyck, for whom economic constraint is one of the few effective levers in the face of states' reluctance to limit their sovereignty in environmental matters (Duyck, personal communication, 2025). These analyses confirm the idea that the success of the Montreal Protocol rests on the legal quality of its commitments. This reading of the Montreal Protocol's "success" can, however, be qualified by other analytical approaches. Indeed, Eugénie Dugoua points out that the Protocol's measures were originally of low ambition (Dugoua, 2021). In her view, the treaty's success lies less in the strength of its initial objectives than in its ability to generate progressive technical innovations through constraint. This divergence highlights the extent to which definitions of ambition and success are subject

to subjective interpretation and can vary according to the analytical framework adopted. However, the approach adopted here is built more around the consideration of clear, quantified scientific measures as a characteristic of a successful treaty, rather than the progressive dimension of such measures. On the other hand, the protocol has been able to evolve thanks to a legal architecture conducive to progressive technological innovation (Dugoua, 2021), and this observation is widely accepted among researchers and supports our results, testifying to its ability to articulate incentive-based commercial constraints and binding scientific objectives.

The triangulation carried out here, based on expert interviews and secondary sources supports the results obtained through coding, as well as the sub-hypotheses formulated within the framework of this study. On the one hand, it confirms that the Montreal Protocol has the characteristics of an institutionally "successful" treaty, and on the other, that it is strategically compatible with U.S. interests.

b. Kyoto Protocol

The Kyoto Protocol is an additional MEA to the United Nations Framework Convention on Climate Change. It was signed on December 11, 1997, and came into force on February 16, 2005. It has now been ratified by 192 parties (UNTC, 2025), including the different legal values linking states to the protocol (Ratification, Accession, Acceptance, Approval, and Succession). Of particular note is the absence of the U.S., which signed the text in 1998 but officially renounced ratification in 2001. This non-ratification, though politically significant, does not invalidate our analysis, insofar as the study focuses essentially on the design phase of the protocol, rather than on its national implementation. This protocol concerns the reduction of greenhouse gas (GHG) emissions, notably carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6), with high global warming potential (GWP). This Protocol aims to establish differentiated commitments, based on the principle of Common but Differentiated Responsibilities, to be achieved over the period 2008-2012. Although the protocol has undergone several changes, notably with the Doah amendment introducing a second commitment period between 2013 and 2020, we have chosen to focus on the initial

version of this protocol for the sake of brevity. The sub-hypothesis that the Kyoto Protocol is in part an "unsuccessful" treaty, and "incompatible" with U.S. strategic interests, seeks support here. To this end, we calculate the score of the various Kyoto Protocol indices, through the coding of different documents on MAXQDA. First, to calculate the score for its Strategic Compatibility with U.S. interests, we study a report published by the U.S. Energy Information Administration (EIA) in 1998, prepared for the Committee on Science U.S. House of Representatives. This report analyzes the potential economic and energy impacts of the Kyoto Protocol implementation on energy markets and the U.S. economy between 2008 and 2012. In addition, a 2008 report by the UNFCCC provides a detailed look at the institutional, legal, and technical mechanisms put in place to ensure the Protocol's implementation, monitoring, and compliance. These documents are technically neutral, allowing us to manually code the criteria that correspond to our different code lines. Finally, to calculate the Success Index of the Kyoto Protocol, we look at two different legal documents. Firstly, the official version of the Kyoto Protocol, as agreed in 1997, specifies the greenhouse gases concerned, the mechanisms for progressively reducing their emissions, as well as the monitoring, implementation, flexibility, and control mechanisms. It forms the legal basis of the Agreement. To study the Kyoto Protocol's compliance mechanisms, this study uses the first formal document adopted by the Conference of the Parties: Decision 27/CMP.1 of the Kyoto Protocol in 2005. This document is adopted by consensus and holds the operational authority within the regime. These four documents, selected for their analytical complementarity and institutional rigor, form the empirical basis for MAXQDA coding, from which we now proceed to calculate the two Kyoto Protocol evaluation indexes.

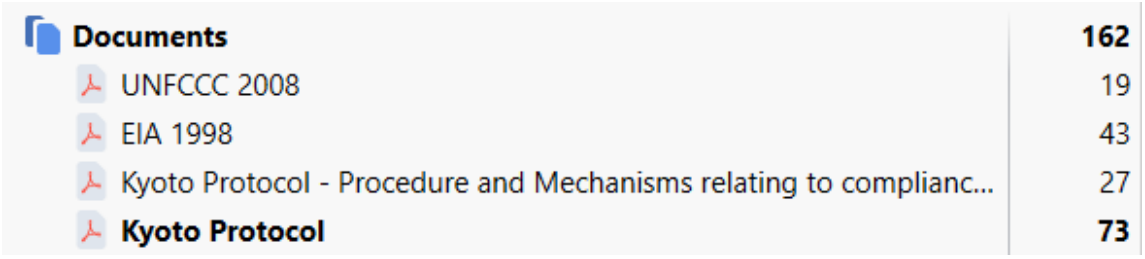

Figure 8. Distribution of Coded Segment by Source Document

i. Strategic Compatibility Index - Kyoto Protocol

To check whether our sub-hypotheses can be supported, we first seek to calculate the Strategic Compatibility Index of the Kyoto Protocol, which we have so far estimated to be negative, justifying the case selection. To support this sub-hypothesis, three characteristics are considered: the sectoral impact of the Protocol's measures, the availability of viable alternatives to the substances covered by the Protocol, and the cost of compliance for the U.S.. Each of these codes is not automated for these three indicators, as the segments that make them up may depend on an interpretation that cannot be identified by coding a recurrence of terms.

First of all, we analyze the U.S. sectors that could have been impacted by the protocol's measures. This makes it possible to observe whether these measures could have had a considerable impact on the major sectors, established here as agriculture, industry and transport, (WEF, 2022, p.26) or whether it was more the secondary sectors, understood as the other less strategic economic and societal sectors, that would have been impacted. To this end, the coding of selected documents enables an overall assessment of the sectors potentially affected. The reduction in CO_2 emissions could have affected many U.S. sectors, notably energy, which would have been the most affected (UNFCCC, 2008), but which is identified here as a secondary sector. However, this impact would have had serious consequences for certain energy-intensive U.S. industries, which would have had to reduce their production (EIA, 1998). According to the EIA's predictions, the industrial sector would have had to prepare for a slowdown in demand growth, as well as higher prices for goods and services, following the application of such measures. Most industrial processes would also have to be transformed (UNFCCC, 2008). Secondly, the transport sector would be particularly affected in these predictions, with a rise in the price of carbon, increasing the cost of rail transport, making Western coal less competitive (EIA, 1998). Transportation would have been the biggest target for U.S. emissions reductions, being the most oil-intensive sector in the U.S.. The reports also note that the agricultural sector could have been affected by these measures, being a particularly methane-emitting sector (UNFCCC, 2008). Finally, many other secondary sectors would have been affected, such as waste management and solvent use (ibid.). All the occurrences, positive and negative, identified for each document are summarized in the coding table below.

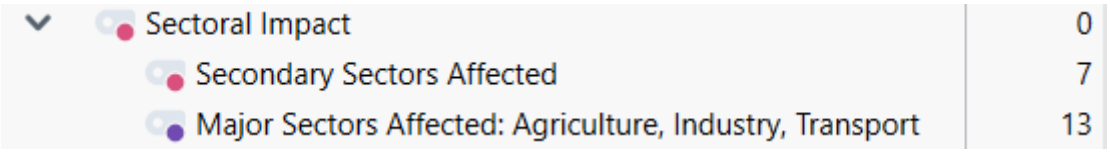

Figure 9. Distribution of Coded Segment by Sectoral Impact

We can therefore see that 13 segments in these documents refer to potential major sectoral impacts. We also note that 7 segments refer to potential impacts on secondary sectors. The two documents converge on this conclusion, recognizing significant effects on all sectors of U.S. activity, mainly threatening transport and domestic industry, but also secondary sectors. We therefore perform a weighted dichotomization. Given the significant imbalance between negative segments (n = 13) and positive segments (n = 7), we establish that the Kyoto Protocol scores zero points for the strategic compatibility of its sectoral impact with U.S. interests (See Table 7). In fact, in addition to the fact that the major sectors are the first victims of the application of these measures, the protocol could have affected all forms of activity in the country, thus compromising U.S. interests.

Secondly, a technological and industrial analysis of the alternatives available at the time the agreement was signed is carried out. Generally speaking, the documents analyzed suggest that it is unlikely that technological alternatives will be able to penetrate sufficiently to avoid the use of these high GWP gases over the period 2008-2012 (EIA, 1998). In particular, the difficult adaptation of the industrial sector is asserted, mentioning that emissions are structural to its activity, and that it therefore appears difficult to replace or simply reduce the use of these gases without direct loss (EIA, 1998). The EIA report sets out various scenarios, according to which ambitious reductions could only be achieved through technological breakthroughs, thus assuming that the reduction implied by such measures is difficult for U.S. industries to circumvent. The likely shock of implementing such measures seems likely to be reduced by the development of nuclear power plants, although this alternative will not cover the short-term efforts of the Kyoto measures (ibid.). Renewable energies, natural gas and nuclear power seem to be the only conceivable alternatives, although they do not have the capacity to replace significant quantities of coal over the 2008-2012 period (ibid., P.5). Finally, the analysis in the UNFCCC report does not mention any technological alternatives to the gases covered by the Protocol, even though it was published a decade after the Protocol's conclusion. The absence of any mention of alternatives suggests that these emissions were considered difficult to replace, and that

reducing their use was essentially based on a direct reduction in emissions, with no support from substitute technologies. All occurrences, positive and negative, for each document are summarized in the coding table below.

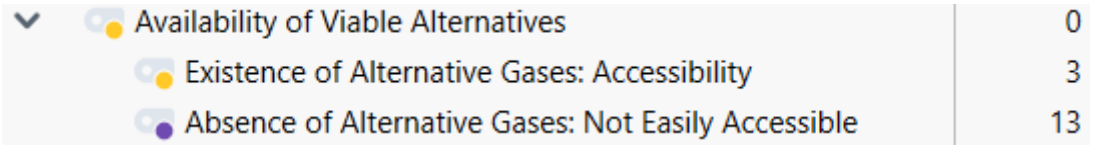

Figure 10. Distribution of Coded Segment by Availability of Viable Alternatives

We note that 3 occurrences refer to the existence of accessible alternatives to the gases regulated by the Kyoto Protocol. Conversely, 13 segments refer to the absence of alternatives or their limited access, depending on the context of use. Overall, the documents studied converge on the observation that technical availability is very low, while mentioning certain alternatives that may not be sufficient to compensate for the efforts required. We therefore perform a weighted dichotomization. Given the significant imbalance between positive segments (n = 3) and negative segments (n = 13), we assign a score of 0 to the criterion "Availability of Viable Alternatives" in the composition of the Strategic Compatibility Index (see Table 7). Indeed, the weak and unviable availability of methods to compensate for the reductions imposed by the protocol does not guarantee the protection of significant disruptions to U.S. business, contributing to the incompatibility of this protocol with U.S. interests.

Finally, the costs of adapting to the Protocol's measures are assessed, whether in terms of replacement gas prices or the investment required to transform production structures. The scenarios drawn up by EIA suggest that, if economic growth increases after the potential adoption of the Kyoto Protocol, energy demand will be greater, and the price of carbon will have to be higher. According to this hypothesis, growth will make the potential consequences of the Protocol more violent for the U.S. economy, since an energy-intensive economy will be more costly (EIA, 1998). Moreover, if technological progress can reduce the costs of reducing emissions, it must be rapid, as a slow transition will be more difficult and more costly for the U.S. economy (ibid.). What's more, rising energy prices would force companies to modify their production processes, entailing restructuring costs. Potential Gross Domestic Product (GDP) is thus reduced by compliance constraints (ibid., P.16). Lastly, the Protocol's

economic flexibility measures nonetheless make it possible to reduce adaptation costs by relocating efforts (UNFCCC, 2008), explaining some of the evidence of low adaptation costs. The coding table below summarizes all positive and negative occurrences for each document.

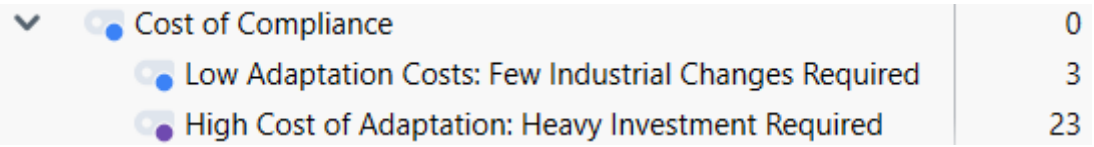

Figure 11. Distribution of Coded Segment by Cost of Compliance

We note that 3 occurrences refer to low adaptation costs. Conversely, 23 segments refer to high costs that could be generated by adaptation, including corporate restructuring and heavy investment, slowing down potential U.S. economic growth. Although negative segments are by far the majority, the presence of positive segments invites us to qualify the analysis by taking into account the economic flexibility proposed by the Kyoto Protocol. Overall, the documents studied converge on the observation that adaptation is relatively costly, while highlighting avoidance mechanisms. In light of these results, we have carried out a weighted dichotomization. Given the significant imbalance between positive segments (n = 3) and negative segments (n = 23), we assign a score of 0 to the criterion "Cost of Compliance" in the composition of the Strategic Compatibility Index (see Table 7). Indeed, the predominantly high costs likely to be generated by these regulatory changes contribute to the incompatibility of this protocol with U.S. interests.

The calculation of these three characteristics, which make up the Strategic Compatibility Index, enables us to assign a negative score to the Kyoto Protocol, which is structurally incompatible with U.S. strategic interests. The measures set out in the Kyoto Protocol have the potential to have an important impact on major sectors of the U.S. economy, without there being any viable alternatives to offset the efforts required or to avoid the heavy investment needed for adaptation. Indeed, the notion of Institutional Fit (Young, 2002), which measures the compatibility of a treaty with the strategic interests and institutional framework of the States Parties, enables us to legitimize the calculation of this negative strategic compatibility. In addition, the sub-hypothesis that the Kyoto Protocol is incompatible with U.S. interests is now supported, allowing us to deconstruct the biased aspect of case selection.

	Segments (Positive and Negative)	Dichotomization	Assigned Points
Sectoral Impact	7 positive segments 13 negative segments	7 < 13	0 point
Availability of Alternatives	3 positive segments 13 negative segments	3 < 13	0 point
Cost of Compliance	3 positive segments 23 negative segments	3 < 23	0 point
Total			0/3
Strategic Compatibility Index Value			0

Table 7. Summary of Strategic Compatibility Index Coding and Scoring

ii. Success Index - Kyoto Protocol

Then, to test our general hypothesis, we now seek to calculate the Success Index of the Kyoto Protocol. To support the sub-hypothesis that the Kyoto Protocol is "unsuccessful", three characteristics are considered: the number of signatory states, the ambition of the Protocol's measures, and its binding dimension. The first characteristic, being purely quantitative, is not coded and evaluated as such. The segments concerning the ambition of the measures are not coded automatically, as they depend on an interpretation that cannot be identified by coding a recurrence of terms. However, the binding dimension of the measures is partly coded automatically, around the recurrence of the term "Party/ies shall", but also manually according to the existence of control and monitoring mechanisms.

First of all, to assess whether the Kyoto Protocol meets the first criterion of a "successful" international agreement, i.e., broad ratification, we rely on the number of States Parties that have signed up to the Protocol. To do this, we adopt a longitudinal approach, examining the evolution of the number of ratifications over time, using the most recent official reports. This perspective enables us to better appreciate the Protocol's capacity to generate growing and lasting adherence, an essential indicator of its normative legitimacy. It had 189 ratifications when it came into force in 2005 (UN, 2005), and 192 parties in May 2025 (UNTC, 2025). This figure includes all the legal forms of accession recognized by international law (Ratification, Accession, Acceptance, Approval, Succession, and

Provisional Application). As previously established, an MEA is considered widely ratified if the number of States Parties is greater than two-thirds of the sovereign states recognized on the international scene, i.e. greater than 130 out of 195 recognized states (UN, 2025), as it represents the minimum threshold for generating a strong normative effect (Koremenos et al., 2001). The Kyoto Protocol far exceeds this threshold and is therefore awarded a point for this criterion. It is important to note, however, that it took a relatively long time for the Protocol to come into force, since it was not effective until 2005, seven years after its adoption in December 1997. This delay can be explained by the double condition necessary for its activation: ratification by at least 55 states, representing at least 55% of the GHG emissions of Annex I industrialized countries (UN, 1998). Furthermore, although the U.S. non-ratification constituted a significant political event, it does not in itself invalidate the analysis of the normative conception of the agreement, which does not focus on the modalities of its concrete implementation. Nonetheless, the absence of such an actor necessarily calls into question the effective scope of the scheme and invites us to qualify the degree of its universality. However, for this evaluation, we consider that the threshold of majority support has been reached, which justifies awarding one point for the criterion of broad ratification. Nevertheless, it is important to point out this limitation of the analysis. The methodological choice of adopting a longitudinal perspective, focusing on the progression of the number of ratifications over time rather than just on the initial presence of certain key states, is certainly debatable. Nevertheless, this approach enables us to better grasp the Protocol's capacity to generate a broad and growing normative consensus, which is in itself a significant indicator of institutional success.

Secondly, to establish whether the Kyoto Protocol's measures involve scientific and legal innovations or not, a linear analysis of the Protocol is carried out, and the analysis of ambition is divided into two categories. Firstly, in general terms, certain objectives of the Protocol are clearly quantified, such as the reduction of at least 5% of emissions compared with 1990 levels, for Annex I countries (UN, 1998, Article 3.1). However, innovative measures of this kind are rarely found in the Protocol, and there is a great deal of room for interpretation in the formulation of commitments. Indeed, the Protocol lays down very few strict rules on initial quantification, and states that the reductions imposed by the Protocol must be "additional" (ibid., Article 12.5), with no further details. References to terms such as "appropriate adjustments" (ibid., Article 5.2), "appropriate reforms in relevant sectors" (ibid., Article 2), or "in accordance with its national circumstances" (ibid.) also leave the Parties

considerable room for interpretation. Moreover, the Protocol contains no explicit provision imposing an obligation to review the Protocol in the light of scientific advances. The articles on amendments and periodic revisions make no explicit reference to the integration of scientific knowledge in the revision process. The elements presented here illustrate the positive and negative types of coded segments, the recurrences of which are summarized in the table below.

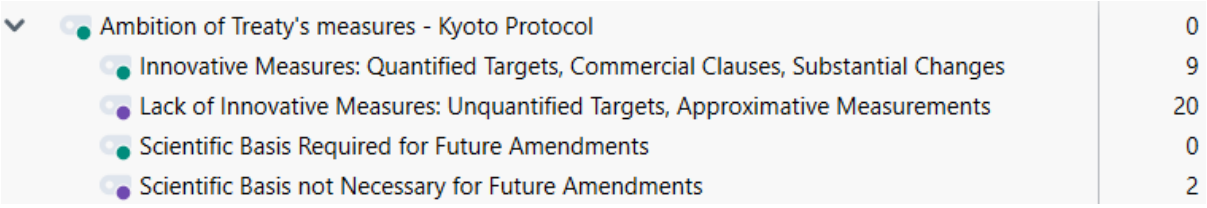

Figure 12. Distribution of Coded Segment by Ambition of Treaty's Measures

We note that 9 occurrences refer to innovative, quantified measures involving substantial changes. By contrast, 20 segments refer to unquantified and approximate measures. Moreover, the analysis also reveals that no occurrences refer to the need for scientific foundations in the future development of the protocol, and 2 segments identified testify to this absence of a scientific framework necessary for re-evaluation. We then perform a weighted dichotomization. Given the significant imbalance between positive segments (n = 9) and negative segments (n = 20) for the first category, but also observable in the second category, which has only negative segments (n = 2), the protocol scores zero points in each category. Therefore, we assign a score of 0 to the criterion "Ambition of Treaty's Measures" in the composition of the Success Index (see Table 8). Indeed, the Kyoto Protocol's unambitious and approximate measures give it a characteristic associated with MEA considered here as "unsuccessful".

Finally, to establish whether the Kyoto Protocol measures imply binding or non-binding commitments, a linear analysis of the protocol is carried out, and the analysis of constraints is divided into two categories: flexibility of commitments and procedural flexibility for the formulation of sanctions. Generally speaking, the documents analyzed contain 10 mentions of the words "Party/ies shall", so we can observe an existing but much less recurrent use of the imperative than in the Montreal Protocol. The Protocol also introduces three flexibility mechanisms: the Joint Implementation process (UN, 1998, Article 6), the Clean Development Mechanism (CDM) (ibid., Article 12), and the Emissions Trading

process (ibid., Article 17). These tools enable Annex I countries to meet their commitments while maximizing the profitability of emissions reductions. Moreover, there is a strong recurrence of references to exemptions, such as the possibility for transition countries to designate a different reference year (ibid., Article 3.5). However, we note the establishment of real monitoring, verification and reporting mechanisms, whose action nevertheless focuses mainly on controlling the transparency of the parties (UNFCCC, 2005, P.97). Furthermore, the functions of the Compliance Committee's facilitating arm, which can propose technical assistance, technology transfer or capacity-building measures, testify to a high degree of cooperative follow-up and procedural flexibility (ibid., P.93). Moreover, although consequences are provided for in the event of non-compliance, they are applied according to differentiated procedures adapted to national circumstances (ibid., P.95), and without recourse to coercive trade clauses (ibid., P.101). Sanctions, however, are internal to the scheme, such as suspension of access to the carbon market mechanism (ibid., P.102). These sanctions threatening withdrawal from the market are the only ones here that come closest to trade sanctions, and although they are coded as such, they do not represent the same constraint for the parties as more economic trade measures. The elements presented here illustrate the positive and negative types of coded segments, the recurrences of which are summarized in the table below.

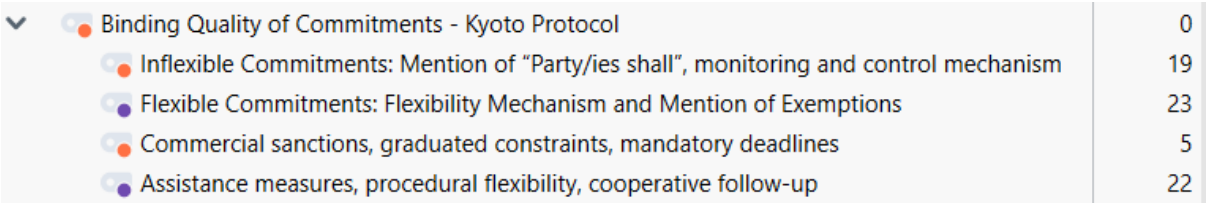

Figure 13. Distribution of Coded Segment by Binding Quality of Commitments

We note that 19 occurrences refer to monitoring and control mechanisms, or mention the term "Party/ies shall". On the other hand, 23 segments mention flexible commitments, notably referring to flexibility mechanisms and exceptions in obligations. The analysis also reveals that 5 segments refer to trade sanctions, graduated constraints, or mandatory deadlines, while 22 segments refer to assistance measures. We therefore perform a weighted dichotomization. Given the significant imbalance between positive segments (n = 19) and negative segments (n = 23) for the first category, but also observable in the second category, which has more negative segments (n = 22) than positive segments (n = 5), the protocol has no points in either category. The difference between positive and negative segments in the

first category suggests a slight predominance of flexible commitments, although control mechanisms are also present. These do not, however, reflect a strong legal constraint, as they are mainly based on controlling the transparency of the parties. Therefore, we assign a score of 0 to the criterion "Binding Quality of Commitments" in the composition of the Success Index (see Table 8). Indeed, the majority of legal commitments under the Kyoto Protocol are flexible and not very binding, giving it a characteristic associated with MEA considered here as "unsuccessful".

By calculating these three components of the Success Index, we can assign a negative score to the Kyoto Protocol, which has only one component of a "successful" MEA as we have defined it, and is therefore below the 3/3 threshold. The measures established by the Kyoto Protocol show a real tendency to establish vague measures that leave room for interpretative bias, and are more incentive than constraint. Indeed, the notion of Compliance Theory (Chayes & Handler Chayes, 1993), according to which compliance with commitments by states depends not only on the presence of effective control mechanisms and sanctions, but also on international normative pressure, legitimizes the attribution of the "unsuccessful" criterion to the Kyoto Protocol.

	Segments (Positive and Negative)	Dichotomization	Assigned Points
Number of States Signatories	192 signatory states	192 > 130	1 point
Ambition of the Treaty's Measures	9 positive segments 20 negative segments	9 < 20	0 point
	0 positive segments 2 negative segments	0 < 2	0 point
Binding Quality of Commitments	19 positive segments 23 negative segments	19 < 23	0 point
	5 positive segments 22 negative segments	5 < 22	0 point
Total			1/3
Success Index Value			0

Table 8. Summary of Success Index Coding and Scoring

iii. Triangulation and Discussion

The results of coding the selected documents show that the Kyoto Protocol meets none of the criteria for Strategic Compatibility with U.S. interests, and only one criterion for a "successful" MEA. While it combines near-universal ratification, it imposes weak legal constraints and scientifically unambitious commitments. It also appears to be structurally incompatible with U.S. sectoral and economic interests. To confirm the validity of this trend observed by the indices constructed, we seek to compare different theoretical contributions to validate or qualify the interpretation of these scores.

First of all, the incompatibility of the Kyoto Protocol measures with the strategic interests of the U.S. is also supported in various academic works. Indeed, one of the reasons why the Protocol was not ratified by the U.S. was that the U.S. Senate opposed it, perceiving the economic cost as excessive and not very binding for developing countries (Sunstein, 2006). The U.S. perception of the Protocol as a threat to its interests was particularly based on the fact that China and India were not expected to meet the same emission reduction targets (Depledge, 2005). It was thus perceived as inflicting costly and unequal reductions on the States Parties, without guaranteeing the fulfillment of U.S. interests (Sunstein, 2006). We therefore understand that the negotiation of the Protocol's measures was structurally at odds with U.S. political and economic priorities. A structural divergence in U.S. climate policy can be observed in these negotiations: while the European Union is particularly committed to reducing emissions in favor of reducing climate change, the U.S. is focusing more on adaptation (Steurer, 2003). This orientation reflects domestic economic and political concerns for a hegemonic country whose economic competitiveness cannot afford to be limited in its GHG emissions.

Moreover, the Kyoto Protocol's tendency to propose measures that are neither ambitious nor binding is also supported by various academic studies. The undisputed weight of the U.S. in the Protocol negotiations has greatly influenced these two dimensions (Depledge, 2005), even though the U.S. Senate did not allow the Protocol to be signed. Indeed, this is what international environmental law specialist Jean-Frédéric Morin maintains, asserting that although it could not ratify it, it was the U.S. executive that negotiated the protocol and influenced these measures (Morin, personal communication, 2025). Concerning the ambition of these measures, the work of Ugo Mattei (2024) affirms the tendency of

international environmental law to subordinate the law to the interests of the economy, "making it favorable to the market, reducing ecology to the simplistic metric of CO_2 emissions" (Mattei, 2024). This simplification of objectives is predominant in the Kyoto Protocol measures, supporting our analysis, which qualifies these measures as unambitious. Moreover, the observation that the Kyoto Protocol relies more on incentives than binding obligations is corroborated by international environmental law specialist Sébastien Duyck, who argues that the Protocol's core legal commitment is to ensure transparency (Duyck, personal communication, 2025). This reflects a legal architecture designed less to enforce rules through sanctions than to promote them through accountability and peer review, to preserve state sovereignty and encourage participation. However, the reduction commitments of the parties involved are not binding in themselves, as Jean-Frédéric Morin asserts when he states that it "costs nothing to be a member" (Morin, personal communication, 2025 [*translated by the author]*). However, this reading of the Kyoto Protocol's lack of strong constraints and ambition can be qualified by other analytical approaches. Indeed, Sébastien Duyck points out that the potential exclusion from the carbon market as a sanction is particularly encouraging, since, in his view, it represents a real commercial constraint through participation. In his view, the Kyoto Protocol is therefore particularly restrictive. This divergence underlines the extent to which the definition of the notion of constraints can be subject to subjective interpretation. However, although the approach adopted here recognizes carbon market exclusions as trade-restricting measures, it also takes into account that they do not have the same economic consequences for the States Parties. The interpretation of the latter as having a strong binding power is therefore highly nuanced. On the other hand, the fact that the Protocol is mainly based on transparency obligations, with few effective material sanctions, is widely accepted by researchers.

The triangulation carried out here, based on expert interviews and secondary sources, supports the results obtained through coding, as well as the sub-hypotheses formulated within the framework of this study. On the one hand, it confirms that the Kyoto Protocol has the characteristics of a treaty that is incompatible with U.S. interests, and on the other, that it is largely limited in terms of scientific ambition and legal constraint.

2. Comparison

The next step is to carry out a comparative analysis of the two selected protocols, which can then be built on the clear establishment of the different scores of the predefined indices. We therefore recall the question at the heart of this research: *To what extent does the compatibility between the measures provided by an MEA and the strategic interests of hegemonic states explain the variation in the success of its development?* To answer this question, we seek to verify whether the hypothesis that the "success" of a MEA (Y) depends on the "compatibility" of its provisions with the strategic interests of hegemonic states (X), is supported or refuted by the results of this comparative analysis of the "success" of the Montreal Protocol and the Kyoto Protocol, and the "compatibility" of the latter with U.S. interests. Below are the scores for each of the indices calculated and attributed to the two Protocols.

Protocols	Sectoral Impact	Availability of Alternatives	Cost of Compliance	Total Score	Position in the Strategic Compatibility Index
Montreal Protocol	1	1	1	3/3	**Compatible = 1**
Kyoto Protocol	0	0	0	0/3	**Incompatible = 0**

Table 9. Comparative assessment of the compatibility criteria of the Montreal and Kyoto Protocols using the Strategic Compatibility Index

Protocols	High Level of Ratification	Ambitious Treaty Measures	Clear Legal Constraints	Total Score	Position in the Success Index
Montreal Protocol	1	1	1	3/3	**Successful = 1**
Kyoto Protocol	1	0	0	1/3	**Unsuccessful = 0**

Table 10. Comparative assessment of the success criteria of the Montreal and Kyoto Protocols using the Success Index

Our research shows that the Montreal Protocol is a particularly "successful" MEA in terms of its scientific ambition and legal constraints, and that it is also particularly "compatible" with U.S. interests. Conversely, the Kyoto Protocol, which is particularly "incompatible" with U.S. interests, is a treaty that we describe here as "unsuccessful", as it does not correspond to the criteria of scientific ambition and legal constraint previously established as determining the "success" of an MEA. Indeed, if we compare the measures of each of these protocols in more detail, we observe a structural divergence in their objectives. First of all, the Montreal Protocol mainly impacts the secondary sectors of the U.S. economy, which have to adapt their industrial processes, whereas the sectors impacted by the Kyoto Protocol are particularly important in U.S. industries, and should slow down their activity to match the emissions reduction expectations formulated by the protocol. The sectoral impact of these two protocols is therefore structurally different, and suggests that legally binding commitments in these two protocols would not compromise U.S. economic activity in the same way. What's more, the existence of accessible alternatives to the substances restricted by the Montreal Protocol makes the legal commitment less compromising for U.S. businesses, which will be able to operate without compromising their profits, and at low cost. Conversely, the general reduction in GHGs implied by the Kyoto Protocol makes it impossible, or very difficult, to maintain the same level of activity, due to the limited availability of alternatives and the high costs of adaptation. A strong legal commitment implied by these measures would therefore have been particularly compelling for the U.S..

To provide theoretical explanations for this empirical evidence, we analyze our results in the light of concepts developed in various academic works. Firstly, in line with Rational Design Theory (Koremenos et al., 2001), which postulates that states design international institutions strategically according to their national preferences, the analysis of these two protocols enables us to empirically link the degree of strategic compatibility of a treaty with its institutional structure. This leads us to believe that the structural differences between the Montreal Protocol and the Kyoto Protocol cannot be understood in isolation from U.S. interests. This reading is reinforced by the concept of Institutional Fit (Young, 2002), according to which the success of an MEA depends on its alignment with institutional structures and stakeholder interests. In this respect, the two protocols studied illustrate this logic in contrasting ways. The Montreal Protocol, identified as "successful", presents a high level of institutional fit with U.S. preferences and capacity. These factors facilitated both its scientific ambition and its legal constraint. By contrast, the Kyoto Protocol, identified as

“unsuccessful”, reflects a low level of institutional fit with its priorities. Its economic implications placed it in structural tension with U.S. preferences and capabilities. This discrepancy explains both the lack of ambition and constraint in the formulation of the protocol’s measures (which are the result of negotiations largely influenced by the U.S.) and the latter’s withdrawal in the face of commitments that are nonetheless perceived as too costly.

Indeed, this structural discrepancy helps to explain the difference in the wording of the measures between the two protocols. Whereas the Montreal Protocol is based on ambitious and progressive bans, the Kyoto Protocol establishes 3 flexibility mechanisms, making it easier for stakeholders to adhere to them by minimizing their compliance costs. As specialist Jean-Frédéric Morin argues, the Kyoto Protocol’s flexible, unambitious measures are representative of negotiation processes strongly influenced by the U.S. (Morin, personal communication, 2025). Indeed, U.S. strategy during these negotiations is influenced by internal pressure from Congress and powerful interest groups, strongly opposed to binding commitments without equivalent participation from developing countries (Depledge, 2005). The U.S. thus appears to have steered negotiations towards flexible procedural structures and broad treaty implementation modalities, to limit the potential binding implications in the event of ratification, illustrating how the interests of hegemonic states can shape global regulatory frameworks and limit their ambition (Lazarus, 2022). Conversely, the Montreal Protocol, which reflects a high level of Institutional Fit (Young, 2002), involves commercial incentive clauses and becomes a “climate club” (Morin, personal communication, 2025 [*translated by the author)*, in which participation is more advantageous than withdrawal, particularly from a commercial and technological point of view. The high level of ambition achieved by this agreement thus seems to have been made possible by its structural compatibility with U.S. interests, in a context where strong legal constraints were not perceived as incompatible with their economic priorities. In other words, when the objectives and instruments of a treaty are not in direct tension with U.S. interests, normative ambition can be sustained and even reinforced.

The low success score attributed to the Kyoto Protocol, compared with the Montreal Protocol, therefore seems to provide an explanatory framework consistent with the gap observed in their respective levels of strategic compatibility. These observations thus explain the formulation of unambitious and binding targets for the Kyoto Protocol, for which

negotiations were largely influenced by the U.S., before the latter officially withdrew from the Protocol's implementation. The U.S. interest in avoiding measures that are too scientifically ambitious and legally binding, given their potential economic costs, is evident here. Given the theoretical explanations and the results obtained, we can confirm that the hypothesis formulated is supported by the observation of the expected link. Indeed, we did not observe that an MEA "incompatible" with U.S. interests possessed the three characteristics of a "successful" treaty. This allows us to affirm that the hypothesis we formulated is supported, recognizing that, despite the use of the MSD, which sets aside the majority of other characteristics with explanatory potential, certain factors other than strategic compatibility may influence the success of a protocol. Indeed, we cannot assert that there are no other moderating variables, such as international governance or the influence of various lobbies, that could explain success. As our study only compares two specific protocols, it cannot be used on its own to establish a direct causal relationship. Indeed, the relationship identified here must be understood as a plausible but non-exclusive causality, which merits further study, notably through research designs extended to other cases. Nor can we exclude the possibility of contextual coincidence.

However, we can affirm the validity of the observation of a trend verified in this MSD-controlled environment: if the objectives of a treaty are incompatible with the interests of the U.S. as a hegemonic actor, then the probability that it will result in the formulation of scientifically ambitious and legally binding objectives decreases. This theoretical relationship is confirmed empirically in our comparison. We can therefore underline the decisive importance of integrating strategic interests in the contemporary analysis of *climate regimes*. The latter, despite the unprecedented environmental urgency surrounding them, appear to be shaped more by geopolitical dynamics and power relations than by strictly scientific imperatives, thus revealing the structural obstacles weighing on the ambition and constraint of MEAs. In this respect, these findings also resonate with broader debates on the implementation of MEAs, where issues of compliance, enforcement, financial commitments and technology transfer remain central. The divergence observed between the Montreal and Kyoto Protocols reflects enduring challenges such as the contested role of flexibility mechanisms, and the continuing asymmetries between developed and developing countries in formulating their commitments. Understanding strategic compatibility thus not only sheds light on negotiation outcomes but also offers valuable insights into the practical pathways and obstacles that shape the long-term effectiveness of environmental treaties, as well as their

capacity to contribute meaningfully to slowing global warming. By fostering a closer analytical dialogue between the Success Index, the Strategic Compatibilit Index and the neo-institutionalist perspective, we can better explain how institutional structures channel states interested into specific commitments designs. This approach underscores the importance of robust, well-aligned institutions in enbalnig cooperation, sustaining ambition, and ensuring that treaty provisions are both politically feasible and environlentally effective.

Chapitre 6 - Conclusion

The apparently paradoxical trend observed between the fragile ambition of international environmental law measures and the scientific recommendations for legislating to regulate the contemporary ecological crisis is clarified in the light of this analysis. This research reveals the underlying structures that condition the development of MEAs, revealing how the sovereign interests of states influence the development of international environmental law. We are thus in a position to formulate a well-founded answer to our initial questioning, observing a significant trend towards a positive influence of the compatibility between the provisions of an MEA and the strategic interests of hegemonic states such as the U.S. on the variation in the level of institutional success of these agreements. This comparative analysis of the Montreal Protocol and the Kyoto Protocol highlights the significant correlation between strategic compatibility and the success of an MEA. The Montreal Protocol, selected for its now verified strategic compatibility with U.S. interests, proved to meet all the criteria for a successful MEA, through its ambitious scientific and particularly legally binding measures. The opposite trend is observed for the Kyoto Protocol, selected for its now proven incompatibility with U.S. interests, which meets only one of these "success" criteria. This observation is unlikely to be coincidental, as the explanatory power of other potential factors is greatly reduced by the use of MSD. As both protocols are constituted in the same way under the UN framework, this difference in outcome is most likely explained by the difference in compatibility between the protocols. This analysis of the power of hegemonic states over the formation of international environmental law is significantly rooted in the neo-realist reading of international relations, according to which sovereign interests predominate over the interests of inter-state collaboration (Krasner, 1982). Here, the strategic interests of U.S. economic influence can be a real brake on the formation of ambitious and binding legal commitments, insofar as sovereign interests predominate over global environmental threats. The Kyoto Protocol's initial aspirations to reduce GHG emissions on a global scale are far more compromising for the U.S. than the Montreal Protocol's aspirations, which focus on substances whose replacement does not compromise any U.S. strategic axis.

We are witnessing the development of what we might call the “Compatibility Trade-Off Dilemma”. This preliminary conceptualization is offered as a working hypothesis and could benefit from further exploration and debate within the academic community. This notion aims to capture a structural tension in the design of MEAs. Indeed, to be compatible with the strategic interests of hegemonic states such as the U.S., the original aspirations of MEAs must not concern the reduction of gases and substances essential to U.S. economic or geopolitical influence, as is the case for the GHGs at the heart of the Kyoto Protocol. When the issues at stake in an MEA concern these sensitive sectors, the significant influence of the U.S., and certainly of other hegemonic states concerned, will tend to pressure for these commitments to be formulated flexibly. However, the more flexible an MEA’s measures are, the less likely these commitments are to be legally binding and scientifically ambitious. This dilemma highlights the significant gap that can emerge between the normative aspirations of an MEA, such as the desire to regulate substances and gases massively produced and integrated into the global economy, and the actual formulation of its legal provisions, which reflect the outcome of multi-party negotiations. While the desire to regulate the GHGs represents a major symbolic advance in international environmental law, it seems to come up against the structural limits imposed by the search for a strategic consensus. Conversely, the Montreal Protocol, while equally innovative in its original aspirations, appears to be a textbook case of institutional success, precisely because it does not involve a confrontation between its measures and the strategic interests of a hegemonic power like the U.S.. This concept, which is based on this particular study, is in line with a neo-realist approach to international relations, according to which states act first and foremost according to their sovereign interests, including in environmental regimes. However, it also mobilizes elements from neo-institutionalism, in particular Rational Design Theory (Koremenos et al., 2001), which postulates that the institutional form of treaties is the result of rational choices made by states according to anticipated constraints. The idea of a Compatibility Trade-Off Dilemma thus refers to a situation where the legal architecture of an MEA appears to be strategically adjusted to accommodate the sovereign interests of hegemonic states, at the cost of a partial weakening of its commitments. While this formulation remains exploratory, it raises questions that deserve closer examination and could open up fruitful avenues for future academic inquiry. This tension is also illuminated by the notion of Institutional Fit (Young, 2002) on which this analysis is built, which emphasizes that the institutional success of a treaty depends on its alignment with the institutional and strategic structures of the participating states. Finally, this research is also at the frontier of neo-institutionalism since it

recognizes the structuring role of legal regimes in shaping international environmental normative dynamics. It thus aims to deepen our understanding of these mechanisms by identifying the structural levers that underpin them, to contribute to a strengthening of the normative effectiveness of the *climate regime*.

In addition, it is important to acknowledge that this study presents certain methodological limitations that should be taken into account when interpreting the findings. Firstly, it does not claim to establish a direct causal link between the strategic compatibility of MEAs and their level of institutional success. Indeed, the comparison method used here, based on MSD, enables us to highlight interpretive regularities and correlated trends, but does not permit a formal causal inference. The reasoning is therefore based on analytical plausibility, i.e., interpretative consistency between the variables selected and the empirical results observed. Furthermore, the analysis is based on a limited number of cases, considering only two MEAs. While these cases were chosen because of their structural proximity and historical importance in international climate governance, they cannot be considered entirely representative of all MEAs. A robust generalization of the trend identified would require an extension of the comparative analysis to a wider corpus of treaties. Finally, the study pays particular attention to the U.S., considered here to symbolize the hegemonic actors. While this choice is legitimized by their central role in structuring environmental regimes (Depledge, 2005), it is possible that other dominant powers, such as China or the European Union, do not adopt the same strategic preferences or the same power of influence concerning the design of MEAs. These limitations call for interpretative caution as to the generalizability of this study's findings, and suggest avenues for future, broader comparative research. What's more, although the analysis is largely based on qualitative coding work, structured around deductive grids designed to objectify the evaluation of the two protocols, a subjective part of interpretation remains unavoidable. Indeed, despite the prior definition of criteria and the anchoring of each coding in precise contextual sources to ensure internal consistency, it is impossible to perfectly eliminate all potential interpretative biases. Most of the variables involve an analytical reading of the documents, and cannot be totally dissociated from the researcher's point of view. Although this subjectivity has largely been deconstructed and controlled by an ongoing reflexive process, it constitutes an inherent methodological limitation of the adapted approach. Furthermore, the empirical soundness of certain indicators can be questioned in the light of major political facts. In particular, the non-ratification of the Kyoto Protocol by the U.S. constitutes a politically significant element, likely to weaken the

effective scope of the agreement. Although this research focuses solely on the normative conception of the treaty, the absence of the U.S. nonetheless invites us to relativize the universal scope of the regime. This justifies the fact that, although the threshold of majority adherence is reached and the criterion of broad ratification is validated, this limit is indicated in the interpretation of the results.

Finally, several research perspectives and theoretical ideas emerge from this comparative analysis. Firstly, the analysis reveals a structural trend in the formation of the Montreal and Kyoto Protocols. The method used, based on a comparative coding of legal and scientific indicators, calls therefore for replication on a larger scale, providing a transferable analytical framework for other MEAs. This work aims to contribute to academic research in international environmental law, and in particular to enrich the literature on the prosperity of environmental regimes by proposing a composite definition of institutional "success", conceived as complementary to existing approaches. In this respect, for example, it follows on from the work of Jean-Frédéric Morin, who highlights the structuring role of certain trade provisions integrated into MEAs, as is the case in the Montreal Protocol, in explaining their success. These ideas open the way to a new empirical question: Is the institutional model of the Montreal Protocol an exception, or can it serve as a source of inspiration for the design of future climate treaties?

More fundamentally, this research invites a reconsideration of how international environmental law is developed. By identifying structural constraints arising from conflicts between a treaty's normative ambition and U.S. strategic interests, it proposes a more pragmatic reading of the conditions for the adoption and effectiveness of MEAs. It sheds light on institutional obstacles that may have limited the impact of agreements such as the Kyoto Protocol and offers conceptual tools for reinterpreting the architecture of contemporary agreements. We could indeed transpose this reflection to the Paris Agreement, whose institutional characteristics seem to present strong similarities with the dynamics that led to the qualification of the Kyoto Protocol as "unsuccessful". Although the Paris Agreement embodies a new institutional spirit, based on a bottom-up approach that seems to make sense for fairer and more proportionate investment by stakeholders, it nevertheless appears to perpetuate, in another form, institutional dynamics that are subordinate to sovereign interests (Bodansky, 2016). This observation calls for a re-examination of the dominant paradigms of international environmental law. By identifying its structural

limitations, this research provides a basis for analysis to strengthen the coherence and credibility of the international *climate regime* and to guide the design of future agreements that are commensurate with these challenges. The main contribution of this research lies in its effort to reconcile legal ambition and strategic viability, not by lowering standards, but by identifying the dominant levers that determine the form and future of environmental agreements. In doing so, it aims to contribute to the development of more effective, inclusive, and sustainable climate governance pathways based on a reconfiguration of the relationship between sovereign interests and ecological imperatives. The challenge is to move toward a collective recognition that protecting the global environment is, in itself, a universally shared national interest, even though it escapes traditional sovereign logic. This research therefore seeks to contribute to this awareness, in the hope of fueling the effort to deconstruct sovereignty and paving the way for multilateral environmental agreements commensurate with the contemporary ecological emergency.

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