

EXPECTED PAYOFF ANALYSIS

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Expected Payoff Analysis:

A consumer chooses x , the quantity of common resource to be consumed, given the institutional factors. The rational consumer would seek to maximise the consumption of x ; however, her consumption of the common is not an independent choice variable. It is determined by the following parameters:

1. Allotted consumption of the common, x^*
2. Probability of detection, p , of defection from allotted consumption
3. Sanctions imposed on defection, $S(x-x^*)$
4. Administrative cost, C

$$E(x) = p(x^* - S(x-x^*)) + (1-p)x - C$$

The consumer's expected payoff is a weighted average of her payoff in the case of detection and non-detection, minus the administrative costs. If she is caught defecting from the allotted consumption, she may only consume the allotted consumption with a deduction (amounting to the sanction imposed). If she is not caught, the consumer may consume x .

Each of these parameters are affected by Institutional factors, which are factors determined by the organisational principles of the Common Resource Management practice in place. The major Institutional factors, as identified by Ostrom (1990), Thomas Dietz (2003), Nives Dolsak (2002) pertinent to the analysis are:

1. **Cost of excluding non-members** from use of the common. This involves clearly defining user rights and their allotment, and preventing access of non-members. This also involves a **cost of collecting information** necessary for sustainable appropriation of the resource. These costs affect the administrative cost, C (denominated in real terms).
2. **Monitoring** of use of the Common, to keep a check on misappropriation of the resource by user-right holders. Effective monitoring of the resource increases p , the probability of detection when any user defects.
3. **Sanctions** imposed for misappropriation of the Common, including social costs of defection. The sanctions may be a fixed penalty (S is thus a constant) or they may vary with the amount of resource misappropriated (S is then a function of the difference between actual and allotted consumption).
4. **Conflict resolution mechanisms:** Maintaining long-term institutions requires quick and low-cost access to conflict resolution among participants and among enforcers and participants. In absence of this mechanism, the institution breaks down.

A comparative analysis of three broad systems for management of Commons is made, to determine the under which system do the institutional factors optimise the parameters of Expected Payoff function. The three empirically observed systems are command-and-control, private property rights and self-governed institutions based on user rights.

When the common is divided or **privatised**, property rights are allotted and the decision to appropriate user rights rests with the holder of property rights. Once privatized, the consumers find the incentive which was so far missing in their use of the resource that belonged to them just as much as it did to others. "If a resource can be privatized -- that is, owned by individuals -- we now see an alignment between an individual's interest and the long-term interest, because they don't want to destroy this resource; they want to keep it for the next year or for the next generation." (Tomkin, 2012) . With privatization in place, the amount used is self regulated by the owner and hence only the optimal quantity gets used up; x^* is consumed with probability equal to 1.

However, in cases where the resource cannot be divided and property rights cannot be clearly defined, the administrative costs are prohibitively high as cost of excluding non-members and other users rise substantially. At a level where C exceeds x^* , the expected payoff will be negative and the institution breaks down.

In a **command-and-control system**, an external agent appropriates user rights to the common among consumers, based on optimal consumption for sustainable use of the resource. Allocation thus takes the form of an upper limit on consumption of the Common. The monitoring of use and imposition of sanctions for violation is performed by the external agent or another agent on its behalf. The consumer of the resource again faces an incentive for rational usage as the penalty that the aforesaid law declares. The consumer is made to pay the price for overexploitation of the resource and as long as the cost is more than the benefit and the threat remains credible, degradation of resource from over consumption can be avoided. Hardin favored these regulations as long as they were democratically formed or what he termed –“mutual coercion mutually agreed upon”. Environmental agencies in many countries monitor the amount of pollutants released in the air and the failure to comply invites hefty fines.

Even so, government regulation still face major assessment hurdles “Effective regulation and taxes require that politicians and regulators have information not only about social costs and optimal levels of production, but also about the (often varying) private production and compliance costs of individual users. This is a requirement that few regulators can meet” (Libecap, 2009). C can be prohibitively high in this case.

Another empirically observed system of management of Commons is **self-governed institutions** with shared property rights. These institutions, which also take the form of community management, allow participants to make decisions regarding allotment of user rights, monitoring etc. and are typically observed when resource is shared among a group of limited participants. Flexibility is characteristic in this approach as it emphasises on only one rule of the game: that the rules be determined by participants and be allowed to differ depending on the context. The differences allow the institution to model their rules on local condition; take its advantage or avoiding potential pitfalls.

The involvement of participants may make information about the resource and its optimal appropriation for sustainable use more readily available and also reduce costs of excluding non-members in smaller, close-knit communities where participants recognise each other and thus can easily detect outsiders. C will be low in this case. Literature on self-governed institutions also point to an effective monitoring of resource by participants, because personal incentives are aligned with community interests; p would be high. Another notable feature about community management in particular is that sanctions are not only economic, but can also take the form of social costs imposed on defector which act as a major deterrent to defection. Conflict resolution is also administered locally while reducing time and costs incurred; however, the need for an impartial third party for adjudication is a concern that cannot be overlooked. Cumulatively, self-governed institutions optimize the parameters of Expected Payoff function and can be expected to deliver conformist behaviour.

Thus, the fundamental difference in authority which appropriates the common resource translates into how participants engage in monitoring and sanctioning of use of the common. In a command-and-control system where a central authority appropriates and monitors the common, participants' engagement in monitoring and sanctioning the use of the resource is very limited. With private ownership of the common, individuals appropriate the common for use and are singularly responsible for its monitoring. The system for imposing sanctions in these cases are generally centralised, but the imperative to see them lies with the property right holder. Self-governed institutions for managing the commons, on the other hand, are based on the principle that the participants themselves are appropriators and monitors of the common. This not only creates a sense of ownership among participants, due to shared user rights without demarcating property rights at all, but also precludes the cost of engaging an external agency to monitor the resource.

The aim of the analysis is to point out fallacies in the one-size-fits-all prescriptions to resource management policy made by proponents of both command-and-control policies as well as privatisation of resources. Each kind of common resource management institution has its benefits and shortcomings. The kind of institution which should be established is thus, largely context-based. If a resource like fishing waters which may not be effectively divided, property rights cannot be established and user rights should be precedence. At the same time, it should be noted that the assertions are about the institutional factors which should be optimised, each due to a specific parameter of the Expected Payoff function it affects. This analysis thus brings a fresh perspective to the literature on New Institutional Economics; by emphasising on optimisation of every *parameter* of a representative Expected Payoff function, it draws the focus away from principles of organisation of institutions managing commons. This approach not only allows a more precise evaluation of existing institutions by determining if the Expected Payoff from conformation to rules is greater than from defection, but it also allows a greater diversity of institutions, each with their unique combination of organisational principles, to be studied.

It should be noted that the evidence in favour of self-governed institutions seems less convincing in light of the fact that even privatisation of the commons may be successful if components of administrative cost can be provided efficiently by the property-right holder the common is divisible. In fact, depending on the context, even a central authority may provide the necessary coordinated action required to break out of a pareto-inferior equilibrium. Other contexts where the possibility of self-governed institutions may be limited would be the case where monitoring, conflict resolution and exclusion cannot be effectively organised by the

participants themselves. Such organisation may require economies of scale larger than may be delivered by the participants or involve complex issues of autonomy as in global commons. Recent research on global commons encourages putting an end to the principle of national sovereignty of a single country on a resource. The countries that claim such rights to the resource often shirk off their responsibility towards it. The governing of the global common rather asks for a world government with regulatory power

Empirically though, the most successful institutions are self-governed and managed by a community. Susan Jane Buck Cox, in her paper titled “No Tragedy of the Commons”, sought to refute the very idea of the tragedy of the commons rose from the decline of common grazing land in medieval Europe. She states that in medieval England, the decline of English commons was not due to overuse by the sheep herders rather due to reforms favouring a selected few and industrial revolution, thereby questioning the very basis of the paradox. Instead, the inbuilt community system was postulated to be stable and sustainable. The subsequent articles present case studies from communities around the world, who have long governed their common resource for sustained use.