6. Governance of the global commons: a question of supply and demand, the answer of polycentricism

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1. INTRODUCTION

Global commons refer to resource domains or areas that lie outside the physical or political reach of any one nation state, such as the Atmosphere or the High Seas. With a growing world population and the related challenges of pollution, food shortages and political tensions, these global commons are under pressure. Resources can also be harvested on a scale larger than ever before as a result of technological advancements. This makes many global commons vulnerable to over-consumption and degradation. Global collective action problems need to be tackled to avoid catastrophes. But what does (and should) such global governance look like? We will try to answer this question by regarding actors involved in such governance regimes, ranging from indigenous tribes to international organizations, as actors with a bounded rationality, vying to achieve results that reflect their preferences. Using rational choice theory we assume that these actors have their preferences in what global governance must supply, which in turn determines their demand of certain governance regimes. We underline that these preferences are not, necessarily, economically driven. An actor strives to maximize its preferences, but these preferences are not only about wealth and power but can encompass many other aspects, such as improving the quality of life or the environment. This expansion of a primarily economic concept builds further on the work of Elinor Ostrom (1999), in which she recognized the rationality of involved actors but was critical of thin models of rational choice and the supposed inability of actors to govern a commons collectively. Such collective governance can create a system that is able to protect the resources in a commons, enabling participants to create higher pay-offs than when individuals do not organize. In his famous article 'The Tragedy of the Commons', Garrett Hardin (1968), building on the work of Coase (1960), did not believe rational

actors could move beyond their short-term interests. In his view, individuals would seek to maximize their short-term profits even if it would lead to the degradation of a commons. Actors would display such behaviour since the individual would assume the other users would follow the same rationale and exhibiting self-restraint would have no substantial effect on the well-being of the commons. This would lead to a tragedy of collective overuse. We distance ourselves from that pessimistic view and believe that the forming and workings of governance of global commons can be explained with a bounded rational choice approach. Actors are influenced by their past experiences and norms and trust, reputation and reciprocity when we allow for actors to have longer time-horizons. Communication and information sharing are crucial in understanding how collective action is achieved on a global level. In this chapter, we will look deeper into the dynamics that may give rational actors incentive to pursue long-term strategies and try to explain their political behaviour. We do this by laying bare social mechanisms that occur in strategic interactions, thus building a behavioural foundation for collective action on global governance for global commons.

The puzzle of what global governance exactly is and how it functions has intrigued many scholars. A vast literature exists on international cooperation, but much of it is fragmented and focused only on specific arrangements. In this chapter we will try to link together many of the insights of these studies, while focusing on global commons governance. This focus is motivated by our observation of the deepening common action problems global commons encounter. Unlike international governance systems such as the European Union (EU) or North Atlantic Treaty Organization (NATO) that can give direct benefits to its participants (Abbott and Snidal, 2000; Koenig-Archibugi, 2004), the direct benefits of good global commons governance are less obvious. One reason for this is that global commons are large (world-spanning) and complicated to monitor. The participants of global commons governance regimes and the actors who have direct interests in these commons are very diverse and not necessarily the same, which can result in severe collective action problems. According to many scholars, there is also a large discrepancy between, on the one hand, the vital ingredients of successful governance, such as monitoring and sanctioning, and on the other, current international global commons governance regimes where those elements appear absent. In this chapter we will expose the challenges global commons governance encounters and present the reader with the prerequisites we believe are needed to achieve successful management of the global commons. We take the next step, and move on from understanding governance regimes as separate independent entities and approach the governance of global

commons as linked to many other governance regimes in a polycentric setting. The linkage between these regimes provides us with a convincing explanation on how collective action problems on a global scale can be overcome.

We start this chapter by reviewing the lessons learned in the study of local commons and their applicability to global commons governance. With these lessons in mind, the central part of this chapter (Sections 3 and 4) is divided into two sections: demand and supply. There we will discuss how and by whom the demand for global governance and institution formation can be voiced. We continue by discussing the products a successful global governance system must supply. To achieve and maintain a governance system is costly for its members. Participating in such a system does not come for free and, thus, the perceived benefits of participation must outweigh the perceived costs. Otherwise, the demand and support for the system will dissipate and a governance system is not viable. When demand and supply of governance is matched in a satisfying fashion, global commons can be successfully managed and protected from degradation. We mirror our arguments using the micro-economic model of supply and demand. In such a model the demand for a particular good will equal the supply, resulting in an equilibrium (Coston, 1998). We argue that governance and, in particular, the governance of a commons, can be seen as a public good, and in the case of global commons as a global public good (GPG). The defining characteristics of a public good are that it is non-excludable and non-rival (Samuelson, 1954). In other words, no one can be excluded from it and the good does not diminish when it is used. A public good is, thus, a term for a broad range of goods and services that can have an effect on everyone. Since a governance regime applies to all subjects and actors under its jurisdiction, it makes it non-excludable since no actor can be barred from it. It is also, to a large degree, non-rival since the governance system and the products it provides, such as courts or monitoring systems, do not diminish when an extra actor uses/consumes it (see Figure 6.1 for a representation of the classic distinction of goods based on the characteristics of excludability and rivalry or subtractability).

In our final section we bring the demand and supply side together and discuss institutional arrangements needed in doing so. We argue that interconnectedness and overlapping of several governance regimes can be a solution for the observed collective action problems. We disagree that polycentricism is solely problematic as it can lead to inefficient, opaque and undemocratic governance (Buchanan and Keohane, 2006). Interconnectedness of regimes also enables us to create a setting whereby actors can be given a fair representation and where sufficient monitoring

		Rivalry/Subtractability	
		Low	High
Excludability: Low		Public goods	Common pool resources/ Open access goods
Excludability: High		Club goods/ Toll goods	Private goods

Figure 6.1 Classic economical representation of different types of goods

and sanctioning systems are in place, when this is not possible in a single global all-encompassing arrangement.

2. FROM LOCAL TO GLOBAL COMMONS

In this section, we revisit the lessons learned in some of the fundamental literature on the (local) commons. We then attempt to apply these lessons on global governance systems and consider how global governance can incorporate them. As we will see, global commons share some characteristics with commons on a local level, but differ from them in some crucial aspects. Determining the differences and similarities helps us in establishing the characteristics of the supply and demand for governance of commons on a global scale.

The first studies on commons focused on physical areas producing common pool resources (CPRs). This concept of collectively owned goods stems from economic theory, most notably from the works of Samuelson (1954), Buchanan (1965) and Olson (1965). They were the first to distinguish specific goods, based on characteristics of rivalry and excludability. When a good has non-excludable and rivalrous characteristics, it is labelled a CPR. An individual unit of a CPR can only be appropriated by an individual user, making the system sustainable if the rate of replenishment is higher or equal to the rate of withdrawal. When withdrawal exceeds the replenishment rate, the CPR declines and the commons deteriorates. These characteristics lead to collective action problems described by Hardin (1968). In his seminal article entitled 'The Tragedy of the Commons', he outlined a bleak future for the commons where these CPRs can be found. Although in his article he does not distinguish between open access and

communal property (Ciriacy-Wantrup and Bishop, 1975), his 'Tragedy of the Commons' is still a good starting point to explain over-exploitation in a commonly owned territory on a local, but also on a global, level.

In Hardin's view, economically rational users of a commons do not take the negative externalities of their actions into account, but will solely try to increase their own utility. Such users make demands on a resource until the expected benefits of his or her actions equal his or her expected costs, and because each user ignores costs imposed on others, individual decisions cumulate to a tragic overuse and the potential destruction of an open-access commons. Hardin partly based his article on the concept of maximum sustainable yield, developed by Gordon and Schaefer in the 1950s (Gordon, 1954). They managed to calculate the maximum yield point after which resources will decline. Hardin's proposed solution of preventing this over-consumption was either instating public regulation or privatization of free enterprise. In his view, rational users do not have a demand for a governance scheme because they are not willing to let an authority curb their own exploitation of it. Users of a commons, in that view, are trapped in a situation they cannot change themselves. External authorities are then the only way out. But this disregards the fact that both government ownership and privatization are themselves subject to failure as well, in part because the direct link between demand for governance and governance itself is lost.

One of the strongest critics of Hardin's theorem was Elinor Ostrom (1990; 1996; 1999), who received the Nobel Prize in Economics in 2009 for her work on the analysis of economic governance of the commons. Ostrom (1990) proved that when communities manage CPRs themselves, a commons can thrive. When a community takes control, the demand and supply for governance are directly linked and this helps to overcome Hardin's disempowering and pessimistic vision of the human prospect. The recognition of her work stimulated many more researchers to study the underlying mechanisms that shape the governance of CPRs. Research has shown that even as early as in the Middle Ages, plots of land or pastures were commonly owned and had communal institutions supplying rules and regulations to its users. These commons were able to be extensively cultivated while remaining common property (Zückert, 2003; De Moor, 2011). However, while local commons have a history of being able to function well, the broadening of the governance principles from these local commons to a global scale has, as we will see later, proven dissatisfactory.

Overcoming collective action problems is germane to governing any commons successfully. Global commons, however, differ widely from local commons because they are domains that have cultural and/or natural resources on an international, supranational or global scale and can also be degraded on a large scale affecting millions (or even billions) of actors.

There is much debate on what intrinsically distinguishes a commons from other property regimes, since it can encompass anything that is commonly owned (De Moor, 2011). Dardot and Laval (2014) argue that a common can be virtually anything; not bound by intrinsic features, but is defined based upon the mode of governance administered (see Dardot, Chapter 2 in this volume). Historically, from a juridical viewpoint there are only a couple of commons on a global scale: the High Seas, the Atmosphere, Antarctica and Outer Space. The conception of these areas have been guided by the principle of the common heritage of humankind – the open access doctrine or the *mare liberum* (free sea for all). That these areas were historically designated as global commons is no coincidence, as the resources found there were, at least at the time of their establishment, either especially hard to appropriate, or so abundant that restricting access or striving for exclusive control was not economically justified (Wijkman, 1982). Next to these four classic global commons, other domains can also be considered as global commons, even under international law. This can be the case when an area is viewed as of global concern. These areas are usually not under an international regime but are subject to national jurisdictions. Examples are rainforests or national waters (Costanza, 1999). The Internet (or cyberspace) can be considered a global commons and has a complicated multi-layered governance system (Hess and Ostrom, 2003; 2007). Global commons are thus widely diverse in nature and can supply goods behaving as CPRs or even public goods (De Moor, 2011: p. 430).

While research on local commons focused on CPRs, global commons can have very different characteristics. The Internet, for example, does not behave as a commons in Hardin's Tragedy because, even though it is hard to exclude people from using it, the resources it produces (knowledge) are not reduced when consumed. It can even be argued that in consumption, the resource grows since information can actually be added by its users, as Figure 6.2 illustrates. It is clear that commons that have a low degree of rivalry do not need to be protected from over-exploitation. In these cases, the resources in the commons do not exhibit the characteristics of a CPR but that of a public good and the main problem associated with public goods is under-provision. And this is indeed what we witness in these commons that have resources that are non-subtractable. Many users access, use and share information at the same time, leading to the existence of a shared resource or a knowledge commons. The demand for information is extremely high but information can be restricted due to reasons such as limited access, bandwidth limitations or copyright issues. In a commons that produces such non-subtractable (or public) goods, a certain governance regime is also demanded by its users, but the prerequisites and set up would be very different to that of a commons producing CPRs. It is

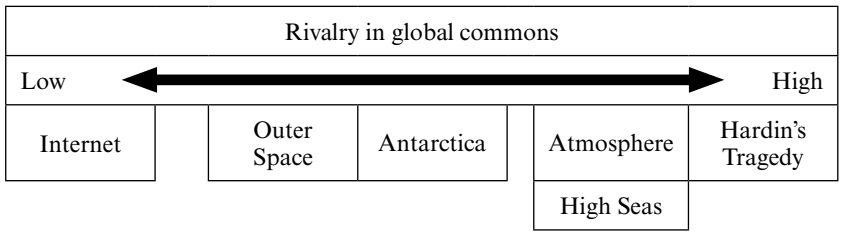

Figure 6.2 Typological positioning of global commons on an indicatory rivalry scale

clear that the traditional framework of maximum sustainable yields is not well applicable for such an instance, and we are in need of a new paradigm.

Global commons, however diverse their nature, are intrinsically difficult to manage. They transcend the scale of a town, region or even a single country and some of these resources can only become effectively depleted or made available in an international context. Resources in such vast areas are also more difficult to measure and monitor or require measurement with advanced and costly technology. Some global commons, such as the global climate, are largely self-healing in response to a broad range of human actions, until these actions exceed a certain threshold (Broecker, 1997: p. 1582) making it hard to predict the eventual outcome of a certain level of use. The enormous scale of global commons, and the complications that this entails, makes it impossible for small, relatively unorganized societies to efficiently manage these resources and match demand and supply for governance. A governance system must be formed by a cooperation of the appropriate international, national and local institutions. Ostrom et al. (1999) sum up the six main challenges in creating these global governance structures:

- '*Scaling up problems*': When many participants are involved in managing a CPR, it is increasingly difficult for the members to organize and to reach agreements on rules and their enforcement.
- '*Culture diversity challenge*': Finding shared interests and understandings can become more difficult when there is a wide cultural diversity of participants.
- '*Complications of interlinked CPRs*': Since the world is getting more and more interconnected and interdependent it will become increasingly difficult to manage resources in an adherent fashion.
- '*Accelerating rates of change*': Population growth, economic development, capital and labour mobility, together with technological change pose new challenges on our learning ability.

- '*Requirement of unanimous agreement as a collective-choice rule*': Since most governance schemes concerning global resources are negotiated treaties with a voluntary assent, governments can hold out for special privileges before they join. This strongly affects the policies that can be adopted.
- '*We have only one globe with which to experiment*': With a local commons, it is possible to move on to better pastures when a tragedy occurs, but with global commons there is no such escape clause.

The challenges identified are indeed problematic in creating successful global governance structures. Basic premises, such as face-to-face communication, which helps to increase joint gains and improve defection rates (Ostrom et al., 1992; 1994), are much harder, or even impossible, to accomplish on a global scale, but still remain important alongside autonomy to establish rules duties and an allocation of rights (Walker, 2000). Global commons with more heterogeneous sets of participants are more difficult to govern and have a greater tendency to deteriorate (Keohane and Ostrom, 1994). It is far more challenging to develop trust among participants that do not share common understandings. It is also more problematic to reach agreements and to monitor and impose sanctions (Choucri, 1993). On a global scale, the heterogeneity of interests grows exponentially with different political ideologies, culture and economies that pose challenges that must be taken into account. A governance regime should overcome the existing heterogeneity through good institutional design (Varughese and Ostrom, 2001). However, because of the large and complicated interconnectivity of our actions, it is hard to recognize their exact consequences. This ambiguity shrouds the true interests and intentions of actors even from themselves, since the outcome resulting from actions taken is, to a high degree, unknown and uncertain. Consumers, for instance, cannot observe the degradation that is occurring because of their purchases. Since they are not aware of the true consequences of their behaviour their pay-offs are unknown and they will not have an incentive to change their behaviour. Corporations, while they can observe the degradation, have little to no incentive to inform their clientele. Such actors have a strong incentive to focus on short-term interests and disregard the ecological degradation (Stern, 2011). Creating governance regimes that can protect these resources is, as we have discussed, very difficult. But aside from facing organizational difficulties, these processes are also under time pressure. The timeframe for achieving good governance systems is limited. For many natural global commons the resources are non-renewable in a human lifetime. Carbon dioxide emissions for instance can affect the global climate for the next 1,000 years (Weber and Stern, 2011) – meaning

that in many cases action has to be undertaken now to prevent catastrophe in the near and not so near future.

It is difficult for individual actors to comprehend the significance of global commons and what the actual need for cooperation and governance is. Yet, understanding of these aspects is crucial for resources to be managed successfully. The true demand for governance on a global level is extremely hard to unravel and this complicates assessing whether the supply of governance is just – even more so because of the interactions between global commons and the complexity of existing governance schemes. The following section will focus on the actors who are considered to be the owners of a global commons and who can find themselves voicing demands for its governance. We will look into the underlying demand for governance and try to determine how demand can manifest itself, leading to the formation of new institutions.

3. DEMAND FOR GLOBAL COMMONS GOVERNANCE

When resources are commonly owned, collective action problems typically emerge. Under-investment in maintenance and overuse, for example, can damage the resources, depleting benefits for other users. CPRs are also susceptible to free riders, which can be seen as the most typical example of a collective action problem. Free riders shirk costs of maintenance and access, leaving others to bear them. Free riding occurs particularly when a resource is widely available to a large population (Russett and Sullivan, 1971). Since rational individual actors would prefer not to fall under a restrictive governance regime themselves (so they can continue to free ride), the demand for such a regime is not straightforward. Yet, authoritative structures capable of supplying sufficient investment in the maintenance of common resources, as well as supplying or restricting equal access to users, are needed to prevent the deterioration of a (global) commons (Dietz et al., 2003). Users of a commons will, thus, have to step over their own restrictive personal rationale and be prepared to work with the other users, in order to reach a self-sustaining commons and so increase the collective pay-off. This, however, remains difficult.

As mentioned, collective action problems arise when 'personal interest' of a user, or player, is not aligned with 'group interest'. This leads to outcomes with inefficient Pareto Nash equilibria (Kollock, 1998). The prisoner's dilemma, assurance and playing chicken, are all basic games that can be applied to the governing of global commons (Ward, 1993). These 2×2 games show some of the fundamental dilemmas when dealing

with collective action, as when collaboration is absent, an inefficient equilibrium is achieved instead of a Pareto-optimal one. In these games, alternative outcomes, whereby the pay-off for the entire collective is higher, without reducing the pay-offs of the other players, are possible. But that outcome cannot be reached because there is no cooperation due to the actions of the players who act solely egocentrically. A certain incentive is needed to move beyond this self-defeating behaviour and governance can be the vehicle that supplies the players with this.

We have already argued that a governance regime for a global commons can be seen as non-excludable and, to a degree, non-rivalrous, so it can be viewed as a GPG. The amount of protection that is provided by a governance regime can be enjoyed by all. This non-excludability can lead to under-provision because actors will want to lower their own contributions for such a regime and so will be unwilling to show their true demand. The costs for a governance system must be borne by the participants, while non-participants will receive the benefits as well. It is therefore attractive for actors not to participate but let others pay for the protection. The true demand for the good will, thus, be higher than is visible (Hirshleifer, 1983).

When actors have a self-interest to deviate from actions that serve the common interest, it is shown that repeated games help conformance to the rules (for example, Axelrod and Hamilton, 1981). In a single game, it is not possible to be punished later on, so self-interest prevails. When the same game is being played over and over, the players can adapt their strategy to each other, making deviation from the common interest unattractive. Defectors can then be punished in later stages. These interactions enable those who use reciprocity to gain a reputation for trustworthiness, and others in turn will be willing to cooperate with them (Nowak and Sigmund, 1992).

Reciprocity and trust are, thus, very important to rule confirmation and the development of norms. Modern technology, such as the Internet and the media, enable large groups to monitor one another's behaviour and coordinate activities in order to solve collective action problems. Although evolved norms are not always sufficient to prevent deterioration of a commons, they play a crucial part when constructed by the participants themselves (Ostrom, 1999). These rules must then be monitored and enforced. These rules define, for example, who can enter a commons, use it and, if so, how much.

The production of any good is only viable if actors are indeed willing to bear the costs of producing it. They will only do so if the perceived benefits (direct and/or indirect) are at least equal to the perceived costs. Establishing and maintaining a governance system is costly and includes costs of negotiating, monitoring and enforcement of the rules. Coasian

theory suggests that when these costs are too high, the creation of an efficient regime that can govern the resources is unlikely (Coase, 1960). When the resource is large and complex, users will also lack a common understanding of the dynamics of the resource (Ostrom et al., 1999). Such a caveat makes the perceived benefits hard to observe, while the costs are much more certain. This will make potential participants of a governance regime more hesitant in joining.

In our next section we will examine who the governance demanding parties, or the users and managers of a global commons, might be. The subsequent step is to discuss how these parties might be able to overcome collective action problems and form a new institution to govern the global commons.

3.1 Participants of a Governance Regime

A demand for a governance system must typically come from the managers, or users, of a commons. Although a global commons would typically be owned by all, it is beneficial here to define ownership more closely. The concept of ownership in relation to the commons has puzzled many scholars. This is for a large part the case because for a long time it was assumed that when a person did not have the right to sell the property (alienation rights), such individual would not have any property rights at all (Alchian and Demsetz, 1973). Since a commons typically cannot be sold by anyone, this led to the unsatisfactory concept of commons being a place with resources without any ownership at all. Schlager and Ostrom (1992) moved away from seeing ownership as a single undividable concept and built further on the work of John Rogers Commons (1924), who defined ownership as a bundle of rights that are divisible, separable and alienable.

The bundle of rights as defined by Schlager and Ostrom (1992) consists of the right to:

- have access to the resource;
- appropriate the resource;
- manage the resource;
- exclude others from using the resource and how that right might be transferred;
- sell the management and exclusion rights.

These property regimes are independent and can be combined in multiple ways so the diverse nature of a commons is correctly displayed – although many theorists discarded the possibility of efficient management of resources without the right of alienation. Schlager and Ostrom (ibid.)

criticize this by showing that efficient management is possible when the four other rights are well defined.

It is hard to apply these rights directly to global commons. Not only because we cannot truly speak of ownership of a global commons, since when it is subject to the common heritage principle they cannot be appropriated or be subject to sovereignty claims. But also because the actors with property rights are found across the globe, and are therefore often unable (or unwilling) to come and participate in accomplishing a shared governance system. This is true for the natural, but also for the knowledge commons. The Internet, for instance, is subject to diverse national laws and legislations that differ widely from country to country. Another important difference with local commons is the absence of a clear community. In international relations, individual people are not the main participating actors. They are (for a large part) represented by governments, intergovernmental organizations, corporations and non-governmental organizations (NGOs) (Stern, 2011). Because not all users and managers of a global commons can be included in its governance, the costs will be shared disproportionally. The actors that do participate must bear all costs, which in turn makes the reaching of the break-even-point (the moment where the costs equal the benefits) more difficult, thus leading to increased under-provision.

Our assessment that most users and managers of a global commons cannot execute their bundle of ownership rights directly by participating in a governance system may seem pessimistic and discouraging. It is, however, the first indication that a governance scheme of a global commons cannot be truly understood when it is studied as existing in a presumed vacuum without links to other (more local) governance systems. A governance system that governs (part) of a global commons is, in fact, in connection with many other governance schemes. This interconnectedness ensures that owners of a global commons that are not well represented in a certain governance scheme can still have influence (albeit indirectly) when they are represented in another. Such polycentric governance can not only give us a way out of the representation dilemma, it can also help us in solving many collective action problems, an aspect we will now turn to.

3.2 Institution Formation

We have showed that the formation of a governance system for a global commons is not straightforward. These difficulties are primarily caused by the fact that global commons deal, and are 'owned' by, a multitude of actors. The number of actors alone can pose a challenge in institution formation, but so can their size and diversity. Actors involved in global

commons range from individuals to international organizations and everything in between. This poses extra challenges, but also opportunities, for efficient and effective governance. Many authors do not include this premise in their analysis but implicitly accept the constrictive framework set by Hardin (1968), where a central authority is necessary to effectively manage collective resources (Stern, 2011). This is a major departure of Ostrom's contribution in promoting collective self-governance and institutional design. A central authority on a global scale is also not in accordance with what we observe in contemporary global governance. In many instances, multiple governments have worked together in protecting the global commons (Haas et al., 1993; Tietenberg, 2002; Young, 2002). Also international NGOs play a major part in these governance regimes (Prakash and Potoski, 2006). Such regimes are thus very complex, and can differ widely from one instance to another. Due to the size and complexity of global commons, it is apparent that their governance should be able to deal with changing circumstances. Dietz et al. (2003) present us with some requirements for adaptive governance systems. Next to a trustworthy provision of information on resource stocks, flows and processes, and in addition to interactions with the environment and a system that deals with solving conflicts that arise between actors and the inducement of compliance to rules through formal and informal mechanisms, they find that a physical and technological institutional infrastructure, which is adaptive, is necessary to handle complex systems.

To arrange the infrastructure for an adaptive governance regime is costly, and its costs must be borne by the participants. We have already argued why participants would prefer to free ride while others form the institution. If all actors would behave this way, a governance regime would not be formed. Such a formation can be seen as a second-order free-rider problem and applies to any mechanism that solves the first-order free-rider problem, of actors not following rules. Theoretical and empirical analyses indicate that institution formation can, even so, be an important and effective solution in social dilemma situations (Kosfeld et al., 2009).

Despite the second-order free-rider problem, the institution formation process can be structured in such a manner that the implementation of a sanctioning organization is supported by a Nash equilibrium. When each player earns a higher pay-off than in the status quo equilibrium (where no players contribute to the public good), an organization can be implemented by only a subset of players. This subset takes for granted free riders that do not contribute. Experimental results of Kosfeld (ibid.), however, show the crucial role of fairness in such an institution formation process. Individuals are very reluctant to comply with a sanctioning system that governs only a subset of individuals. This is true even if the subset of individuals can

earn a higher material pay-off than in the status quo with no sanctioning system, thus making the implementation of the system optimal, at least from a material standpoint. Buchanan and Congleton (1998) use this argument to propose the so-called generality principle as a normative guideline for political action. The principle asserts that political choices should be general in nature, that is, non-discriminatory and based on equal treatment of all individuals. They, thus, impose upon it yet another hurdle in achieving successful governance regimes for global commons.

We have argued that actors have an incentive to hide their true preferences, in order to free ride on the efforts of others. This premise suggests that the level of protection or management of global commons, whether they produce CPRs or public goods (such as knowledge), will be lower than the true aggregated demand, which can lead to degradation of a commons. Establishing a governance regime is made more difficult because of the lack of transparency and the complexity that global commons inherently entail. Governance regimes that are established will not be able to accommodate all the owners of a global commons because of the sheer numbers of actors who can claim partial ownership. Studies have also shown, however, that individuals are less likely to implement a system when it only applies to a subset, as opposed to the entire collective. These observations all reinforce our main argument that a successful global governance regime must be linked to others, in order to achieve a more universal coverage with more information about the individual actors and the status of the global commons. On a smaller scale, for instance within local communities, institution formation can be achieved more easily. When these systems work together, a global commons might be managed successfully. But what is successful governance exactly; what must it supply? This is something we will discuss in the following section.

4. SUPPLY OF GOVERNANCE FOR GLOBAL COMMONS

The puzzle of how to achieve collective action lies at the core of the challenges global commons face. When collective action fails, a commons deteriorates. As we discussed, global commons have widely different characteristics. Some produce resources that are highly rivalrous in nature, such as fish in the oceans, while others do not produce any goods at all. Antarctica is the prime example here. While it does harbour natural resources, the harsh environmental conditions make almost any economic activity unviable, at least at the time the agreement came into force in 1961. Governance schemes in place focus instead on protecting the area from any

negative externalities that can harm the environment or endanger peace, such as military and economic activities in its direct vicinity (Wijkman, 1982). This governance regime, thus, restricts access. Knowledge commons, such as the Internet, require different governance schemes, since the knowledge they produce does not diminish when consumed and so shares commonalities with a public good. Successful governance schemes here should supply measures that ensure the accessibility of the commons and limit negative externalities that emanate from this. Examples of such negative externalities are the usage of the Internet to facilitate illegal activities such as terrorism or child abuse. We will first discuss the main ingredients a governance regime can supply us with – transparency, monitoring and sanctioning – after which we will look at more concrete measures a governance regime for a global commons can take.

4.1 Transparency, Monitoring and Sanctioning

Governance can only function if there is a certain degree of transparency. The actions of an actor must be known, to a certain degree, to others. If one cannot observe the actions of other actors and ascertain when a rule is breached, it is also not possible to sanction or punish the defector. This makes monitoring and sanctioning the two key concepts a governance system must supply. How this should be achieved in governing commons has been discussed by Weissing and Ostrom (1991). They argue that monitoring should not be directly carried out by the actors themselves, since there is always a temptation to deviate from rules and obligations, and this does not exclude monitoring activities. Special independent monitoring actors can sufficiently restrain the participants. A regime should, thus, be able to function relatively independently from its users if it is to supply adequate governance. Only with such independence is it possible to reach an equilibrium without perfect cooperation.

Next to monitoring, a successful governance regime should also be able to issue sanctions. Formal and informal sanctions include: fines, restrictions, peer pressure, gossip and social ostracism. All these instruments are an encouragement for actors to exhibit group-oriented behaviour (Blau, 1964). Experiments indicate that a formal sanctioning system can increase contributions (Fehr and Gächter, 2000). Masclet et al. (2003) also show that, in addition to a formal system of monetary fines, the sanctioning system is a vehicle to express disapproval of decisions by others and, thus, functions as an informal system as well. Punishment can be a powerful form of communication because it serves as a warning that in the future the player will have a lower pay-off if things do not change. It has also been shown that direct punishment of non-co-operators can cause a rise in the

level of the average contribution to the system and co-operators are even prepared to pay a cost for punishing ('altruistic punishment') (Milinski et al., 2002).

Many CPR regimes around the world rely on sanctions, and there is almost unanimous agreement in the literature that an effective sanctioning system is a major determinant of the success of such regimes (see, for instance, Baland and Platteau, 1996; Ostrom, 1999). Examples in the international arena are the EU Stability and Growth Pact (Buti et al., 2003), which was created to enforce budgetary discipline among EU member states, or the World Trade Organization (WTO), which regulates international trade by implementing legally binding agreements (Barton et al., 2008). These institutional arrangements are not imposed from without, by an external actor, but are formed from within in the sense that, at some point in time, a set of agents voluntarily agreed to implement this kind of arrangement. In this situation, two different types of subgame perfect Nash equilibria exist: a so-called organizational equilibrium, where players successfully implement an organization, and a so-called status quo equilibrium, where no organization is implemented. A sanctioning system in itself is often not enough to ensure that participants fully conform to the rules. In the Stability and Growth Pact, large countries such as Germany and France managed to escape fines on multiple occasions, and the financial crisis of 2008 has highlighted that the monitoring system implemented was inadequate in finding discrepancies in the Greek financial reports. In many instances, it becomes apparent that the eventual sanctioning system in place is not adequate and cannot produce the desired results. In some cases, it is lacking all together (Börzel and Risse, 2005). Empirical studies also find that monitoring and sanctioning are not central in international negotiations. This is remarkable, since if a sanctioning system were important, the negotiating parties would put a lot of emphasis on it (Kennan and Wilson, 1989). Apparently the demand or need for these instruments is not as prevalent as one would expect. An explanation for this absence is given by Coleman (1990), who states that shared behaviour is vital when members of a group have individual incentives to take actions that reduce the overall welfare of the group. Nevertheless, most authors do assume that norms should be backed up by implicit or explicit sanctions that penalize deviations from acceptable behaviour (Homans, 1961).

4.2 Measures and Barriers

We have taken a closer look into the scientific discourse on governance and the roles transparency, monitoring and sanctioning play. We then discussed the difficulties in achieving these elements in realizing a governance

regime for something as large and complex as a global commons. We will now consider actions a governance regime of a global commons can take to protect it from degradation. For natural global commons harbouring CPRs, trade barriers of any kind need to be implemented and enforced. Otherwise the users of such a commons will extract more resources than can be replenished (Gordon, 1954). These barriers can either help to reduce the demand for the goods in a commons, or make it less attractive or impossible to (over)exploit them. Conventional trade barriers are tariffs and quotas and they are regularly used in protecting (global) commons. An environmental tariff on imports or exports can be used to increase the costs of purchasing a product. This higher cost will lower the demand for these items. These measures can be instated when resource extraction or the production process causes natural degradation. These external costs are then borne by the consumers. This can be used to fight eco-dumping and prevent an ecological race to the bottom. Non-tariff measures (NTMs) are all policies affecting trade, other than tariffs, and can prove to be very effective to curb natural common degradation. They often reduce welfare and distort trade flows; however, since we do not have a perfect market without externalities and information asymmetries, the instruments are highly valuable in a non-perfect market (Van Tongeren and Marette, 2009). The prime example of NTMs are quotas. Quotas put a direct limit on the amount of resources available to consumers and are used in areas such as fisheries and the emission of greenhouse gases. The advantage of using a quota in comparison to a tariff is that it is clear from the start how many resources exactly can be extracted from a commons (Kraus, 2013). For a quota system to be incentive-feasible it must be implementable by a Perfect Bayesian equilibrium, meaning that players need to have conditional beliefs about the other players at every information set and define a strategy accordingly to maximize their pay-off. In the case of a global commons, each country (or other manager of the resource), after updating its beliefs by observing the resource consumption over the previous period, chooses its own rate of consumption for the following period. Since the destruction of a global commons would be disastrous for all, participants would be able to agree on a punishment system. In such an equilibrium the quota system can be dynamically self-enforcing (Haurie et al., 2008; Harrison and Lagunoff, 2017). Such a system would require a certain degree of transparency and enforceability. We have already established that due to the size and complexity of global commons, they are very vulnerable to externalities and information asymmetry, making effective monitoring difficult.

NTMs were traditionally applied for protectionist purposes but are now also being introduced by policy makers to address market imperfections

and so help facilitate trade. In order to strengthen assurances of safety and quality, for instance, standards and regulations can be implemented. Certification is helpful to signal to consumers whether they are acquiring sustainable products. Forest certification has proven to lower demand for unsustainable wood, and is therefore a good incentive for corporations to engage in sound environmental practices (McDermott and Cashore, 2009). NTMs can, thus, facilitate trade since reputation and certification increases trust, while quality standards help reputation (Blind et al., 2013). Also transparency provisions can facilitate regulated trade flows (Lejárraga et al., 2013). Such measures, nonetheless, receive their fair share of criticism. Because it is expensive to meet such standards, more so for foreign suppliers than for domestic, it can reduce market access for foreign producers. This is contentious especially in North-South trade (Jaffee and Henson, 2005).

Global commons with CPRs thus need protection from over-exploitation. Knowledge commons, however, must be governed quite differently, since their resources are non-rival. Instead of limiting access, governance systems here must focus on combating under-provision. Although, as stated above, information is in essence non-rival, the existence of copyrights and patents enables actors to invoke exclusivity. Governance regimes must balance this exclusivity of private information with promotion of access to information because:

> Properly linked, private property can enhance the value and importance of the commons, and vice-versa. Thus there is – or should be – an important place for both commons and property in Internet governance, and it is unwise to emphasize one to the exclusion of the other. Indeed, the very structure of the Internet, which combines exclusive, private network facilities and services with open, nonproprietary standards, is a prime example of this interdependence. (Mueller, 2007: p. 24)

Private property can range from patents to personal pictures or information on web browsing behaviour. This information should not be considered public. A governance system must, thus, be able to protect these personal interests because otherwise the commons will degrade, while, on the other hand, open access should be stimulated so public information can be exchanged more freely.

The measures a global commons governance system must supply differ. Executing tariffs, quotas and quality standards can suffice to protect natural global CPR commons. However, often economic interests prevail when governing bodies must choose between them or combating, for instance, pollution (Birdsall and Wheeler, 1993). And the adverse results of climate change are felt more with each passing year. Promoting the sharing

of information, while combating negative externalities that occur when private or illegal information is accessible by limiting and restricting access to those types can make information commons thrive. While Internet laws are now in place, their execution is hampered by physical barriers and legislative frontiers. Hacking and identity theft are becoming more prevalent (Taylor et al., 2014). Thus on the one hand, governance regimes do not supply us with enough restrictive measures so the exploitation of our physical natural resources can be lowered to acceptable levels. While on the other, the protection of information is lacking and criminal organizations or malicious governments seem to be able to regularly obtain and misuse private information. More restrictions on information are not the sole answer, however. Over-protection of information can cause problems, since it can lead to underuse of scientific resources when intellectual property rights are too strict (Heller, 1998). The classical solution to these problems, that is, the instalment (Hardin, 1968) of a single all-encompassing governance regime that can weigh all interests and has universal applicability, is not only unfeasible given the very diverse interests of the many actors involved in the creation of such an institution; it is also no true solution, since global commons are too large and complex to be managed by a single behemoth-regulator. We believe polycentricism is the solution for this conundrum, since it can be inclusive, diverse and adaptive to handle large complex systems. We will discuss polycentric governance in more detail in the following section.

5. POLYCENTRIC ORGANIZATION OF A SUCCESSFUL GOVERNANCE REGIME

Collective action problems were typically presented as simple 2×2 games. We argue that this classical approach, which prevails throughout the literature, starting with Stein (1982) and Snidal (1985), is unable to capture the complicated reality of global commons governance and that a new paradigm has to be developed that links governance regimes to one another.

A governance system of a global commons must have a functioning monitoring system of the resources it contains. In this respect, it is not important whether the resources are rivalrous (such as fish or mineral deposits) or non-rivalrous (such as knowledge). Governance must also supply us with rules and regulations to avoid degradation of the global commons. The system must monitor the actors that use the resources of the commons and must be able to punish defectors of the rules. McGinnis and Ostrom (1996) made an overview of institutional arrangements that, in theory, could be used in international regimes that govern commons.

This classification includes governmental, intergovernmental, corporate and NGO-actors. These actors can either be monitoring the resource or sanctioning the defectors. This can happen in different configurations. A government can, for instance, fine a corporation when it is observed that it violated a law. NGOs can play a significant role in monitoring corporations and governments. Defecting governments can then be punished by fellow governments. McGinnis and Ostrom recognize that there are no powerful external authorities that can enforce agreements. The absence of an external authority means that voluntary assent by countries to negotiated treaties is the standard collective-choice rule for global resource management (Wiener, 1999). This voluntary assent allows some national governments to insist upon special privileges before they join the governance system, thus strongly affecting the kinds of resource management policies that can be adopted at this level, as they lack universal coverage. In local commons, this is not really an issue, since there is always the state and the rule of law that can help keep violators in check. Although international law of course exists (see Brunnée, Chapter 13 in this volume), there is no true active enforcement regime (Koh, 1997). Sanctioning must, therefore, come from the participants themselves, since the participants of the regime in principle will want to do so. Otherwise they would not have agreed that a global commons is worth protecting. They may, however, be tempted to act as free riders and try to break the rules themselves. Participants will also be hesitant to pay for monitoring and punishment.

When sanctioning only applies to members of the institution, non-members remain free in their choices and, hence, following public good logic, are given a strong incentive to free ride (Kosfeld et al., 2009). Everyone, thus, profits if an institution is formed, but each individual profits more if others form, and bear the costs for, that institution. If all participants followed that logic no institution at all would be formed, and everyone would be worse off. This is what can be termed a 'dilemma of endogenous institution formation'. A possible solution is proposed by Haas (1980), who advocates the linkage of issue-areas, so players can adapt their behaviour in one arena based on what happens in another policy area. This can help coerce players to conform to the set rules, because even if it is not possible to sanction someone in one governance scheme it might be possible in another. Since most research focuses on only one governance regime, the influence of linkage has been mostly disregarded (Contandriopoulos et al., 2010). We argue that the concept of linkage is crucial in understanding global governance and how monitoring and sanctioning can truly be supplied. Considering only single governance arrangements has led to many false assumptions on how sanctions and monitoring are not important because they are not instated on a sufficient level or fail to be executed

properly. As discussed, global commons are so large and complicated that monitoring is difficult. We also discussed the diffuse users and managers of a global commons. It cannot be said that countries are the only managers and/or users of a global commons but that they share this with a plethora of other actors such as indigenous communities, NGOs or even ordinary citizens. Instead of creating a Gordian knot that cannot be unravelled, we believe the combination of a complex problem with complex management can be a solution for our governance conundrum. We argue that a good mix of actors in a global commons governance regime can ensure a better estimation of the demand for governance and can also provide a successful monitoring and sanctioning system. Actors will only be willing to invest in monitoring when the (perceived) benefits outweigh the costs. These benefits are, on a global scale, uncertain – but on a local scale much more apparent. For instance, indigenous communities, or NGOs that are active on the ground, witness climate degradation on a daily basis. Their costs for monitoring are low, while possible benefits for well-executed governance are very apparent. It is key that they are able to communicate (and convince) other owners of the need for governance measures. When other global actors can be made aware of the degradation, their involvement can lead to successful governance. Informed citizens all over the world can then punish polluters themselves (by boycotting products from certain companies or countries) or by inducing their governments to do so (by voting for certain parties or demonstrating for policy change). When citizens demand action, costs for punishment by country governments can be compensated by electoral support.

When local actors and global communities interact, they can create a powerful mix. Such a governance regime will not be monocentric. Local actors can only be involved in a small piece of the puzzle. But these pieces are interconnected, enabling the linkage between different regimes. Linkage also makes rule conformance possible when this might not be likely in isolated instances. Because countries and other actors in global governance participate in several social games simultaneously, the interaction or linkage of these games provides a sophisticated way by which trust is gained and collective action problems can be overcome. In global governance indirect reciprocity, that is, 'give and you shall receive', is built on reputation that can be gained in the multiple international policy arenas. Indirect reputation can sustain a high level of cooperation. The need to maintain reputation for indirect reciprocity can help ensure cooperation at a surprisingly high level (Milinski et al., 2002).

Linkage helps us to understand why punishment regimes in a single governance scheme may seem to be inadequate. The more complex a commons is, the more challenging it is to craft a well-tailored set of institu-

tional arrangements that can protect a global commons from degradation. Through polycentric governance, or in other words multiple governing authorities operating on different scales, the complexities can be matched and rules and regulations can become more flexible (Nagendra and Ostrom, 2012). It also enables punishment regimes to become more effective. Actors will be hesitant to break a rule when they may be punished in any number of other policy arenas, or are hampered in their actions on the world stage because they no longer enjoy the trust of the other participants. This line of reasoning implies that actors who participate in many policy arenas at once and who are, thus, vulnerable to sanctions on multiple levels, will be more inclined to follow the rules, while actors who are fairly isolationist can disregard more easily international sanctions for the governance regimes of which they are a part. Also the size of actors matters. Large and economically strong actors are able to withstand the backlash they receive from breaking the rules or as a result of their unwillingness to participate in a certain governance scheme. Strong actors are also able to compensate participants for the damages or coerce them and so hamper the monitor and sanction functions. The results that are found in diverse theoretical models (see, for instance, Nordhaus and Yang, 1996; Baliga and Maskin, 2003; Dutta and Radner, 2006; 2009; Harrison and Lagunoff, 2017) point towards polycentric governance, whereby different types of actors shape the monitoring and sanctioning system, as being most effective in governing global commons. A mix of organizations is important, since exclusive monitoring responsibility provides a strong incentive for bribery and corruption. Collusion must also be avoided since it would likely result in poor rule enforcement (McGinnis and Ostrom, 1996). Large power imbalances can also severely obstruct governance regimes from successfully protecting global commons. These imbalances may be countered when such groups can keep each other in check, as consumers versus multinationals, voters versus governments, or multinationals versus cyber-terrorists. A further complication is that the effective implementation of formal polycentricism must rely on clear boundaries, but global commons sometimes require approaches that are not always geographically or legally coterminous (Andereis and Janssen, 2013). This has as its result that a polycentric system in a global commons setting will have to remain informal and, to some degree, ambiguous. Nonetheless, polycentric governance with linked governance regimes gives us a convincing explanation of how a successful global commons governance is formed. When diverse interests are accommodated these are able to better estimate the demand for governance. At the same time, monitoring and sanctioning is facilitated because of the increased number of countries and organizations involved that are able to execute them. It is a comforting thought that, although our global

commons are under increasing strain, our modern ways of communication make the world smaller, allowing us to link demand and supply for governance on a global scale more effectively than ever before.

6. CONCLUSION

We have assumed that actors involved in global commons are participants with a bounded rationality striving to maximize their preferences. The size and complexity of global commons prevent actors from achieving successful collective action in single, world-spanning, governance systems. In this chapter, we have approached the governance of global commons as a GPG, because governance supplies us with non-excludable rules and regulations, while being non-rivalrous in nature. Looking through a public good lens, we can use the economic adage of demand and supply to better understand what kind of collective action problems exist in global governance and how they may be solved. It becomes intuitively apparent that global governance is at risk of being under-provided, which can lead to the degradation of global commons. A successful governance regime must lead to a perceived benefit for the participating actors that is higher than the perceived costs. But governance on such a level is costly and inefficient while the direct benefits to the participants are unclear.

Monitoring and sanctioning devices are crucial for any governance system to succeed, but they are difficult to construct when actors on a global level typically can choose whether to participate or not. In smaller settings with fewer participants or a limited policy scope, institution formation is easier. When actors know each other better, trust between them is improved and monitoring and sanctioning are more effective. With a small policy scope, uncertainty is low and transparency high. When these local arrangements are transposed to the global level many of these virtues are lost. We believe that the solution for successful global governance lies not in simply copying local arrangements but in linking local initiatives to governance regimes on regional and global levels. Such polycentric governance regimes can best handle the complexities of a global commons. Linkage of governance regimes enables the reputation of actors to cross over and so act as a deterrent for free-rider behaviour, since rule breaking in one policy arena can lead to repercussions in many other arenas. By harnessing the knowledge of local actors, the true demand for governance can be better estimated while the costs for monitoring a global commons can decrease since there are local observers. But local actors cannot achieve a successful global commons governance regime by themselves. The involvement of global actors can, next to the execution of coordinative activities, help

divide costs between many actors, thus reducing the risks of participation. Paradoxically, while some modern developments put our global commons under pressure, our modern communication methods can help generate polycentric governance systems to protect them.

We have provided the reader with some of the building blocks for creating and developing successful governance regimes for global commons. Empirical research on polycentricism and linkages between governance regimes on an international level is still far behind on what we have learned already on a local level. Our hope is that the theoretical framework we have presented can lead to a better understanding of what our common responsibilities are and how we can protect on a global scale the shared resources we hold dear.

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