Enough for All Forever

A Handbook for Learning about Sustainability

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COMMON GROUND

Sustainability

Chapter 11

A Fair Share of the Information Commons

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The issue

Human culture is based on information, as is all economic production, making information essential in attaining virtually all desirable ends. What types of new information would generate the greatest improvements in human welfare at the lowest cost? While this is inevitably a somewhat subjective question, certain issues that dominate the global headlines seem to suggest some likely answers, especially those that are necessary for basic well-being: energy, food, biological diversity, water, shelter, sanitation, and medical treatment, to name a few.

Information has some unique characteristics. Unlike most other goods and services, it is neither rival (use by one prevents use by others) nor non-rival (use by one does not affect use by others), but is 'additive' (enhanced with increased use). Therefore a unique allocation system for both the production and consumption of information is needed. Under the current market-based allocation system, production of information is often limited through the exclusive rights produced by patents and copyrights. This limits scientists' ability to share and build on each other's knowledge.

In this chapter we discuss the special characteristics of information as a type of *commons* that needs special institutions to manage its production and use effectively and create greater overall economic efficiency, social justice and ecological sustainability. These methods include monetary prizes, publicly funded research from which the produced information is released into the public domain, and status driven incentive structures like those in academia and the *open-source* community.

Distribution of Information

Markets privatize knowledge through intellectual property rights (IPRs) in the form of patents and copyrights. As a resource, information has unique characteristics that affect its allocation. Conventional market resources are rival, or subtractive: one person's use leaves everyone else less to use. For example, if one person cuts down a tree to build furniture, it is no longer available for someone else to build a house. Information is a different type of resource. If one person uses information, it does not leave less for anyone else to use. No matter how many people read this paragraph, there will be no less information left for anybody else. Economists refer to such resources as *non-rival*. However, the resource of information is not just non-rival, but actually improves through use. The term *additive* can be used to describe a resource that improves through use. After reading this chapter you may develop new and better ideas from which we may all benefit in the future. Hence, IPRs provide incentives for the production of information, but in exchange create artificial scarcity and inefficiencies in consumption for the duration of the patent or copyright.

Most economists assume that markets reveal the desired ends through market demand as manifested in purchase decisions, then efficiently allocate the scarce resources necessary to achieve those ends. But what is economic demand? Economic demand is preferences weighted by income, implying that those with no income have no demand. For example, this implication states that very little demand exists for life saving cures for contagious diseases that affect poor people since they do not have the income to pay high prices for those cures. Economic markets also only reveal demand for marketed goods and services. Only privately owned goods and services can be marketed, making private property rights a pre-requisite for conventional markets to function. However, many important goods and services are, in practice, *non-excludable* and cannot be effectively privately owned. For example, if a technology to restore the ozone layer is developed, the use of the restored ozone layer cannot be restricted to individuals who pay for its restoration. Within such a system, no market incentives exist to pay for the services, therefore no market demand is created for such services. Conventional economic markets therefore lack the incentives to create information required to cure contagious diseases affecting the poor or to preserve ecosystem services.

An example can clarify how markets are the primary decider on which information to produce and how to allocate it. Some exceptions exist around the production of information by non-profits or non-governmental organizations when they put that information into the public domain. In the 1970s, Aventis, a pharmaceutical company, began developing a compound called eflornithine as a potential anti-cancer drug. During the development process the drug was also found to remove hair and treat human African trypanosomiasis (HAT), or African sleeping sickness, a contagious and debilitating disease endemic in Africa. However, when in 1995, the drug was found to have no affect on cancer, Aventis halted production including the forms of the drug that cured sleeping sickness. At the time, much of central Africa was war-torn, the population requiring the drug was unable to pay for it, meaning that no economic demand existed, so Aventis had no interest in producing it. A few years later another pharmaceutical company, Bristol-Myers Squibb (BMS), began producing a form of this same compound as a facial hair removal cream for women. This again created an economic demand because now rich women were willing to pay large sums for this cream. Once the production resumed, the World Health Organization (WHO) and Doctors Without Borders were able to convince BMS to donate 5 years of the drug to patients in Africa, this move also persuaded Aventis and Bayer to donate $5 million a year for monitoring, treatment, and research and development. Patents on drugs and surgery related techniques and technologies have become increasingly popular in the past two decades. Since 1988, over 145,000 patents have been granted in the United States alone on drugs and bio-affecting and body treating compositions. Net sales and expenditures by the companies have also increased in the past decade. In 2007 alone, net sales from pharmaceuticals and medicines were over $350 billion.

This example shows how economic market forces can allocate scientists' efforts towards producing luxury goods instead of basic necessities for the poor. Scientists, unlike information, are a rival resource, if one is hired to develop cosmetics for the rich, that person is no longer available to work on life saving cures for the poor. Although economic markets are accepted as the deciding mechanism for society's desired ends, if asked directly, most of the population would presumably rank developing life saving cures as a more desirable end for society than removing women's facial hair.

So why is the allocation of information important and why is it a tragedy if not allocated correctly? When the current economic paradigm was originally created, with its assumptions and conventions, material wealth was the limiting factor to improving well-being. That has now changed in many countries, where there is an excess of material goods, but a poor distribution of those goods and a dearth of social and natural capital. This has become a global problem that requires global information exchange to solve. And yet this paradigm has persisted due to a lack of alternative options and the benefits it provides to a key minority. We are now using the market to deal with completely different problems, and need information that is no longer revolving around material production and consumption, but around solving global public goods problems on the social and natural level, such as climate

change, biodiversity, and water scarcity. The development and the allocation of this type of information for a greater social good has a different level of responsibility associated with it. It requires that the focus be placed on the social good instead of the private gain.

Society increasingly relies on markets to produce and allocate information; at the same time, society also faces a number of serious problems that may be unsolvable without new information to generate new technologies. For example, many experts believe that if we fail to reduce CO_2 emissions by less than 80%, atmospheric carbon stocks will continue to climb, resulting in runaway climate change and ecological catastrophe. However, our society is currently so dependent on fossil fuels that reducing emissions by 80% could result in mass starvation and economic collapse.

Unfortunately, intellectual property rights (IPRs) are unable to solve these types of problems. The changing nature of the problems that the global society faces has increased the disadvantages of using conventional markets to produce and allocate information. The value that is placed on patented technology disregards whether that technology destroys half of the world's forests, kills thousands of people, or pollutes our air and water. It has no way to encourage technologies that generate more human wellbeing by using fewer resources, conserving ecosystem services, and generating less waste. The market is unable to meet society's desirable ends and creates a system that encourages competition instead of collaboration, decreasing the opportunity for innovation. Alternative institutions may be better equipped for managing the flow of information, ones that focus on the social good instead of the private gain. Information should therefore be managed as a global public good, or a *commons*.

Information is also not the only resource that is in jeopardy because of the use of the economic market for its allocation. Another such resource is the services that ecosystems provide that are essential to all life on Earth. When dealing with ecosystem services, the market assumes that they are just another good that can be traded. Private property rights establish a scheme in which buyers and sellers can exchange parts of an ecosystem through changes in land ownership. However, because of the nature of ecosystem services, they benefit not just the owners but the surrounding, if not the global, population. The owners are free to utilize the ecosystem in any way they see fit, with no regard to the social good. Hence, many use those ecosystems to enhance their own personal economic welfare. For example, privately owned forests are often cut down, sold for the timber, and made into agricultural land. This takes away from the social good as it eliminates a key aspect of global carbon sequestration. Landowners receive no compensation, nor any other incentives, to continue providing the ecosystem services. Hence they tend to be underprovided.

Alternative allocation mechanisms

Because the market is unable to properly allocate resources towards public goods that are most likely to be the desirable ends in today's world of climate change, fossil fuels, water scarcity, etc, alternative incentive and allocation mechanisms are required. Throughout history, various incentive schemes have been used to successfully encourage development of specific technologies or solutions to specific scientific problems. Here we review some of these systems and proposed some new ones.

Prizes

One of the most popular alternative allocation methods has been rewarding innovations with monetary prizes and then releasing the information into the public domain. Examples of these include: France offering a prize for the development of the workable water turbine in the seventeenth century; a century long reward, around the same time, for the development of a method to calculate longitude while at sea; or more recently, a prize for creating the 100 mpg car. The use of monetary prizes as an incentive to develop specific information has certain advantages over the use of intellectual property rights. It allows society, and not just the market to decide on which innovations would be most beneficial. Because corporations would be rewarded monetarily through the prize, patents would no longer be necessary on the innovations, allowing the information to be released to the public domain and utilized by more researchers. However, this approach does fail to address the issue of firms competing for a prize instead of collaboratively working together during the production process, thus creating some inefficiency during the process.

Non-monetary incentives

Certain industries do not use monetary incentives as a reward structure. Open source software has recently re-emerged as a strong competitor to patented software and in certain circumstances significantly exceeds its quality (e.g. Firefox vs Internet Explorer). Within this open source community and many academic fields, a type of incentive structure exists based on an individual's reputation amongst his or her colleagues for contributions to the field. This system rewards participants based on how quickly discoveries are made and how quickly they are published within the community. It is typically protected by a Creative Common (CC) license or copyleft. This means that anyone can use and alter the work, however, the original creator has to be given attribution and all subsequent work has to remain protected under the same license, and can never by patented or placed under conventional copyright.

In academia, mathematical theorems cannot be patented, and yet many mathematicians continue to work on their development. The extent of the reward given to an academic working within this system is determined by the community as a whole. The community assesses the quality of the discovery, after its publication, on the criteria of how much it benefits that

community and how much it furthers that community's knowledge. The rewards may be monetary in the form of a promotion but commonly consist of such things as honorific awards, positions at more prestigious universities, tenure, large citation numbers, colleagues' esteem, and overall status. The size of the reward is dependent on how much the discovery benefits the community, or in other words, how much it advances the community's efforts towards a single goal or vision. This communal vision is established not by the market but by the community as to what the most desirable ends are.

Besides advancing knowledge in the entire community, the act of publication also serves two other purposes. First, it ensures that the discovery does not remain within the confines of a group which may not have the resources or ability to utilize that discovery to its fullest. Second, it allows for peers to evaluate the discovery, significantly minimizing the opportunity for errors. However, once a discovery is completely disclosed to the community through publication, it becomes simple for others to copy portions of the published work and claim to have also independently done the research. Consequently, academia does not reward second place discoveries, encouraging academics to collaborate instead of competing to discover and publish first.

Capping salaries

Historically, inventors worked independently in either the pursuit of profit (e.g. Thomas Edison) or to contribute to the public good (e.g. Nikola Tesla). Today, the majority of scientists work within the private or public sectors, with defined salaries. The rights to any patents they procure are assigned to the organizations that they work for, eliminating much of the incentives for the individual scientists to research one type of information over another. By capping salaries amongst the different sectors, scientists would have no incentive to work for corporations such as Bristol Meyers Squibb over the National Institute of Health. A natural cap could be forced by taking away the right of major corporations to patent drugs that are beneficial to society. Through their choice of organizations, scientists would have the discretion of deciding on how the results of their research were to be utilized. By offering competitive salaries, the government would have the opportunity to promote the type of research most beneficial to society.

Research consortium

A global research consortium should determine appropriate technologies for alternative energy, agroecology, green chemistry, industrial ecology, and so on in collaboration with those who would use them. These new technologies could be *copylefted* (as opposed to *copyrighted*), meaning that they are freely available for anyone to use as long as derivative products are available on the same terms. This would allow the consortium to determine that the research priority included finding an alternative, clean source of energy, protecting the ecosystem services, managing fresh water efficiently, or feeding the world's hungry. This institution would consider the global wellbeing of the population instead of purely economic demand.

The US Department of Energy, which oversees the US's energy sector, is beginning to move towards this form of research with the establishment of what they are calling Energy Innovation Hubs. The hubs will "foster unique, cross-disciplinary collaborations by bringing together leading scientists to focus on a high priority technology." The one downfall of these hubs is that when a new technology is ready to be released to the public, it will be handed over to private industry to patent and market. Although the innovation out of these hubs has the potential to solve many of our global problems, placing it into corporate hands only allows this technology to be distributed to the rich.

Publically funded research

Potential also exists to move away from the market in funding certain types of research. In the 1950s and 1960s the US government funded much more than half of all research and development, but by 2006, it funded only 28%. By increasing the proportion of publicly funded research and placing all information obtained through publicly funded research into the public domain, monopoly pricing on this technology would no longer be an option, creating both open information and competition for further advancements, two critical aspects to the proper functioning of the market. It would also eliminate 'me too' research, using resources more efficiently. Taxpayers would still be required to fund further advancements in research through the price of goods, however, that price would be set by a market instead of by a single corporation. Patents also create a strong incentive to research information that can be potentially commercialized instead of basic research or applied research that provides and protects public goods, which has historically been an important resource for other researchers in both the public and private sectors. Placing information into the public domain would take the focus away from items that can be commercialized and refocus research on areas most necessary for solving society's problems.

Large governmental grants can also be used to bring together top researchers in specific fields from multiple corporations, universities, and governmental agencies to work together toward common goals. Besides placing the smartest people on a certain topic together to exchange ideas, it would also create collaboration between different institutions and avoid the competition that usually occurs. The information produced would be released into the public domain, allowing the entire world, including developing countries, to benefit. Such systems were used to spur both the Green Revolution[1] and to get humans to the moon, creating remarkable scientific advancements in short periods of times, and in one case deterring a mass famine.

1. The Green Revolution occurred between the 1940s and late 1970s. It was a series of research, development and technologies developed to improve agriculture production internationally.

Additional public funding for R&D could be made available through the taxing of certain excludable goods within specific industries. As an example, the computer industry has been having significant difficulties in stopping the pirating of software. Software, due to its nature, should not be an excludable good because after it is developed, the creation of an additional copy has insignificant marginal costs associated with it. This creates a significant social inefficiency. If a system were established in which the hardware was taxed and the revenues used to fund software development that was provided freely to the users, this would eliminate the social inefficiency. Similar taxes can be placed on the energy industry. Technologies based on fossil fuels and use of the fuels themselves could be taxed (or permits auctioned) and that money could be directed towards the development of alternative energy technologies. Such a tax would have multiple advantages, including the reduction of greenhouse gas emissions.

Conclusion

Goods and services that improve with use, such as information, require alternative incentive structures. Although market-based allocation systems have the advantage of providing incentives to create new information, they fail to correctly determine what information needs to be produced to reach society's desired ends or how that information should be allocated once it is produced. With consumptive goods no longer necessary to improve wellbeing, but information that improves and protects global public goods, such as climate, oceans, etc, being a requirement, a different allocation system is required for both the production and consumption side of information. Since information is the basis of economic production, common ownership of information would significantly increase information transfer and produce a greater rate of innovation. It will also provide a means of allocating information towards the desirable ends of society and the common good by allowing a larger number of scientists and researchers access to the information.

Thinking it through: where do I stand?

What types of licenses exist for information? What is the difference between copyrighting and copylefting? What are the most popular licenses?

When you download information from the Internet do you know what kind of license it is under? What kind of license is Wikipedia under? What about some of your other favorite websites?

Action: what can I do?

Find out what information license your school and city websites are using. Does this license all the audience you are targeting to access it? Which license would work best for the information's intended purposes?

Further reading

Kubiszewski, I., Farley, J. & Costanza. R. (2010). The production and allocation of information as a good that is enhanced with increased use. *Ecological Economics, 69*, 1344 – 1354.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Naeem, S., Limburg, K., Paruelo, J., O'Neill, R.V., Raskin, R., Sutton, P. & van den Belt. M. (1997). The value of the world's ecosystem services and natural capital. *Nature, 387*, 253 – 260.

Hardin, G. (1968). The tragedy of the commons, *Science 162*, 1243 –1248.

Resources

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