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The **tragedy of the commons** is a situation in a shared-resource system where individual users, acting independently according to their own self-interest, behave contrary to the common good of all users by depleting or spoiling the shared resource through their *collective* action. The concept originated in an essay written in 1833 by the British economist William Forster Lloyd who used a hypothetical example of the effects of unregulated grazing on common land (also known as a **commons** in Great Britain and Ireland).^[1] The concept became widely known as the "tragedy of the commons" over a century later after an article written by Garrett Hardin in 1968.^[2] In a modern economic context, "commons" is taken to mean any shared and unregulated resource such as the atmosphere, oceans, rivers, ocean fish stocks, or even an office refrigerator.

The term is also used in *environmental science*. The "tragedy of the commons" is often cited in connection with *sustainable development*, meshing economic growth and environmental protection, as well as in the *debate over global warming*. It has also been used in analyzing behavior in the fields of economics, evolutionary psychology, anthropology, game theory, politics, taxation and sociology.

Although common resource systems have been known to collapse due to overuse (such as in *over-fishing*), many examples have existed and still do exist where members of a community with access to a common resource co-operate or regulate to exploit those resources prudently without collapse.^{[3][4]} Elinor Ostrom was awarded the 2009 Nobel Prize in Economics for demonstrating this concept in her book *Governing the Commons*, which included examples of how local communities have been able to do this without top-down regulations or privatization.^[5]

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Expositions

Lloyd's pamphlet

In 1833, the English economist William Forster Lloyd published a pamphlet which included a hypothetical example of over-use of a common resource. This was the situation of cattle herders sharing a common parcel of land on which they were each entitled to let their cows graze, as was the custom in English villages. He postulated that if a herder put more than his allotted number of cattle on the common, overgrazing could result. For each additional animal, a herder could receive additional benefits, while the whole group shared the resulting damage to the commons. If all herders made this individually rational economic decision, the common could be depleted or even destroyed, to the detriment of all.^[1]

Garrett Hardin's article

In 1968, ecologist Garrett Hardin explored this social dilemma in his article "The Tragedy of the Commons", published in the journal *Science*.^[2] The essay derived its title from the pamphlet by Lloyd, which he cites, on the over-grazing of common land.

Hardin discussed problems that cannot be solved by technical means, as distinct from those with solutions that require "a change only in the techniques of the natural sciences, demanding little or nothing in the way of change in human values or ideas of morality". Hardin focused on human population growth, the use of the Earth's natural resources, and the welfare state.^[3] Hardin argued that if individuals relied on themselves alone, and not on the relationship of society and man, then the number of children had by each family would not be of public concern. Parents breeding excessively would leave fewer descendants because they would be unable to provide for each child adequately. Such negative feedback is found in the animal kingdom.^[4] Hardin said that if the children of improvident parents starved to death, if overbreeding was its own punishment, then there would be no public interest in controlling the breeding of families.^[5] Hardin blamed the welfare state for allowing the tragedy of the commons, where the state provides for children and supports overbreeding as a fundamental human right, *Malthusian catastrophe* is inevitable. Consequently, in his article, Hardin lamented the following proposal from the United Nations:

The Universal Declaration of Human Rights describes the family as the natural and fundamental unit of society. [Article 16] It follows that any choice and decision with regard to the size of the family must inevitably rest with the family itself, and cannot be made by anyone else.

— U Thant, Statement on Population by the Secretary-General of the United Nations^[6]

In addition, Hardin also pointed out the problem of individuals acting in rational self-interest by claiming that if all members in a group used common resources for their own gain and with no regard for others, all resources would still eventually be depleted. Overall, Hardin argued against relying on conscience as a means of policing commons, suggesting that this favors selfish individuals – often known as *free riders* – over those who are more altruistic.

In the context of avoiding over-exploitation of common resources, Hardin concluded by restating Hegel's maxim (which was quoted by Engels), "freedom is the recognition of necessity". He suggested that "freedom" completes the tragedy of the commons. By recognizing resources as commons in the first place, and by recognizing that, as such, they require management, Hardin believed that humans "can preserve and nurture other and more precious freedoms".

The "Commons" as a modern resource concept

Hardin's article was the start of the modern use of "Commons" as a term connoting a shared resource. As Frank van Laarhoven and Elinor Ostrom have stated: "Prior to the publication of Hardin's article on the tragedy of the commons (1968), titles containing the words 'the commons', 'common pool resources', or 'common property' were very rare in the academic literature." They go on to say: "In 2002, Barnett and Matry conducted a major survey of biologists to determine which publications in the twentieth century had become classic books or benchmark publications in biology. They report that Hardin's 1968 article was the one having the greatest career impact on biologists and is the most frequently cited."^[3]

Application

Metaphoric meaning

Like Lloyd and Thomas Malthus before him, Hardin was primarily interested in the problem of human population growth. But in his essay, he also focused on the use of larger (though finite) resources such as the Earth's atmosphere and oceans, as well as pointing out the "negative commons" of pollution (i.e., instead of dealing with the deliberate depletion of a positive resource, a "negative commons" deals with the deliberate comminization of a negative, cost, pollution).

As a *metaphor*, the tragedy of the commons should not be taken too literally. The "tragedy" is not in the word's conventional or thearitic sense, nor a condemnation of the processes that lead to it. Similarly, Hardin's use of "commons" has frequently been misunderstood, leading him to later remark that he should have titled his work "The Tragedy of the Unregulated Commons".^{[10][11]}

The metaphor illustrates the argument that free access and unrestricted demand for a finite resource ultimately reduce the resource through *over-exploitation*, temporarily or permanently. This occurs because the benefits of exploitation accrue to individuals or groups, each of whom is motivated to maximize use of the resource to the point in which they become reliant on it, while the costs of the exploitation are borne by all those to whom the resource is available (which may be a wider class of individuals than those who are exploiting it). This, in turn, causes demand for the resource to increase, which causes the problem to snowball until the resource collapses (even if it retains a capacity to recover). The rate at which depletion of the resource is realized depends primarily on three factors: the number of users wanting to consume the common in question, the consumptive nature of their uses, and the relative robustness of the common.^[12]

The same concept is sometimes called the "tragedy of the fishers", because fishing too many fish before or during breeding could cause stocks to plummet.^[13]

Modern commons

The *tragedy of the commons* can be considered in relation to environmental issues such as *sustainability*. The commons dilemma stands as a model for a great variety of resource problems in society today, such as water, forests,^[14] fish, and non-renewable energy sources such as oil and coal.

Situations exemplifying the "tragedy of the commons" include the overfishing and destruction of the Grand Banks, the destruction of salmon runs on rivers that have been dammed – most prominently in modern times on the Columbia River in the Northwest United States, and historically in North Atlantic rivers – the devastation of the sturgeon fishery – in modern Russia, but historically in the United States as well – and, in terms of water supply, the limited water available in arid regions (e.g., the area of the Red Sea) and the Los Angeles water system supply, especially at Mono Lake and Owens Lake.

In economics, an *externality* is a cost or benefit that affects a party who did not choose to incur that cost or benefit. Negative externalities are a well-known feature of the "tragedy of the commons". For example, driving cars will have many negative externalities, such as environmental pollution, carbon emissions, and traffic accidents. Every time "Person A" gets in a car, it becomes more likely that "Person Z" – and millions of others – will suffer in each of those areas.^[15] Economists often urge the government to adopt policies that "internalize" an externality.^[16]

The *tragedy of commons* can also be referred to the idea of *open data*. Anonymous data are crucial for useful social research and represent therefore a public resource – better said a common good – which is liable to exhaustion. Some feel that the law should provide a safe haven for the dissemination of research data, since it can be argued that current data protection policies overburden valuable research without mitigating realistic risks.^[17]

Examples

More general examples (some alluded to by Hardin) of potential and actual tragedies include:

- Planet Earth ecology
 - Uncontrolled human population growth leading to overpopulation.^[2]
 - Atmosphere, through the release of pollution that leads to ozone depletion, global warming, ocean acidification (by way of increased atmospheric CO2 being absorbed by the sea), and antibiotic pollution
 - Light pollution – with the loss of the night sky for research and cultural significance, affected human, flora and fauna health, nuisance, trespass and the loss of enjoyment or function of private property.^[18]
 - Water – Water pollution, water crisis or over-extraction of groundwater and wasting water due to *overirrigation*.^[19]
 - Forests – Frontier logging of old growth forest and slash and burn^[20]
 - Energy resources and climate – Environmental residue of mining and drilling, Burning of fossil fuels and consequential global warming
 - Animals – Habitat destruction and poaching leading to the Holocene mass extinction^[21]
 - Oceans – Overfishing^{[22][23]}
 - Human and wildlife conflict^[24]^[citation needed]
- A preference for sons made people abort foetal girls. This results in an imbalanced sex ratio.^[25]^[citation needed]
- Antibiotics – Antibiotic Resistance Mis-use of antibiotics anywhere in the world will eventually result in antibiotic resistance developing at an accelerated rate. The resulting antibiotic resistance has spread (and will likely continue to do so in the future) to other bacteria and other regions, hurting or destroying the Antibiotic Commons that is shared on the worldwide base^[24]
- Vaccines – Herd immunity Avoiding a vaccine shot and relying on the established herd immunity instead will avoid potential vaccine risks, but if everyone does this, it will diminish herd immunity and bring risk to individuals that cannot receive vaccines for medical reasons.^[26]

- Publicly shared resources
 - Spam email degrades the usefulness of the email system and increases the cost for all users of the Internet while providing a benefit to only a tiny number of individuals.
 - Wi-Fi and its overcrowded 2.4 GHz channels.
 - Vandalism and littering in public spaces such as parks, recreation areas, and public restrooms.
 - Hoarding of items such as toilet paper during a perceived threat such as weather events or disease epidemics results in a few people having access to many people not having enough.
 - Knowledge commons encumbrance immaterial and collectively owned goods in the information age, including, for example:
 - source code and software documentation in software projects that can get "polluted" with messy code or inaccurate information.^[26]
 - Skills acquisition and training, when all parties involved pass the buck on implementing it.^[27]
 - Electric vehicle (EV) charging station built by parked vehicles, ICE vehicles whose drivers rent EVs, EVs that overstay time limits, and EVs whose owners have no intention of charging but fees they are entitled to park.
 - Space debris in Earth's surrounding space leading to limited locations for new satellites and the obstruction of universal observations.^[28]

Application to evolutionary biology

A parallel was drawn recently between the tragedy of the commons and the competing behavior of parasites that through acting selfishly eventually diminish or destroy their common host.^[29] The idea has also been applied to areas such as the evolution of virulence or sexual conflict, where males may fatally harm females when competing for matings.^[30]

The idea of evolutionary suicide, where adaptation at the level of the individual causes the whole species or population to be driven extinct, can be seen as an extreme form of an evolutionary tragedy of the commons.^{[31][32]} From an evolutionary point of view, the creation of the tragedy of the commons in pathogenic microbes may provide us with advanced therapeutic methods.^[33]^[ceter source needed]

Commons dilemma

The *commons dilemma* is a specific class of social dilemma in which people's short-term selfish interests are at odds with long-term group interests and the common good.^[34] In academia, a range of related terminology has also been used as shorthand for the theory or aspects of it, including *resource dilemma*, *take-some dilemma*, and *common pool resource*.

Commons dilemma researchers have studied conditions under which groups and communities are likely to under- or over-harvest common resources in both the laboratory and field. Research programs have concentrated on a number of motivational, strategic, and structural factors that might be conducive to management of commons.

In *game theory*, which constructs mathematical models for individuals' behavior in strategic situations, the corresponding "game", developed by Hardin, is known as the Communitize Costs – Privatize Profits Game (CC–PP game).

Psychological factors

Kopelman, Weber, & Messick (2002), in a review of the experimental research on cooperation in commons dilemmas, identify nine classes of independent variables that influence cooperation in commons dilemmas: social motives, gender, payoff structure, uncertainty, power and status, group size, communication, cues, and frames. They organize these classes and distinguish between psychological individual differences (stable personality traits) and situational factors (the environment). Situational factors include both the task (social and decision structure) and the perception of the task.^[35]

Empirical findings support the theoretical argument that the cultural group is a critical factor that needs to be studied in the context of situational variables.^{[36][37]}^[citation needed] Rather than behaving in line with economic incentives, people are likely to approach the decision to cooperate with an appropriateness framework.^[37] An expanded, four factor model of the Logic of Appropriateness.^{[38][39]}^[citation needed] suggests that the cooperation is better explained by the question: "What does a person like me (identity) do (rules) in a situation like this (recognition) given this culture (group)?"

Strategic factors

Strategic factors also matter in commons dilemmas. One often-studied strategic factor is the order in which people take harvests from the resource. In simultaneous play, all people harvest at the same time, whereas in sequential play people harvest from the pool according to a predetermined sequence – first, second, third, etc. There is a clear order effect in the latter games: the harvests of those who come first – the leaders – are higher than the harvests of those coming later – the followers. The interpretation of this effect is that the first players feel entitled to take more. With sequential play, individuals adopt a first-come-first served rule, whereas with simultaneous play people may adopt an equity rule. Another strategic factor is the ability to build up reputation. Research has found that people take less from the common pool in public situations than in anonymous private situations. Moreover, those who harvest less gain greater prestige and influence within their group.

Structural factors

Hardin stated in his analysis of the tragedy of the commons that "Freedom in a commons brings ruin to all".^[40] One of the proposed solutions is to appoint a leader to regulate tasks. Groups are more likely to endorse a leader when a common resource is being depleted and when managing a common resource is perceived as a difficult task. Groups prefer leaders who are elected, democratic, and prototypical of the group, and these leader types are more successful in enforcing cooperation. A general aversion to autocratic leadership exists, although it may be an effective solution, possibly because of the fear of power abuse and corruption.

The provision of rewards and punishments may also be effective in preserving common resources. Selective punishments for overuse can be effective in promoting domestic water and energy conservation – for example, through installing water and electricity meters in houses. Selective rewards work, provided that they are open to everyone. An experimental carpool lane in the Netherlands failed because car commuters did not feel they were able to organize a carpool.^[41] The rewards do not have to be tangible. In Canada, utilities considered putting "smiley faces" on electricity bills of customers below the average consumption of that customer's neighborhood.^[42]

Solutions

See also: *Externality* & *Possible solutions*

Articulating solutions to the tragedy of the commons is one of the main problems of political philosophy. In many situations, local implement (often complex) social solutions that work well. When these fail, there are many possible governmental solutions such as privatization, internalizing the externalities, and regulation.

Non-governmental solution

Robert Axelrod contends that even self-interested individuals will often find ways to cooperate, because collective restraint serves both the collective and individual interests.^[43] Anthropologist G. N. Appell criticized those who cited Hardin to "impose" their own economic and environmental rationality on other social systems of which they have incomplete understanding and knowledge.^[44]

Political scientist Elinor Ostrom, who was awarded the 2009 Nobel Memorial Prize in Economic Sciences for her work on the issue, and others revisited Hardin's work in 1999.^[45] They found the tragedy of the commons not as prevalent or as difficult to solve as Hardin maintained, since locals have often come up with solutions to the commons problem themselves.^[46] For example, it was found that a commons in the Swiss Alps has been run by a collective of farmers there for their mutual and individual benefit since 1517, in spite of the farmers also having access to their own farmland. In general, it is in the interest of the users of a commons to keep them functioning and so complex social schemes are often invented by the users for maintaining them at optimum efficiency.^{[47][48]}

Similarly, geographer Douglas L. Johnson remarks that a *nomadic pastoralist* societies of Africa and the Middle East in fact "balanced" local stocking ratios against seasonal regional conditions in ways that were ecologically sound", reflecting a desire for lower risk rather than higher profit; in spite of this, it was often the case that the "nomad was blamed for problems that were not his own making and were a product of alien forces".^[49] Independently finding precedents in the opinions of previous scholars such as Ibn Khaldun as well as common currency in antiquity, current attitudes towards non-sedentary peoples,^[50] governments and international organizations have made use of Hardin's work to help justify restrictions on land access and the eventual *sedentarization* of pastoral nomads despite its weak empirical basis. Examining relations between historically nomadic Bedouin Arabs and the Syrian state in the 20th century, Dawn Chatry notes that "Hardin's argument [...] was curiously accepted as the fundamental explanation for the degradation of the steppe land" in development schemes for the arid interior of the country, downplaying the larger role of agricultural overexploitation in desertification as it melded with prevailing nationalist ideology which viewed nomadic societies as socially backward and economically harmful.^[50]

Elinor Ostrom and her colleagues looked at how real-world communities manage common resources, such as fisheries, land irrigation systems, and farmlands, and they identified a number of factors conducive to successful resource management. One factor is the resource itself: resources with definable boundaries (e.g., land) can be preserved much more easily. A second factor is resource dependence; there must be a perceptible threat of resource depletion, and it must be difficult to find substitutes. The third is the presence of a community; small and stable populations with a thick social network and social norms promoting conservation do better.^[51] A final condition is that there be appropriate community-based rules and procedures in place with built-in incentives for responsible use and punishments for overuse. When the commons is taken over by non-locals, those solutions can no longer be used.^[52]

An example of counteracting the tragedy of commons goods is that people who refuse to fill, the total amount of common goods is measurable and if there is a majority who sets up the following rules: people have to pay proportionally for their consumption if they report it, but those who get to fill, will have to pay an equal portion of the amount that is left of the total consumption after subtracting those all reporting individuals'. Since people will consume mostly diverse amounts, those who can - consume less, by interesting in joining the club of those who report and pay proportionally. This goes on until only the biggest consumer won't be reporting, but they don't have to, as their share can already be calculated by subtracting all the reported values from the total consumption.^{[53][54]}

Governmental solutions

Sometimes the best governmental solution may be to do nothing.^[55]^[citation needed] Governmental solutions may be necessary when the above conditions are not met (such as a community being too big or too unstable to provide a thick social network). Examples of government regulation include privatization, regulation, and internalizing the externalities.

Privatization

One solution for some resources is to convert common good into private property giving the new owner an incentive to enforce its sustainability. Libertarians and classical liberals cite the tragedy of the commons as an example of what happens when Lockean property rights to homesteaded resources are prohibited by a government.^[51] They argue that the solution to the tragedy of the commons is to allow individuals to take over the property rights of a resource, that is, to privatize it.^[52]

In England, this solution was attempted in the Inclosure Acts.

Regulation

In a typical example, governmental regulations can limit the amount of a common good that is available for use by any individual. Permit systems for extractive economic activities including mining, fishing, hunting, livestock raising and timber extraction are examples of this system. Similarly, limits to pollution are examples of governmental intervention on behalf of the commons. This idea is used by the United Nations Moon Treaty, Outer Space Treaty and Law of the Sea. Another, similar to the UNESCO World Heritage Convention which involves the international law principle that designates some areas or resources the Common Heritage of Mankind.^[53]

In Hardin's essay, he proposed that the solution to the heritage of overpopulation must be based on "mutual coercion, mutually agreed upon" and result in "relinquishing the freedom to breed". Hardin discussed this topic further in a 1979 book, *Managing the Commons*, co-written with John A. Baden.^[54] He framed this prescription in terms of needing to restrict the "reproductive right", to safeguard all other rights. Several countries have a variety of population control laws in place.

German historian Joachim Radkau thought Hardin advocates strict management of common goods via increased government involvement or international regulation bodies.^[55] An asserted historian tracing "the tragedy of the commons" is frequently warned of as a consequence of the adoption of policies which restrict private property and espouse expansion of public property.^{[56][57]}

Internalizing externalities

Privatization works when the person who owns the property (or rights of access to that property) pays the full price of its exploitation. As discussed above negative externalities (negative results, such as air or water pollution, that do not proportionately affect the user of the resource) is often a feature driving the tragedy of the commons. *Internalizing the externalities*, in other words ensuring that the users of resource pay for all of the consequences of its use, can provide an alternate solution between privatization and regulation. One example is gasoline taxes which are intended to include both the cost of road maintenance and of air pollution. This solution can provide the flexibility of privatization while minimizing the amount of government oversight and overhead that is needed.

The Mid-Way Solution

One of the significant actions areas which can dwell as potential solution is to have co-shared resources that have partial ownership that have partial governmental side and partial ownership from the community. By ownership, here it is referred to planning, sharing, using, benefiting and supervision of the resources which ensure that the power is not held in one or two hands only. Since, involvement of multiple stakeholders and necessary responsibilities can be shared across them based on their abilities and capacities in terms of human resources, infrastructure development ability and legal aspects etc.^[58]^[citation needed]

Criticism

Radical environmentalist Derrick Jensen claims the tragedy of the commons is used as propaganda for private ownership.^{[59][60]} He says it has been used by the political right wing to hasten the final enclosure of the "commons resources" of third world and indigenous people worldwide, as a part of the Washington Consensus. He argues that in true situations, those who abuse the commons would have been warned to desist; if they failed would have punitive sanctions against them. He says that rather than being called "The Tragedy of the Commons", it should be called "The Tragedy of the Failure of the Commons".^[61]

Marxist geographer David Harvey has a similar criticism, noting that "the dispossession of indigenous populations in North America by 'productive' colonists, for instance, was justified because indigenous populations did not produce value", and asks generally: "Why, for instance, do we not focus in Hardin's metaphor on the individual ownership of the cattle rather than on the pasture as a common?"^[62]

Hardin's work was also criticized^[63] as historically inaccurate in failing to account for the demographic transition, and for failing to distinguish between common property and open access resources.^[64] In a similar vein, Carl Dahman argues that commons were effectively managed to prevent overgrazing.^[65] Likewise, Susan Jane Buck Cox argues that the common land example used to argue the common concept is in an very weak historical ground, and misrepresents what the terms was actually the "trumph of the commons": the successful common usage of land for example use as assessed in 2022.^[66] United Nations Publications.

Some authors, like Yochai Benkler, say that with the rise of the Internet and digitalisation, an economics system based on commons becomes possible again. He wrote in his book, *The Wealth of Networks* in 2006 that cheap computing power plus networks enable people to produce valuable products through non-commercial processes of interaction: "as human beings and as social beings, rather than as market actors through the price system". He uses the term *networked information economy* to refer to a "system of production, distribution, and consumption of information goods characterized by decentralized individual action carried out through widely distributed, nonmarket means that do not depend on market strategies".^[67] He also coined the term *commons-based peer production* for collaborative efforts based on sharing information.^[64] Examples of commons-based peer production are *free and open source software* and *open-source hardware*.

Comedy of the commons

In certain cases, exploiting a resource may be a good thing. Carol M. Rose, in a 1986 article, discussed the concept of the "comedy of the commons", where the public property in question exhibits "increasing returns to scale" in usage (hence the phrase, "the more the merrier"), in that the more people use the resource, the higher the benefit to each one. Roles such as examples of commons are group recreational activities. According to Rose, public resources with the "comedic" characteristic may suffer from under-investment rather than over use.^[68]

A modern example presented by Garrett Richards in *environmental studies* is that the issue of excessive carbon emissions can be tackled effectively only when the efforts are directly addressing the issues along with the collective efforts from the world economies. Collective funding and shared solutions across nations could help identify technologies that can solve carbon emission issues. Additionally, the more that nations are willing to collaborate and contribute resources, the higher the chances are for successful technological developments.^[69]

See also

- Bounded rationality
- Dutch disease
- Externality
- Organizational and educational infatation
- International Association for the Study of the Commons
- Nash equilibrium
- Race to the bottom
- Panic buying
- Parasitism (social offense)
- Prisoner's dilemma, wherein two parties may each act in an individually beneficial fashion to the detriment of both.
- Common reputation in fiction

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