

**Protecting the Ozone
Layer: an Institutional Perspective**

by

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Abstract

This paper is a tentative attempt to first have a literature review of current studies on the global environmental institutions. The focus is on the crucial variables and conditions for effective global institutions. These common elements identified serve as the variables studying institutions. In order to further understand these crucial elements, an institutional analysis of the institutions protecting the ozone layer examines these variable in a real context. Actors, incentive structure, monitoring and sanctioning, and multilevel and configurational nature of rules are important factors to consider.

Introduction

For the past few years, global environmental crises have caused deep concern of human being. Ozone layer depletion, global climate change, and population bomb are some of the prominent examples. Facing these global threats, nations with different interests finally agreed on several historical conventions, such as the Montreal Protocol for preventing ozone from depletion and the Framework Convention on Climate Change (FCCC) for stabilizing the emission of the greenhouse gases to the atmosphere. Trying to provide some policy suggestions, scholars strived to identify the crucial factors affecting the effectiveness² and robustness³ of

¹. I am indebted to Aseem Prakash for his thoughtful comments on the earlier draft. However, I did not successfully incorporate his valuable comments because of time constraint.

². According to Keohane, Haas, and Levy (1993, 7), an effective environmental institution is an institutions "would improve the quality of the global environment." However, since the quality of the global environment is very difficult to be measured or operationalized, the focus will be on "observable political effects of institutions rather than directly on environmental impact" (Keohane et al. 1993).

³. A robust institution is defined by Shepsle (1989, 143) as "an institution as essentially in equilibrium if changes transpired according to an ex ante plan for institutional change."

these institutions⁴.

This paper, with the same research interest, is aimed at identifying the crucial variables for designing an effective institutions by using the institutions safeguarding the ozone layer as an example. The ozone treaty is singled out for several reasons. First, the protection of the ozone layer is well recognized as the most successful case of international environmental cooperation. Thus, some elements contributing to robustness of ozone institutions can be drawn from this case. Second, it is an issue area where there is a sufficient long history for examination. The question of how institutions sustain over time may be answered. Finally, the study of the ozone treaty can shed some lights on the design of institutions dealing with climate change, one of the most severe environmental crises facing the human beings.

This paper starts with a discussion about some essential elements of the institutional perspective for studying the global commons. It follows by the analysis of the ozone treaty around four critical issues of forming and sustaining an effective institution. These four issues are uncertainty, conflict of interests, implementation, and collective action arrangements. Organizing these elements around different issue areas, we have a chance to rethink what insights these two groups of institutional studies can offer. In conclusion, some design principles for governing the global commons will be laid out.

An Institutional Perspective

The institutional perspective helps us examine the nature of institutional arrangements that protect the ozone layers. The focus here is not a theoretical comparison between different efforts of exploration. Nonetheless, the emphasis is on what lessons we can draw from different groups of studies on identifying the crucial

⁴. Cox (1992,137) defines institutions as "the broadly understood and accepted ways of organizing particular spheres of social actions -- .. for instance, ... the rules of international law, or formal organizations like the United Nations and....."

elements for robust institutions.

The analysis of this paper is guided by two relevant groups of institutional studies, namely the study of global environmental institutions, and the works on linking local and global commons. The study of the global environmental institutions, systematically examines how institutions affect the national behaviors to achieve specific environmental goals. The works on local commons and their linkage to global commons supply us with some conditions for robust international environmental institutions. Each group of study identifies some crucial elements for examining institutions. The common elements will be presented at the end of this session.

Institutionalism in International Relations

The theorists of international relations tried to answer the question: how institutions affect the international cooperation on the environment? A comprehensive study of the common elements for effective international environmental protection has been done by a group of scholars⁵. Some other literatures on international relations focus on the role that regimes and epistemic community play in improving the effectiveness of cooperation⁶.

Some of the important elements for robustness are identified by these theorists. First, the epistemic community plays an important role not only in collecting and disseminating information but also in forging consensus. These activities bring the issues to governments' attention. Second, the reduction of the monitoring and enforcement cost enhances the effectiveness of institutions. Third, building national capacity of implementation is also essential to improve the robustness of these conventions (Young 1992, 183). For instance, transferring technology and information to countries in need enhances nations' capacity (Levy et al. 1993, 407).

⁵. The group of scholars I am referring to are people participating in writing the book titled "Institutions for the Earth." This book is edited by Peter Haas, Robert Keohane and Marc Levy.

⁶. Leading figures are Peter Haas and Oran Young. Peter Haas (1992) has a exclusive study on how epistemic community facilitate the formation of the treaties protecting the ozone layer. Oran Young (1989) also has works on international environmental regime formation.

Fourth, appropriate collective-choice mechanisms are essential for institutions to sustain when they face disruption or change (Young 1992, 178). For instance, a stable membership is a source of robust collective-choice mechanisms. Moreover, the adaptability of the collective-choice mechanism to the change of environment is also essential. Finally, the distribution of power affects the effectiveness of institutions (Young 1992, 186). For instance, Young (1992, 187) asserts that the symmetry of power among actors helps the effectiveness of institutions but not the formation of institutions.

Linking Local and Global Commons

McGinnis and E. Ostrom (1993, 17) maintain that local and global commons are similar in terms of their substantive elements, underlying logical structure, and responses to the same impairing factors. Based on this assertion, they tried to see how the design principles for robust local CPR institutions can shed some lights on the governance of the global commons.

They reorganized eight design principles⁷ into five groups (McGinnis and E. Ostrom 1993, 32-58). First, clearly defined boundaries and actors. The primary lesson of this principle is that actors and boundaries of CPR institutions must be defined. A clear delineation of the resource boundary and actors reduces the degree of uncertainty associated with free-riding. Second, congruence among rules and with local conditions. This principle addresses the importance of both flexibility in crafting rules and variations in rules to fit into particular context. Moreover, the coherence between rules at different levels is also crucial for a robust institution. Third, collective action arrangements in self-organized and nested regime. All international regimes are multilevel and nested. To form a robust regime, collective action arrangements should include important actors at all levels and make

⁷. These design principles are (1) clearly defined boundaries (2) congruence between appropriation and provision rules and congruence between provision rules and local conditions (3) collective-choice agreements (4) monitoring (5) graduated sanctions (6) conflict resolution mechanisms (7) minimal recognition of rights to organize (8) nested enterprise (E. Ostrom 1990, 90).

sure that the aggregation of different level is consonant with the goal of the CPR regime.

Fourth, monitoring and sanctioning in international regimes. Enduring CPR institutions can be characterized by their low monitoring costs and low initial sanctions (Ostrom 1990, 94-100). Therefore, this design principle is to construct institutional arrangements that lower the costs of monitoring and enforcing. McGinnis and Ostrom's (1993, 42-48) categorization of monitors and actors engaging in sanctions provides policy analysts with a more precise analytical framework. Finally, contestation and conflict resolution. For a regime to sustain over a long period of time, mechanisms for resolving conflicts and contestation should be provided. These mechanisms should facilitate the conflict-resolution process in a low-cost way.

Common Lessons

These two groups of studies, originated at different levels (local and international), have our attentions on some important elements for designing a robust international institution. The first element is about actors. Actors should be clearly defined. In the international arena, actors are not only nations and international organizations but also the epistemic community and non-governmental organizations. Moreover, important actors should be included to form effective institutions. Second, the activities that give rise to transaction costs are crucial variables in analysis. Therefore, in designing robust institutions, we should try to identify activities that can lower the costs of information, monitoring, and enforcement⁸.

Finally, the design principles should address the configurational and multilevel nature of collective action arrangements. Institutions are composed of sets of rules. To achieve certain environmental goals, these rules should be designed in the way of lowering transaction costs; reducing the level of conflicts; maintaining high level of congruence with external

⁸. According to Matthew (1986), transaction cost is "the cost of arranging a contract ex ante and monitoring and enforcing it ex post" (Eggertsson 1990, 14).

environment and with rules at other levels. The study of institutions for protecting the ozone layer is an illustration of how these elements work to overcome the challenges for forming and sustaining effective institutions.

Four Challenges for Design

There are four major challenges for actors in striving to establish and maintain robust institutions: uncertainty, conflict of interests, implementation, and collective action arrangements. Through exploring the case of the Montreal Protocol (the convention aimed at protecting the ozone layer), we may understand what the important factors affecting the effectiveness of international environmental institutions are and in what way.

Uncertainty

There are usually two types of uncertainty associated with global environmental regimes: scientific uncertainty and uncertainty associated with implementation. Scientific uncertainty refers to the lack of scientific evidence on some assertions. For instance, there was no solid evidence on the depletion of the ozone layer at the early stage of study. Implementation uncertainty refers to any uncertainty associated with implementing an agreement. For instance, it is not clear that how domestic politics would affect the implementation of global treaties. Uncertainty, in the context of commons, often delays the time that necessary actions should be taken. Actors usually keep exploiting the common pool resources if there is a high degree of uncertainty about the consequences of their actions and viability of solutions to the environmental problems. The challenge for participants is to design an institution to speed up the appropriate responses to the common problems.

A. Sources of Uncertainty

First, scientific uncertainty. In the early 1980s, there was a high degree of scientific uncertainty about the existence and

extent of ozone layer depletion (Parson 1993, 31). In the later stage, there was scientific uncertainty about what chemicals could cause the ozone layer depletion. Although the degree of uncertainty has been reduced along with the findings of new evidence, there is always a certain degree of uncertainty because of the complexity of the atmosphere. Second, implementation uncertainty. Whether the control measures are viable and effective in term of achieving the environmental goal is constantly waited for periodical evaluation, given the temporal change and the spatial variations at the implementation stage.

B. Institutional Designs for Reducing the Degree of Uncertainty

1. Institutions for Collaborated Research and Channelling Information

At the early stage, the scientific uncertainty was reduced by some activities of institutions. Those activities are conducting joint researches on the potential ozone layer depletion and disseminating relevant information found from these researches. Before the Vienna Convention, the United Nations Environment Programme (UNEP) was the major institution that pooled research resources from different actors together and gave annual report to inform actors about the status of the ozone layer depletion. In 1977, the UNEP launched and coordinated an international cooperation on research on the science and impact of the ozone layer through the "Coordinating Committee on the Ozone Layer" (CCOL). The CCOL mobilized a constellation of institutions, ranging from UN agencies, national governments, and non-governmental organizations to join the research on the ozone layer.

The provision and channelling of information regarding the nature and status of the problem to various nations reduce the degree of uncertainty perceived by nations. The network of epistemic community plays an important role in channeling information to various national governments (Haas 1992, 188). Through this well established network, information is effectively disseminated and appropriately interpreted because the members of this community shared the same logic and beliefs. Therefore, the uncertainty perceived by nations was reduced because there was more

certainty in the extent of the ozone layer depletion and more information channelled to the nation states. The efforts of cooperation in research, transmission of information, and sharing technical expertise at the initial stage was further institutionalized in the Vienna Convention (Article 3-5), the first international agreement regarding the ozone layer depletion. The information-sharing has continued to reduce implementation uncertainty after the investigation of the extent of the ozone layer depletion was somewhat completed (Article 9 of the Montreal Protocol).

2. Institutionalization of Reiterative Mechanisms

The other major coping mechanism for uncertainty is a reiterative reviewing and negotiating process in response to new findings. This coping mechanism, a regular meeting or forum, is incorporated in the global agreements on the ozone layer. The main administrative body for the Vienna Convention, the Conference of Parties, met every two years. Having the same function, the Meeting of Parties to the Montreal Protocol (succeeding the Vienna Convention) is also the established forum for considering any new development. The Meeting of Parties holds annually, which further strengthens the ability of parties to respond timely to any change and new issue. This well-established forum is a responding mechanism of the institutions in adopting to any change.

The principle of reiterative review is also being utilized to deal with the uncertainty associated with compliance (Hurrell and Kingsbury 1992, 24). According to the Article 6 of the Montreal Protocol, the control measures should be reviewed at least every four years. Moreover, at least one year before the meeting, the four Panels of Experts covering scientific, technology, economic, and environmental effects assessment will review the control measures and submit recommendations to the Meeting of Parties. Moreover, an "Ad Hoc Working Group of Legal Experts on Non-Compliance Procedure" was established to manage the unpredictable situations occurred in implementation. This reiterative review is well informed by these supportive organs to the Meeting of Parties. A further examination of implementation will be addressed in the

later session.

Conflict of Interests

The salient issue of the ozone layer depletion requires nations to take aggressive actions to freeze or even phase out their production and consumption of CFCs (ozone depleting substances). Since the ozone layer is a common pool resource shared by all the nations, the North can not solve the problem without the cooperation of the South. However, on this matter, the North and the South have different perception of responsibility and interests. The challenge here is to find an arrangement perceived equitable and acceptable by each party, which is essential when unanimity is the rule of negotiation (Young 1989, 368).

A. The Source of Conflict

Facing the common threat, the North and the South recognized that some actions should be taken. In the case of negotiating the Montreal Protocol, the problem is not so much that these countries were lacking of good faith in solving the problem but on what constituted a fair distribution of burdens and benefits (Benedick 1991, 152). The conflict between the North and the South was along the line of controlling financial resources. The South protested against aggressive measures of controlling ozone-depleting substances by arguing that these measures create unfair burdens for them. The distribution of burden is fair, the countries in the South argued, only if there are funding covering all incremental costs, technology transfer, and grace period for compliance (Benedick 1991, 149-162). The South's concern of equity is acknowledged by the North. However, the control of the financial resources and the degree of technology transfer caused hot debate.

The position of the North was once strong on the their control over financial resource. United States, as the most resourceful actor, once renounced the principle of additionality⁹ (Benedick 1991, 156). Moreover, the debate about whether a multilateral fund

⁹. The principle of additionality means to provide developing countries with financial aid to cover the incremental costs of abating CFCs in addition to the current aid flow.

should be managed through the World Bank signifies the concern of the North about the degree of control they enjoy over the aid. The South advocated that a separated fund from current aid is necessary to guarantee the extra financial aid covering their incremental cost of compliance.

B. The Sources of Conflict Resolution

1. The Perceived Interdependence

The perceived interdependence between the North and the South is the prominent reason for them to resolve the conflict. The more interdependent between actors, the more likely they will resolve the conflicts. The degree of interdependence can be measured by the ability of actors to make a credible threat. Young (1992, 189) argues that the growing degree of interdependence enhances actors' ability of making credible threats. For instance, developing countries, China and India in particular, can make a credible threat by disregarding the terms set in the Montreal Protocol because the North's effort on cutting down CFCs will be offsetted by the South's realization of its potential use and production of CFCs.

To design an effective institution to resolve the conflict, policy makers should identify the types and the sources of interdependence. After identifying the sources of interdependence, institutional analysts should disseminate information about the degree and nature of interdependence among actors. By doing so, the level of perceived interdependence will increase. In turn, some conflicts may be quickly resolved due to the better understanding of interdependency and common interests.

2. Fair Distribution of Costs/Benefits and Duties/Rights

A robust international CPR regime not only allocates costs in proportional to the benefits but also matches duties with rights (McGinnis and Ostrom 1993, 32). The issue regarding the distribution of costs and benefits is usually regarded as the issue of fairness by actors. It is very difficult for different countries to reach an agreement on what constitutes fair in allocating financial burdens, particularly there is great discrepancy in financial and technological capability between countries in the

of this Protocol is not satisfactory. For instance, even one year after the London Revision to the Montreal Protocol, less than half parties submitted completed data of 1986, which is the baseline data for calculating the phasedown schedule (Bergesen et al. 1992, 164). The problem of reporting is more serious in parties of developing countries (UNEP/OzL.Pro.4/6, p.3).

B. Elements for Eliciting Compliance

1. National Capacity Building

National capacity building is aimed at helping laggard countries to keep up with the requirements of treaties. In the case of the Montreal Protocol, transferring technical, financial, and management expertise to countries in need builds the national capacity of implementing the treaty. The Interim Multilateral Ozone Fund, established in 1990, helps developing countries to cover their incremental costs to phasedown controlled substances (CFCs and other ozone hazard substances). Regarding the problem of reporting, regional workshops had been held to address the problems and solutions in meeting requirements (UNEP/OzL.Pro.4/6, p14). However, in transferring management expertise, a special attention should be given to the country-specific transaction technology (Eggertsson 1993, 16).

2. Monitoring

In a comprehensive investigation of institutions for the earth, Peter Haas, Robert Keohane, and Marc Levy (1993, 398) conclude that monitoring is far important activity than enforcement in ensuring the compliance. This is also true in the case of the Montreal Protocol. Compliance is monitored through three bodies: (1) consultation among Parties with the help of Secretariat; (2) the Executive Committee of the Multilateral Ozone Fund; and (3) the deliberation of the annual Meeting of Parties (Bergesen et al. 1992, 164). In general, each party is required to report the amount of export, import, and production of controlled substance to the Secretariat. For parties under article 5 of Montreal Protocol (developing countries), the Executive Committee of the Multilateral Fund indirectly monitors the compliances of parties through reviewing the plans prepared for application of the Multilateral

Ozone Fund¹².

3. Trade Sanction

Trade sanction against non-parties in the Montreal Protocol successfully induces compliance not only from parties but also from nonparties. Sanctioning mitigates the problem of free-riding and exists as potential threat to suckers. According to Article 4 of the Montreal Protocol (Benedick 1991, 245), parties shall put import ban on the controlled substance from nonparties. This sanction mechanism makes two nonparties, South Korea and Taiwan, automatically observe the terms set in the Montreal Protocol (Parson 1993, 56). In robust CPR institutions, sanctioning exists as a credible threat. However, no explicit way of sanctioning is embodied in the Montreal Protocol to sanction parties. The sanction is primarily used to against nonparties. This fact is in line with the minimal use of sanctioning among participants to institutions.

4. Incentive Structure

To elicit compliance, a well designed incentive structure works well. Since international organizations are very unlike to verify the country reports, the other effective way of eliciting compliance is to provide actors with adequate incentives for submitting the accurate data and for complying with the treaty. According to the institutional economists, incentives for actors to comply quasi-voluntarily can reduce the costs of both measurement and monitoring (Eggertsson 1993: 14). In the international arena, the forms of reward are usually prestige, credits, or valuable information. In the Montreal Protocol, financial and technical assistance provide developing countries with incentives to become parties. Giving incentives to information providers and removing barriers to actors responding to non-compliance are two other specific solutions to reporting or monitoring problems (Mitchell 1992, 386-400).

¹². For instance, in March 1993, China submitted a country programme for phasing out of ozone depleting substance to the Executive committee in order to be qualified for technical assistance and funding.

arrangement provides a forum to discuss on-going issues and to respond to new evidences available as promptly as possible. The inclusion of NGOs and major CFC producers in the decision-making processes avoids the potential conflict in interest and facilitates the negotiation process among nations.

3. Matching Rules with External Conditions and other Rules

The collective action arena resides in a nesting multiple level structure. For a robust regime, it should be able to maintain congruence between rules and various conditions at various levels (McGinnis and Ostrom 1993, 32). Given the temporal and spatial variations, maintaining high degree of flexibility is a major way of sustaining the congruence (McGinnis and Ostrom 1993, 32; Hurrell and Kingsbury 1992, 14). The parties to the Montreal Protocol agreed on the level of the cutback in their production and consumption of control substances but the ways of achieving the goal were left unregulated. By doing so, parties can fit the rules to local conditions better. The principle of flexibility is extremely important when there are great cultural, economic, and political differences between actors.

Conclusion

Two groups of studies offer fertile foundation for analyzing global environmental institutions. Theorists in the international relations study how institutions affect the effectiveness of achieving certain environmental goals. The studies of local commons provide us with design principles for governing global commons. Each group of works provides us with some equipments in facing four different challenges: uncertainty, conflict of interests, implementation, and collective action arrangements.

In dealing with scientific uncertainty, a framework convention approach helps not only raise national concerns and but also collect and spread up necessary information at lower cost. Uncertainty is best reduced by an iterative negotiation process. In the process of all negotiations, epistemic community plays an important role in providing nations with focused issues and

choices. Finding a perceived fair solution to the problem is the key to resolve the conflicts. Fair arrangements could be reached by matching the gains with the losses. By disseminating information about the costs and benefits of each nation, institutions can reduce the transaction cost.

The monitoring mechanism, coupled with financial aid and trade sanction, reduces the gap between the goal of the treaty and implementation. The whole sets of incentives elicit potential noncompliance to comply with the agreements. Maintaining a high degree of flexibility but keeping congruence between rules and conditions is the key to design an effective collective action arrangements. The other aspect of designing the collective action arrangements is to include relevant actors in the arrangement. This inclusion will facilitate the processes of negotiations and implementation.

In sum, for institutional designers, there are some guidelines. First, try to include all important actors through the framework convention strategy. Actors should not be limited to the nation states or to the actors only at the international level. Second, an incentive structure coupled with low-cost but effective monitoring and sanctioning is crucial to enhance the robustness of institutions. Finally, the rules-in-use should, on the one hand, be flexible to address the variations among actors. On the other hand, they should maintain a high degree of congruence with external environment and other rules.

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