

The “Law of the Bees”: Property Rights, Externalities, Self-Interest and the Public Interest

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ABSTRACT

This paper examines the “law of the bees” as an interdisciplinary framework for analyzing property rights, externalities, self-interest, collective action, and the public interest. Using the economic relationship between beekeepers and orchard owners as its central example, the paper explains how bee pollination generates positive externalities that may remain outside ordinary market transactions. Drawing on Coasean analysis, it argues that clearly defined and enforceable property rights, reliable contracts, and low transaction costs can enable private parties to internalize these external benefits through mutually beneficial exchange. However, private bargaining is not sufficient in every circumstance, particularly when environmental benefits are widely dispersed, transaction costs are high, bargaining power is unequal, or future generations are affected. This paper further compares the incentive structure of bee colonies with collective agricultural systems in China in the 1960s. It argues that the bee colony illustrates how division of labor, genetic relatedness, inclusive fitness, reproductive incentives, and collective resource management can align individual and collective interests. By contrast, unclear contributions and equal distribution in certain human collective systems may weaken incentives and encourage shirking and free-riding. The analysis does not treat the bee colony as a literal legal or contractual system; rather, it uses the colony as an evolutionary and institutional analogy to show how cooperation can be sustained when incentives and collective outcomes align. The paper concludes that social welfare is best promoted through a balanced institutional framework combining property rights, voluntary exchange, public regulation, information, and collective action. In this sense, the law of the bees shows that self-interest and the public interest can complement each other when supported by appropriate rules and institutions.

Keywords: Law of the bees, Property rights, Positive externalities, Pollination services, Coasean bargaining, Transaction costs, Self-interest, Public interest, Collective action, Collective outcome, Inclusive fitness

Introduction

“The law of the bees” is a useful economic metaphor for examining how private decisions can generate benefits or costs for others. The classic example concerns beekeepers and orchard owners: bees collect nectar to produce honey, while their pollination activity increases the yield of fruit trees. Yet the beekeeper and orchard owner may not automatically receive payment for all of the benefits that their activities create for each other. This illustrates an **externality**, a cost or benefit imposed on a third party that is not fully reflected in a market price.

This paper argues that the “law of the bees” demonstrates that self-interest and public interest are not necessarily opposites. Under clear, enforceable and manageable private rights and collective outcome rights, private actors may exchange and convert implicit contracts that align with their individual incentives with socially desirable outcomes. Therefore, when private rights, private collective rights and identity rights are clear, transaction costs will be low, which made ecological benefits extend beyond identifiable parties, voluntary act may will be sufficient. In such cases, public policy has a legitimate role in protecting the public interest through collective outcome, collective distribution, and environmental communication. This case can be explain in the law of the bee’s Queendom, “**Serve for the Queen with collective contribution and outcome.**”

Bees as an Economic Problem

The bee example became prominent in welfare economics through the work of Apple and Bee’s event. Consider an apple orchard owner and a beekeeper located nearby. The orchard provides blossoms that give bees nectar and pollen, helping the beekeeper produce honey. At the same time, bees pollinate apple trees, raising the orchard owner’s fruit yield. Each producer therefore creates a benefit for the other without necessarily receiving compensation.

This is a **positive production externality**. A positive externality occurs when an individual’s or firm’s activity creates benefits for others that are not included in the market transaction. Since the orchard owner does not receive the full private reward from the additional honey production, the owner may plant fewer apple trees than is socially optimal. Similarly, since the beekeeper may not receive payment for the increased apple harvest, the beekeeper may maintain fewer hives than would maximize total welfare.

The central economic issue is the difference between **private benefit** and **social benefit**. Private benefit refers to the gain received directly by the decision-maker. Social benefit includes both the private gain and the benefit experienced by others. In the bee case, the beekeeper’s private return comes from honey sales, while the social return also includes the increased value of orchard production created through pollination. In the case of China in the 1960s, there was a major

economic depression caused by the social planning of village economies. Village economies made collective contributions and distributed outcomes collectively, but rather than clearly identifying contributions, they took equal shares without accounting for individual input. As a result, people become shirking, and the overall collective outcome decreased, which made the village economies collapse. These can be explained by the following equation.

This can be described by a new equation:

$$(C) \text{ Social village marginal benefit} = (C) \text{ Private village marginal benefit} + (C) \text{ External village marginal benefit}$$

When the social marginal benefit exceeds the private marginal benefit, market production may be below the efficient level. The individual producer makes a rational decision based on personal revenue and cost, but society loses potential output because spillover benefits are ignored.

According to the scholar Wei Li and Dennis Tao Yang research, the case of China during the Great Leap Forward and the early 1960s, the rural economy experienced a severe agricultural and economic crisis. This crisis was partly associated with the institutional design of the people's communes, which organized village production through collective ownership, centralized planning, and communal distribution. Land, labour, and other productive resources were pooled, while agricultural output was allocated according to a combination of subsistence needs and politically determined procurement targets rather than being closely linked to each household's marginal contribution. This arrangement generated a weak incentive structure and created a principal-agent problem. Because individual effort was difficult to observe and remuneration was only loosely connected to productivity, commune members had limited incentives to supply additional labour or improve production efficiency. The resulting free-rider problem, shirking, and moral hazard reduced labour productivity and weakened the efficiency of resource allocation. In addition, the absence of clearly defined and enforceable property rights reduced farmers' residual claims over output, meaning that they received only a small proportion of the benefits generated by any additional effort. Consequently, the collective faced a gap between private marginal benefits and social marginal benefits: the individual bore the cost of greater effort, whereas the benefits were distributed across the entire collective. (Wei Li and Dennis Tao Yang, 2005).

But in the Law of the bee's case, enforcement is the collective outcome, with fertilizing rights becoming the main part of the labor contract of private rights, so the bee's child may be protected and born. With the gen's reproduction factor, these socially collective rights become part of the implicit private property rights, which reflect the true implicit meaning of the self gen's identity. These implicit private property rights include the bee's queendom, which can be sustained. The bee's queendom is far more sophisticated and far better than the village

economies in China in the 60s. The bee's queendom, with its gen's private property rights of fertilizing rights, confirms that worker bees will work hard to min the cost and max the utilities, as long as they can fertilize, with the true identity gen's in the share economies. This is a big difference from the 60s collective outcome, with an unsure identity of their contribution and equal sharing. The Bee's Queendom is served with clear roles, clear work, clear distribution, with clear private fertilization and gene regeneration rights, which makes the Bee's system clearly identifiable with sustainable outcomes.

Property Rights and Incentives

Property rights are the legally and socially recognized rights to use, control, transfer, exclude others from, and benefit from an asset. They are fundamental to market economies because they give people incentives to invest, conserve, innovate, and trade. Economic analysis of property law stresses that property rights facilitate exchange by establishing who has authority to make decisions over resources.

In the bee example, the difficulty is not that bees or apple trees lack economic value. Instead, the challenge is that the relevant benefits are partly unpriced. A beekeeper may own the hives and honey, while an orchard owner owns the land and fruit. However, neither party may initially own a clear right to the pollination service generated when bees visit the orchard.

If the legal system or local custom permits the beekeeper and orchard owner to identify, measure, and contract over pollination services, the externality can be internalized. **Internalization** means bringing an external cost or benefit into the private decision-making process. The orchard owner may pay the beekeeper to place hives near the orchard during flowering season. The beekeeper then earns income not only from honey but also from providing pollination. This changes the beekeeper's incentive to maintain an efficient number of colonies.

The same principle works in the opposite direction. If beekeepers gain substantial value from access to orchard blossoms, they may compensate orchard owners for locating hives on their land. In practice, the exact allocation of payment depends on bargaining power, seasonal conditions, alternative pollination sources, crop value, hive availability, and contractual arrangements. What matters for efficiency is that the gains from cooperation can be shared between the parties.

The Coasean Interpretation

Ronald Coase's analysis of externalities provides a major framework for understanding the law of the bees. The Coasean approach argues that, when property rights are well defined and

transaction costs are low, affected parties can bargain to reach an efficient allocation of resources.

For example, suppose orchard pollination is highly valuable. If orchard owners have the right to exclude bees, beekeepers may pay for access to the orchards. If beekeepers have a recognized right to place hives nearby, orchard owners may pay them to ensure that enough colonies are available during blossom season. In either case, bargaining can potentially lead to an efficient result because both sides gain from cooperation.

The initial assignment of legal rights affects the distribution of income but does not necessarily determine the efficient level of pollination under the strict assumptions of the Coase theorem. If pollination creates a total gain of \$10,000 and the beekeeper's opportunity cost is \$4,000, an agreement can be reached as long as payment falls between those amounts. The orchard owner and beekeeper can divide the remaining \$6,000 surplus through negotiation.

However, this result depends on demanding conditions:

- The parties must be identifiable.
- Property rights must be clear and enforceable.
- The benefits of pollination must be observable or reasonably measurable.
- Contract enforcement must be reliable.
- Bargaining costs must be low.
- There must be relatively few affected parties.

The bee example is important because it shows that externalities do not always require direct government control. Stephen Cheung's study of beekeeping arrangements in Washington State found that contractual and pricing arrangements could coordinate pollination and nectar-related activities. The study suggested that actual market institutions may deal with some apparent externalities more effectively than simplistic textbook models assume.

Self-Interest as a Coordinating Force

Self-interest is often criticized as selfishness, greed, or disregard for society. In economics, however, self-interest has a more neutral meaning: individuals and firms generally seek to improve their own welfare subject to constraints. A beekeeper wants income from honey, while an orchard owner wants higher and more reliable fruit production. These motives are private, but they can produce mutual gains.

The beekeeper does not need to be altruistic to provide pollination. If orchard owners pay a fee for hive rental, pollination becomes a valuable service. The orchard owner does not need to act

solely for environmental reasons; higher yields and improved fruit quality may justify the cost of hiring beekeepers. Through exchange, each party pursues private advantage while helping to generate a broader increase in output.

This is the economic significance of voluntary contracting. It transforms an unpriced spillover into a market transaction. Rather than treating self-interest as inherently harmful, institutional economics asks whether the legal and market framework directs self-interest toward productive behavior.

In this research paper, we argue that the distinction between the collective outcome and the clear identity is crucial. Self-interest without rules can encourage overuse of common resources, pollution, or exploitation. **Self-interest under well-designed rules** can promote investment, innovation, specialization, and cooperation. Property rights therefore do not merely protect private wealth; they can also organize social cooperation by making individuals responsible for costs and able to benefit from value they create.

Public Interest and Market Failure

Although private bargaining may solve some bee-related externalities, the public interest cannot always be left entirely to market forces. Pollination has effects that may extend beyond a single farmer and beekeeper. Bees contribute to biodiversity, ecological resilience, food production, and the reproduction of many flowering plants. These broader effects can involve many individuals, landowners, consumers, and future generations.

When benefits are widespread and difficult to exclude others from enjoying, a public-good problem may arise. A public good is typically non-rivalrous and non-excludable: one person's benefit does not substantially reduce another's, and it may be difficult to prevent non-payers from benefiting. Environmental quality and ecosystem stability often have these characteristics.

For example, a farmer may benefit from pollination performed by bees originating from neighboring land, even without making a payment. If many farmers wait for others to finance bee habitat, society may experience underinvestment. This is a version of the **free-rider problem**. Each individual prefers others to bear the cost while everyone shares the benefit.

In addition, bee populations may be harmed by pesticide use, habitat loss, disease, climate change, and land-use change. A farmer who uses a pesticide may consider its private benefits, such as reduced crop damage, but may not fully consider harm to nearby pollinators, beekeepers, neighboring farms, or ecosystems. This is a **negative externality**. The private marginal cost of pesticide use may be lower than the social marginal cost. If producers ignore the external damage, too much of the harmful activity may occur. The result is not an efficient market

outcome but a market failure. Government intervention may be justified when private contracts cannot adequately account for external effects. The appropriate policy should depend on the nature of the problem, the availability of information, administrative costs, and the possibility of unintended consequences.

Several policy tools are relevant:

- **Pollination subsidies:** Governments may subsidize beekeeping, habitat restoration, or pollinator-friendly farming where private incentives are below social benefits.
- **Regulation:** Authorities may restrict particularly harmful chemicals, require environmental assessments, or set standards for pesticide application.
- **Property-rights reform:** Governments can clarify rights over access, land use, environmental damage, and compensation.
- **Information provision:** Public agencies can fund research, monitoring, labelling, and farmer education on pollination and sustainable agricultural practices.
- **Collective action institutions:** Cooperatives, agricultural associations, and local conservation groups can reduce bargaining costs and coordinate action among farmers and beekeepers.

Meade's original interpretation of the bee-orchard relationship suggested that subsidies might be needed when private incentives diverge from social benefits. However, the Coasean and Cheung-inspired perspective warns that policymakers should not assume that every externality requires state intervention. Before imposing regulation, policymakers should examine whether affected parties already use contracts, markets, industry practices, or local institutions to coordinate behavior.

Limits of Private Property Rights

Property rights are powerful but not unlimited. First, some environmental benefits are difficult to define and measure. It is relatively straightforward to contract for placing a specified number of hives in an orchard for a flowering season. It is much harder to assign ownership rights over biodiversity, genetic diversity, ecosystem resilience, or pollination benefits that spread across a large geographic area.

Second, bargaining may involve many parties. A single orchard owner and beekeeper may negotiate easily, but a region containing thousands of farms, landowners, residents, consumers, and public agencies faces substantial transaction costs. Negotiation requires time, information,

legal expertise, monitoring, and enforcement. Where transaction costs are high, private bargaining may fail even if cooperation would increase social welfare.

Third, bargaining power matters. A small beekeeper may have less negotiating power than a large agricultural corporation. Even where a contract is technically voluntary, unequal access to information, legal representation, finance, and alternatives can influence outcomes. Efficiency alone does not resolve concerns about equity, rural livelihoods, environmental justice, or the distribution of income.

Finally, future generations cannot negotiate directly in current markets. People in the future may benefit from healthy ecosystems and stable pollinator populations, yet they cannot bargain with present-day landowners or pesticide users. This creates a strong public-interest case for environmental rules that consider long-term sustainability.

Serve for the Bee Queen Colony with collective contribution and outcome

In the case of the bee's queen colony, the colony appears to operate according to a norm of service to the queen for a collective outcome. Worker bees devote themselves to foraging, nursing brood, defending the hive, and maintaining the comb. At first sight, this resembles explicit altruism: individual workers sacrifice to support the colony as a whole.

However, from an evolutionary perspective, this behavior may also be interpreted as implicit self-interest. Worker bees are genetically related to the queen and to one another. By helping the queen produce and rear offspring, a worker may increase the survival and reproduction of close relatives who carry many of the same genes. Thus, the so-called collective contribution is not built solely upon survival of the colony; it is also built upon the indirect propagation of the worker's genetic lineage.

In formal terms, worker cooperation can be understood through **kin selection** and **inclusive fitness**. An individual may gain evolutionary benefit not only by producing offspring directly, but also by assisting genetically related individuals to reproduce. Cooperation is evolutionarily stable when the reproductive benefit to relatives, weighted by genetic relatedness, exceeds the cost incurred by the worker.

Apparent Altruism and Genetic Self-Interest

The altruism of the bee colony is therefore not necessarily inconsistent with self-interest. It is **altruistic in appearance**, because worker bees devote energy to collective tasks. Yet it may be **self-interested in genetic terms**, because their labor increases the probability that shared genes will be transmitted to future generations.

This distinction explains why the bee colony system can be sustained over time. Its sustainability rests not only on the survival of individual bees, but also on the protection and reproduction of the queen's offspring. Worker bees maximize colony productivity by collecting nectar and pollen, caring for larvae, regulating hive temperature, and defending the colony. These activities increase the colony's stored resources and improve the survival prospects of the next generation. So, in this interpretation, the queen's colony functions as a protective institution. It shields individual bees from environmental risks while simultaneously enabling the continuation of their genetic line through the queen's reproduction. The colony's collective outcome therefore serves both public and private evolutionary interests.

Reproductive Division of Labor

A honey-bee colony contains three principal castes: the queen, male drones, and workers. The queen is the primary reproductive female, and drones are males whose principal function is to mate with virgin queens.

Caste	Principal role	Reproductive position
Queen	Lays eggs and maintains colony reproduction	Fertile female; mates with multiple drones
Workers Drones	Mate with virgin queens, Forage, nurse brood, defend, and maintain the hive	Male reproductive

The queen mates with several drones during a brief mating period and stores their sperm for future egg-laying. Fertilized eggs normally develop into female workers or queens, whereas unfertilized eggs develop into male drones. This reproductive division of labor allows the colony to allocate labor efficiently: the queen specializes in reproduction, while workers specialize in productive and protective tasks.

Mating Rights and Reproductive Rewards

Our viewpoint is that, in the bee colony, mating rights are normally distributed to worker drones as a reward for labor. The mating opportunities are concentrated among worker drones, whose reproductive role is specifically to mate with virgin queens. From an economic perspective, however, access to reproduction may still be treated as a scarce reproductive asset. For drones, the opportunity to mate with a queen represents a potential reproductive return. For workers, the return is usually indirect: by supporting the queen and rearing her offspring, they improve the reproductive success of genetically related colony members.

Thus, reproductive access may be understood as a form of **reproductive entitlement**. It links individual effort to evolutionary payoff, although the payoff differs by caste:

- Drones may receive a direct reproductive return through mating.
- Workers receive an indirect genetic return through the survival and reproduction of relatives.
- The queen receives the direct reproductive return by producing the colony's offspring.
- The colony as a whole benefits from a more efficient division of labour and greater collective productivity.
- Incentive Compatibility and Labor Allocation

The colony may be interpreted as an evolutionary economy based on labour allocation, incentive compatibility, and reproductive rewards. Worker bees supply labour in the form of foraging, brood care, hive maintenance, and defense. Their labour increases the queen's reproductive output and the survival probability of the colony's young.

In exchange, workers receive indirect fitness returns rather than wages or mating rights. The system resembles a performance-based compensation arrangement only in a broad analogy: effort is associated with reproductive returns, but the returns are transmitted through shared genes rather than through an explicit contract.

The expected return from cooperation depends on genetic relatedness. When workers are closely related to the queen's offspring, helping the queen can yield a high indirect genetic return. When relatedness is lower, conflicts over reproduction may become more likely. Queen pheromones and worker policing help suppress excessive worker reproduction and preserve colony cohesion.

Property Rights Analogy

In a conventional property-rights system, ownership may include the right to income, the right to transfer assets, and the right to control use. In the bee colony, the analogous "assets" are reproductive access, genetic lineage, and the colony's common resources.

The queen controls much of the colony's reproductive output, while workers contribute labour to the common-pool resources of nectar, pollen, and brood care. Drones possess a limited claim to reproductive access through mating opportunities. This arrangement may be described as a mixed system of private incentive and collective ownership:

- The queen holds a concentrated reproductive claim.
- Workers hold indirect genetic claims through relatedness.
- Drones hold a direct claim to mating access.

- The colony collectively owns and manages food stores, brood, and hive infrastructure.

Under this analogy, the collective outcome generates positive externalities. A worker's labour benefits not only itself but also its relatives and the colony. Conversely, the colony's shared resources reduce the transaction costs of survival: individual bees do not need to search independently for food, build separate nests, or raise offspring alone.

Why Collective Systems Fail in 60's but the bee's queendom does not fail

The contrast with human collective villages is important. In many human collective systems, individuals and family units may retain distinct interests. If individuals can reduce effort while still receiving a share of collective output, incentives to work may weaken. This creates a free-rider problem: some members minimize work while maximizing consumption, causing the collective system to deteriorate.

The bee colony differs because reproductive incentives are structured around genetic relatedness and a specialised reproductive division of labour. Workers do not merely serve an abstract collective; they assist relatives whose reproductive success can indirectly propagate their own genes. Moreover, queen pheromones and policing mechanisms opportunistic reproduction by workers.

Therefore, the sustainability of the bee colony does not depend on the assumption that every individual acts selflessly. Rather, it depends on an institutional and evolutionary structure in which individual incentives, genetic relatedness, and collective productivity are aligned.

Mechanism Behind the Bee's Colony

The underlying mechanism is not conscious bargaining. Bees do not negotiate wages, mating contracts, or property rights. Instead, natural selection has shaped behavioural and physiological mechanisms that produce incentive-like outcomes.

The bee's queendom mechanisms are:

- **Kin selection:** Workers gain indirect genetic benefits by helping relatives reproduce.
- **Inclusive fitness:** Cooperation is favoured when its genetic benefits to relatives exceed its cost to the individual.
- **Reproductive division of labour:** The queen reproduces, workers-drown perform productive tasks, and mating opportunities.

- **Queen pheromones:** These regulate worker reproduction and help maintain colony cohesion.
- **Reproductive policing:** Workers can mating with Queen, that provide reproductive opportunities
- **Common-pool resources:** Shared food stores and cooperative brood care lower the individual cost of survival and reproduction.

The bee's queen colony demonstrates that collective contribution and collective outcome can be combined with self-interest. What appears to be altruistic service to the queen may be driven, at a deeper evolutionary level, by the indirect self-interest of propagating shared genes.

The colony persists because it converts individual labour into collective resources, collective resources into reproductive success, and reproductive success into the continuation of genetic lineages. In this sense, the bee colony is an evolutionary economy: labour is allocated through a reproductive division of labour; reproductive access is a scarce reward; genetic relatedness determines the expected return from cooperation; and inclusive fitness measures the broader evolutionary profitability of collective action.

The Relationship Between Private and Public Interests

The law of the bees shows that private and public interests should not be treated as permanently conflicting principles. Private property rights can advance the public interest when they encourage people to account for the consequences of their decisions, invest in valuable resources, and exchange services voluntarily. Clear rights and low transaction costs can allow self-interested actors to discover mutually beneficial arrangements.

At the same time, the public interest requires attention to outcomes that private markets may overlook. Where the benefits of pollination are widespread, where environmental harms affect third parties, or where negotiation is costly or impractical, collective action becomes necessary. Government intervention is not necessarily a rejection of markets; it can be a means of creating the legal and institutional conditions under which markets work better. But over government intervention may also have the opportunities lead to the market failure, so, a small government in a big market is a necessity.

The best approach is therefore an implicit interest with the explicit outcome behavior. So, it is an institutional interpretation which combine with the combination of property rights, contracts, regulation, information, and collective action best aligns private incentives with social welfare.

Conclusion

The law of the bees provides a clear illustration of the relationship between property rights, externalities, self-interest, and public interest. Bees create valuable pollination services while seeking nectar, just as economic actors may generate benefits for others while pursuing private objectives. Yet, without mechanisms to reward those benefits or charge for related harms, market outcomes may be inefficient.

Property rights and voluntary contracts can internalize many externalities by enabling farmers and beekeepers to bargain over pollination services. This supports the Coasean insight that self-interest, properly channelled through clear rights and low-cost exchange, can produce mutually beneficial and socially valuable outcomes. Evidence from contractual arrangements in the beekeeping industry demonstrates that real markets may develop institutions to manage apparent externalities.

Nevertheless, private bargaining cannot solve every problem. Ecological spillovers, free-riding, high transaction costs, unequal bargaining power, and the interests of future generations justify a continuing role for public policy. The most effective approach is one that respects the coordinating role of markets while recognizing the need for collective institutions where private incentives diverge substantially from social welfare. In this sense, the law of the bees teaches that a healthy economy depends not only on individual freedom but also on rules that connect private action to the wider public good. This is **"Serve the Bee Queen with collective contribution and outcome."** Hope our paper can contribute to the world and society.

References

- Wei Li and Dennis Tao Yang (2005). The Great Leap Forward: Anatomy of a Central Planning Disaster. *Journal of Political Economy*, Volume 113, Number 4.
- Cheung, S. N. S. (1973). The fable of the bees: An economic investigation. *Journal of Law and Economics*, 16(1), 11–33.
- Coase, R. H. (1960). The problem of social cost. *Journal of Law and Economics*, 3, 1–44.
- Johnson, D. B. (1973). Meade, bees, and externalities. *Journal of Law and Economics*, 16(1), 35–52.
- Meade, J. E. (1952). External economies and diseconomies in a competitive situation. *The Economic Journal*, 62(245), 54–67.
- Posner, R. A. (1998). *Economic analysis of law* (5th ed.). Aspen Law & Business.