Reflection on the Commons|Development Economics

The concept of common property (natural) resources (Three Influential Models

What one can observe in the world is that neither the state nor the market is uniformly successful in enabling individuals to sustain long term productive use of natural resource systems

1. Tragedy of the Commons (Garrett Hardin, 1968)
Concept: The tragedy of the commons occurs when individuals, acting independently according to their self-interest, overuse and deplete a shared resource, even though it is in no one's long-term interest to do so.
Example: Consider a common grazing field shared by herders. Each herder benefits from adding more cattle to graze, as the individual gain from extra cattle is greater than the shared cost of overgrazing. Over time, this leads to overgrazing, soil degradation, and the collapse of the resource.
Key Insight: The absence of defined property rights or regulations leads to overexploitation because individuals do not account for the negative externality their actions impose on others.

2. Prisoner's Dilemma in Common Resources
Concept: The use of game theory to explain how individuals, seeking to maximize their personal benefit, fail to cooperate even when cooperation would yield a better outcome for the group.
Example: Fisheries provide a classic illustration. If all fishermen agree to fish at sustainable levels, the fish population remains stable and everyone benefits. However, each fisherman has an incentive to overfish, believing their additional catch won't significantly affect the population. If all think this way, overfishing occurs, leading to resource depletion.
Key Insight: Mutual trust and communication are essential for avoiding the prisoner's dilemma scenario. Without these, individuals prioritize short-term gains over collective long-term sustainability.

3. Ostrom's Institutional Analysis (Elinor Ostrom, 1990)
Concept: Ostrom challenged the inevitability of the tragedy of the commons by demonstrating how communities can self-organize to manage common property resources sustainably through rules, norms, and cooperation.
Example: Irrigation systems in small farming communities serve as an example. Farmers often

create rules for water distribution, enforce penalties for violations, and ensure equitable access. For instance, in parts of Nepal, local communities have managed irrigation systems for centuries without external enforcement.

Key Insight: Ostrom identified eight principles for managing common-pool resources, such as clearly defined boundaries, collective decision-making, effective monitoring, and graduated sanctions for rule violators. These principles emphasize the importance of localized solutions and governance structures in preventing resource depletion.

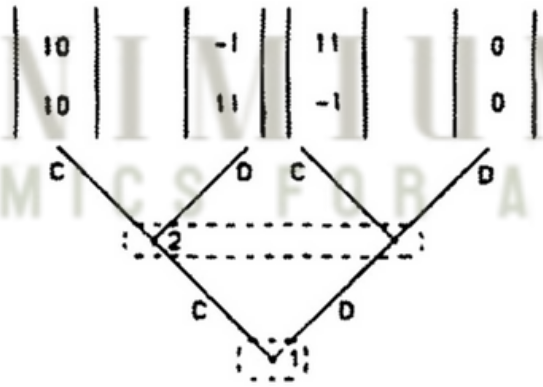
Tragedy of Commons further explained- The Hardin Herder Game

Default game: Suppose the maximum number of animals that can graze is L and there are 2 grazers (or players)

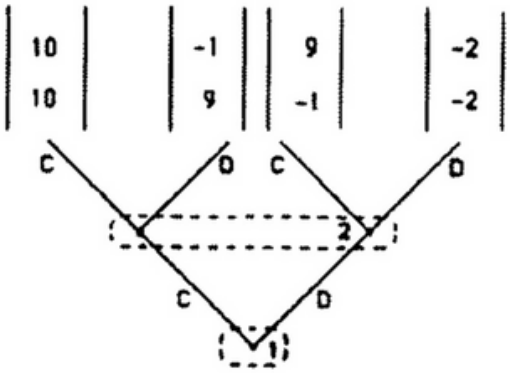
Payoffs are such that:-

- Cooperate ($L/2$, $L/2$)=> Payoff is (10,10)
- One defect and other loose ($L/2$. $l>L/2$) or ($l>L/2$, $L/2$) => Payoffs (-1, 11) and (11,-1) respectively.
- Both defect ($l>L/2$, $l>L/2$) => payoff is (0,0)

Thus, *(Defect, Defect)* or *(D,D)* becomes the equilibrium but it is pareto inferior which suggest that individual rational strategies led to irrational outcomes.



Central Authority Game with Complete Information: Suppose Central authority imposes penalty of 2 on any herder who uses a defect strategy. Then corresponding pay off associated with the strategy *defect* is reduced by 2. Thus 11 becomes 9 and 0 becomes -2.



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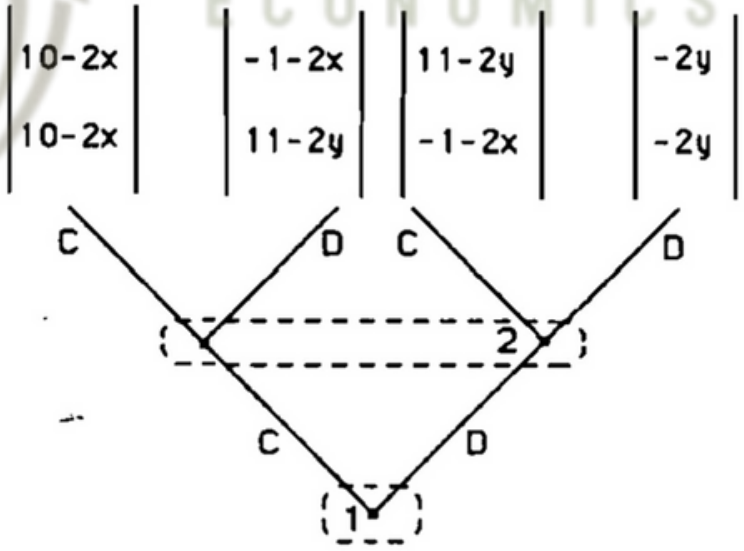
Central Authority Game with Incomplete Information

- Suppose central authority (CA) has incomplete information about the actions of the herders.
- CA punishes defections with probability *y* and fails to punish with probability *(1 –y)* (error)
- CA punishes cooperative actions with probability *x* (error), and does not punish it with probability *(1 –x)*
- Payoff for 1 when both cooperate is $8x + 10(1 - x) = 10 - 2x$ And so on.
- Payoff matrix assuming the penalty is 2 then is

Payoff for 1 when both cooperate: Probability *x* that agent is punished and therefore receives (10 –2) Probability *(1 –x)* agent is not punished and receives 10.

Expected payoff is: $x(10 - 2) + (1 - x)10$ Or $10x - 2x + 10 - 10x$ Or, $8x + 10(1 - x) = 10 - 2x$ And so on.

Payoff matrix then is



Depending on probabilities *x* and *y*, the payoffs may be such that the dominant strategy is *(Defect, Defect)* and the outcome will be pareto inferior When x = 0 and y = 1, i.e. the central agency makes no errors in enforcing the penalties, then the game reduces to Game 2.(with complete info) However, when the central agency does not have complete information on the action of the herders then it imposes both types of sanctions correctly with a probability of say 0.7, i.e. x = 0.3 and y = 0.7. The payoffs are such that the herders again face a prisoner's dilemma game. Herders will again defect (overgraze) rather than cooperate

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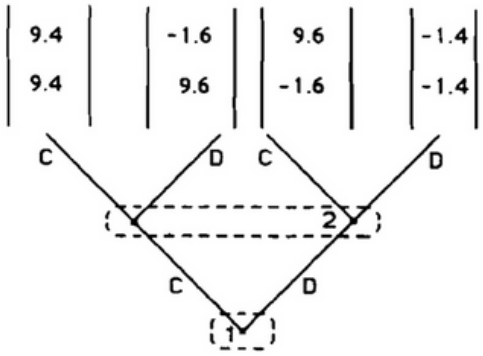
A specific example where x=0.3 and y=0.7



Current policy prescriptions

Levithan as the only way

The concept of "Leviathan as the only way" is rooted in Thomas Hobbes' philosophy, as articulated in his seminal work Leviathan (1651). It refers to the idea that a strong, centralized authority is necessary to prevent chaos and ensure the proper management of resources and order in society. In the context of common property resources, this notion has been discussed in relation to the "tragedy of the commons" and the need for governance mechanisms to avoid overexploitation of shared resources.

- Core Idea: In situations where individuals act in their self-interest without concern for the collective good, Hobbesian philosophy argues that only a "Leviathan" (a powerful authority, typically the state) can enforce rules and regulations to manage resources effectively and avoid their depletion.
- Connection to Tragedy of the Commons: Garrett Hardin's 1968 essay suggested that without some form of external control or governance, common resources would inevitably be overexploited. He proposed "mutual coercion, mutually agreed upon" (like government regulations or privatization) as a necessary solution, which aligns with Hobbes' idea of Leviathan.

Example:

Overfishing in International Waters:

- In the absence of a governing body, countries overfish in international waters, depleting fish stocks. Here, a "Leviathan" could take the form of international treaties or organizations like the United Nations Convention on the Law of the Sea (UNCLOS) that impose restrictions on fishing practices, ensuring sustainability.

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Criticism:

- The "Leviathan" approach assumes that centralized authority is the only viable solution, which can sometimes lead to excessive bureaucracy or infringe on individual freedoms.
- Elinor Ostrom, for example, provided evidence that local communities can often self-regulate shared resources effectively without requiring a central authority.

While "Leviathan as the only way" emphasizes the necessity of external control for managing commons, it is not the only solution. Depending on the context, localized governance, social norms, and cooperative behavior may also play pivotal roles in resource management. However, in scenarios where cooperation is unlikely or impossible, a strong central authority may indeed be the most viable approach to avoid the tragedy of the commons.

Imposition of private property as a solution

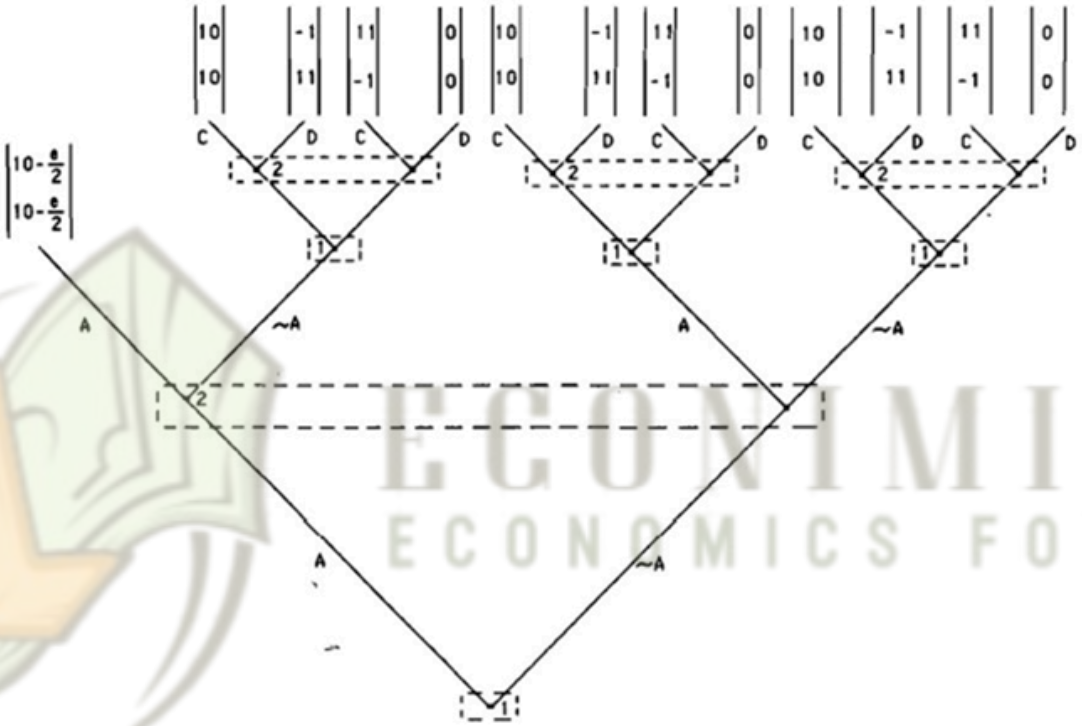
This suffered from three major drawbacks:

- Costs would have to be incurred for investment in fences, maintenance, monitoring, sanctions etc.
- Uncertainty exists surrounding such CPR and even if that could be overcome with setting up markets for them, insurance would require added costs.
- This approach is also not suitable for non-stationary resources like water or fisheries.

Self financed Contract Enforcement

In context with Hardin's Herders game, herders themselves can make a binding contract to commit themselves to a cooperative strategy.
A simple way to represent this is to add one parameter to the payoffs and a strategy to both herders' strategy sets. The parameter is the cost of enforcing an agreement and will be denoted by e.
Contracts are not enforceable however unless agreed unanimously. Consequently the only feasible agreement and equilibrium of the resulting game is for both herders to share equally the sustainable yield of land of a meadow and costs of enforcing the agreement as long as each share of cost is less than the payoff when both cooperates (in our example 10).

Players can always guarantee that the worst they can do is to (defect, defect). If the enforcer decides to charge too much for its services equal to or greater than *Pi(C,C)- Pi(D,D)*, neither player would agree to sign such a contract.



This solution is not the only way and it has its own problems. First, it might be possible for herders to hire a private agent to take on the role of enforcer. A self financed contract enforcement game allows participants in the situation to exercise greater control over decision as compared to previous games. Further there is a possibility of several arbitrators offering enforcement services. The payoff dominant equilibrium is to agree on an arbitrator who will enforce the contract at the lowest *e*.

A further problem is that games in which enforcers have been arranged for by mutual agreement may be mistaken by analysts and public officials for games in which there have been no agreements about how to cooperate or enforce agreements.

For example, when the enforcement mechanism is not an external government agency, some analysts presume that there is no enforcement. There can also be problems where herders underestimate or overestimate the carrying capacity of the meadow. Their own monetary system may break down.

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Policies as metaphors

Centrist presume unified authorities will operate in the field they have been decided to do in theory. Those advocating private property approach presume that most efficient use patterns for CPRs will actually result from dividing the right to access and control such resources. Empirical study shows latter is more efficient but it depends.
Also recently there are some (wrong) advocacies for "institution free institutions". An assertion that central authority is necessary tells us nothing about the way a central agency should be maintained, how it will obtain information or how its agents should be selected, motivated to do work, rewarded or sanctioned.

Challenges regarding policies

An important challenge facing policy scientists is to develop theories of human organization based on realistic assessment of human capabilities and limitations in dealing with a variety of situations. Empirically validated theory of human organization will be essential ingredients of any policy science.
Theoretical inquiry involves search for regularities, abstraction from complexities of field setting, positing of theoretical variables, further abstraction and simplification for the purpose of finer analysis. The power of theory is exactly proportional to diversity of situations it can explain. Models of a theory are limited still further because many parameters must be fixed in a model rather than allowed to vary.
Adequately specified theory of a collective action whereby a group of principles can organize themselves voluntarily to retain the residuals of their own efforts is absent. Until a theoretical explanation based on human choice for self organized and self governed enterprises is fully developed and accepted, major policy decisions will continue to be undertaken with a presumption that individuals cannot organize themselves and always need to be organized by external authorities.