

Draft

Studying Abundance

by Roberto Verzola

It has been recognized for some time that the dynamism of the information economy comes from the diminishing cost of reproducing and transporting the next unit of an information good.¹

This incremental cost (“marginal cost”, to economists) is diminishing not only for software, databases, videos, music and other pure information goods but also products with significant information content. As more and more people acquire access to the Internet and to tools that can reproduce information on various media, the diminishing marginal cost of information goods is bound to become a universal phenomenon.

With the marginal cost of reproducing and transporting information approaching zero, two major and contradictory consequences emerge.

Sharing freely leads to information abundance

First consequence: information now tends to be shared more freely, enhancing the altruistic tendencies usually present in most people. If my neighbor will benefit from the information I have, and I will not lose anything in sharing that information, I will more willingly share it. Perhaps, he will also do the same for me. This key feature of information – that one does not lose it when one shares it – is a strong driving force towards greater sharing. This urge to share information goods freely is so powerful that ordinary people apply it even to commercial software, regardless of what laws say.

The nearly zero cost of reproducing and transporting information is the source of what may be called an emerging abundance in the information sector. This abundance can be seen in the sheer variety and volume of information available on the Internet, much of it for free.

IPRs create artificial scarcity

Second consequence: as its marginal cost approaches zero, the price of the information good becomes nearly pure profit, promising information sellers much greater potential return on investment. This is especially true if the initial price of the information good can be maintained, rather than be allowed to go down to the level of its marginal cost, as conventional economic theory says it should in a competitive market. Indeed, under current legal regimes, information prices are maintained through a system of intellectual property rights (IPR) such as copyrights and patents which take away the people's freedom to make copies of information goods. In effect, this creates an artificial scarcity of information

1 U.S. Congress, Office of Technology Assessment. *Intellectual Property Rights in an Age of Electronics and Information*. OTA-CIT-302. Washington DC: U.S. Government Printing Office, 1986. p.24.

goods, enabling the information sellers to maintain prices above marginal cost. The promise of abundance is broken by means of artificially-created scarcity.

The creation of artificial scarcity through a system of patents and copyrights is usually justified as a way of ensuring the continuous creation of knowledge. Remove IPR, it is claimed, and creativity will suffer, intellectual activity will grind to a halt, and the flow of new knowledge will stop. This argument has been cited to justify the increasingly draconian measures being taken to prevent the copying of information goods. Today, the single biggest obstacle to the full realization of abundance in the information sector is the legal system of IPR.

There is no better counter-argument to the above claim than the dynamic generation of knowledge now occurring under the general banner of the free/open source movement, which has expanded its reach from software to publishing, databases, literature, the arts and other information and cultural fields. Advocates of the free sharing approach argue, in fact, that their approach is more conducive to the generation of new knowledge than the highly restrictive, secretive and contentious attitude fostered by IPR systems. Indeed, the most actively used services on the Internet are those which are freely available and whose guiding principles include the philosophy of sharing.

Anything that can be transformed into bits and stored in digital media is an immediate candidate for abundance. Posting it on a publicly-accessible Internet site for anyone to download makes it instantly available worldwide. People without Internet access can simply ask a friend to download it for them. What is true with digitized information is to some extent also true with books, paintings, analog audio and video, and other non-digitized information. But it is the digital approach that makes possible the unlimited and error-free reproduction of information over any number of generations of copies.

Other forms of abundance can be seen in the information sector, all feeding into the abundance of information that has become possible through digital electronic technologies.

Silicon. Moore's Law says that the power of computer chips would double every two years or so.² It remains true today. The integrated circuits that lie at the very core of today's digital revolution are made of silicon. Since silicon comes from sand, and it is also a recyclable metal, we will not be running out of silicon for a long, long time.

Bandwidth. Today's communication circuits are migrating from copper to optical cables, whose bandwidth capacity are order of magnitudes greater. Optical cables are made of glass, which is also made of silicon.

Storage. Magnetic media, optical media and even electronic media like flash disks continually increase their capacity, faster than we could fill them up. Storage is so cheap nowadays that the mail services of Yahoo and Google essentially give them away for free.

Spectrum. By reducing their power, transmitters free up more of the radio spectrum for other transmissions. The dramatic reduction in cost of electronics has trickled down to older technologies

2 Charlie Rose. "Interview with Gordon Moore". 2005. <http://www.decodesystems.com/moore-interview.html>.

like radio broadcasting. It is now possible to set up a low-power FM station for about the cost of a laptop, making this medium much more accessible to civil society groups and people's organizations. This new abundance in the broadcast spectrum remains mostly inaccessible because of highly restrictive laws.

IP numbers. These are the equivalent on the Internet of private telephone numbers. The scarcity in Internet Protocol (IP) numbers should soon be a thing of the past as more and more servers migrate to next generation protocol (IPNG), which can assign hundreds of IP numbers to every person on earth with a lot to spare.

Abundance among living organisms

Abundance is not exclusively confined to the information sector. It can be found in the biological sector too. Abundance in nature and, by extension, in agriculture, comes from the built-in urge – genetic program, if you will – in every organism to reproduce its own kind and thereby ensure the survival and continuity of its species.

Whenever goods consist of living organisms that inherently reproduce themselves, we find potential for abundance. As long as we manage to keep those biological processes going, we will continue to enjoy the blessings of such abundance. Earlier generations knew this, and their cultures are replete with the concepts of stewardship and caring, respect for nature, love for the forest, the land and the soil. Nature responded in kind, and rewarded earlier generations with its bounty.

Often, no effort is needed at all to make living organisms abundant, since they reproduce and multiply on their own. The key is to be aware of what the favorable conditions are, and to avoid doing anything to disrupt these conditions. If you leave any piece of land by itself, in a few years it will be teeming with plant life. In a few decades, it might have grown a forest. If you dig a pond and simply leave it alone, it will sooner or later be filled with rainwater, and algae will soon grow in it. In a year or so, without human intervention, it will have fish on it. In a few years, it will be teeming with aquatic life. Abundance in the natural world is a living force that continually asserts itself.

But if you put poison in the soil or the water, then of course you will undermine its potential for abundance. Indeed we are putting into our soils and waters substances which we don't even recognize as poisons.

Ecological abundance expresses itself in the following:

The food web. In a finite world, nothing material can grow indefinitely. Living organisms manage to multiply endlessly, only because they have formed among themselves a food web. In this web, one species feeds another, the wastes of some species are themselves food for other species, and every species eventually reaches a dynamic balance with the rest of the living world. Nature maintains abundance indefinitely through its closed material cycles. This provides valuable lessons for humans, if we want to enjoy a similar material abundance of manufactured goods for ourselves, without

suffocating in our own emissions, drowning in a flood of effluents, or getting buried in mountains of wastes.

Agriculture. Human civilization remain part of the living world, in so far as we take our food from it, we breathe its air and drink its water. Thus, we need to master how to keep this living abundance flowing. Nature has shown us the way, we just need to become aware of its own methods and processes of maintaining abundance. Organic farming is showing us how poisons can be eliminated from our farms and how our soils can be regenerated. Permaculture is showing us how, through conscious ecological design, using plants and animals as farm components, we can grow forests and ponds of food and cash crops. Biodynamic farming is, in addition, showing us how to grow high-quality foods that tap the life-forces of the universe.

The basic foundation of any agricultural abundance is the soil. Millions of organisms exist in a single clump of healthy soil, including decomposers and nitrogen-fixers, the true fertilizers of the soil. It is this abundance of soil life that feeds the plant – the basis of the organic dictum that one “feeds the soil, and the soil feeds the plant”. What do you feed the soil with? Organic matter, of course, not chemical fertilizers or biocides that kill these soil organisms and eventually make soils virtually sterile and lifeless.

Work animals. The carabao (Asian buffalo) not only serves as the farmer's super-human source of pulling and carrying power, it provides in addition an abundance of milk as well as of manure. Best of all, this source of motive power can reproduce itself every year or so, so that more farmers may have access to its abundant benefits.

Mother's milk. Of course, nature is prepared to nourish its young. For mammals like us, food is milk, and mother's milk is for babies. It is not only complete as baby's food, it also includes complete protection against various diseases and even serves as a mild contraceptive. Incredibly, millions of mothers miss or ignore this obvious fact. Unethical advertising and pressure from hospitals and doctors have made them abandon this priceless gift from their own bodies, a free bounty from nature and the best for their child, in favor of expensive commercial formula which they must buy from the market, spend sleepless nights preparing, and may furthermore contain questionable substances that can lead to ill-health.

Nature's pharmacy. Over thousands of years, humans discovered an abundance of medicinal plant and animal extracts which their healers and medicine men and women used to restore the human body and mind to balance. Though much of this knowledge has been lost, enough indigenous peoples and herbalists around the world have retained in their native lore knowledge of the medicinal properties of various extracts.

More examples of abundance

Abundance asserts itself not only in the information and ecological sectors. Various manifestations of this phenomenon can also be seen in other sectors as well, including the energy sector and the sector of materials goods.

Energy. It is obvious, though easy to take for granted, that our most abundant source of energy is the sun. Even fossil fuels, which enabled human civilization to enjoy for a few hundred years a temporary spike in energy consumption, represent solar energy captured by biological processes millions of years ago. Through the process of photosynthesis, solar energy drives the biological processes of reproduction and growth that is the source of abundance in the living world. However, for all our vaunted intelligence, we humans have not yet been able to develop processes and technologies that can economically and sustainably do the same. Solar energy remains a backwater of energy R&D, and we remain dangerously dependent on fossil fuels for much of our energy requirements especially for transportation and electricity.

Land. Unlike living organisms, land neither grows nor multiplies. There is only so much arable land, and as the human population grows, relative scarcity threatens. Yet even in this situation, it is still possible to ensure a relative abundance of land for all. Breaking up through land reform huge tracts of land owned by one or a few families, and distributing these to hundreds or thousands of landless families, can give each family an economically-viable piece of land for cultivation and agricultural production. Such mechanism even has a Biblical precedent: the jubilee year, when all slaves are freed, debts forgiven, and land redistributed to give each family a piece for its own. With the proper approach, relative abundance can still be created out of relative scarcity. Gandhi said it best: “there's enough for everyone's need, but not for everyone's greed”.

Water. As in land, relative scarcity can also become a problem in water, but with a subtle difference. Land can be subdivided and parcelled out because plants mostly stay where they are. But fish swim around, so a river or a lake has to remain communally owned, or a “common pool resource”. Where fish have dwindled due to overfishing, communities have imposed measures such as banning commercial fishing in the area, or banning the use of nets, to allow the fish to regenerate and return to their prior state of abundance.

An abundance of happiness. Even the poor can enjoy an abundance of happiness, if we are to believe research on happiness indices and international surveys on the happiness levels of different countries.³ A psychic kind of abundance cannot be easily attributed to the availability of information, energy or matter, but to a state of mind. This can be of an emotional kind, such as joy, love, or peace or it can even be of less definable variety – what some would call spiritual. We have come to a line that many scientists hesitate to cross. They shy away from studying such phenomena, although these are as much a part of reality as the other types of abundance.

Abundance as a field of study

Because abundance is clearly present in many aspects of human life, it is obviously an interesting phenomenon and its study should logically be a major field of study. Yet, economics practically denies abundance, defining itself as the study of efficient options in the context of scarcity. Economists often say that when a good starts becoming abundant, it stops becoming interesting, because the economic problem has been solved. If indeed, abundance is recognized as the solution to

3 Nora Schultz. “Why the world is a happier place”. *New Scientist*. August 27, 2008.

<http://www.newscientist.com/channel/being-human/mg19926714.100-why-the-world-is-a-happier-place.html>

the problem of scarcity, shouldn't it be studied even more? Shouldn't we learn the conditions that lead to abundance, and the conditions that keep it going? Shouldn't we acquire the knowledge and skill to generate abundance at will? Shouldn't we master the art and science of making one form of abundance create another, and another, leading to a cascade of abundance?

Abundance is simply one end of a continuum that has scarcity at its other end. Obviously, anything that is relatively scarce is, at the same time, relatively abundant. For completeness and by any form of logic, the entire continuum should deserve our attention and study. We need a new economic science that studies both scarcity and abundance.

In fact, many of the questions raised here go beyond the realm of economics. They need a multi-disciplinary approach that includes expertise from the social, natural and physical sciences. Indeed, the questions raised by a study of abundance are worthy scientific challenges.

Let us apply our new-found awareness and curiosity about abundance and make the first step towards studying it. Let us see how abundance may be classified..

Classifying abundance

Abundance may be classified in various ways, each way revealing additional facets about the phenomenon and giving us hints about tapping it for the human good. For instance, abundance may be classified according to:

Space. Is it, like a waterfall, available to a few communities only? Local sources need local management, where face-to-face interaction between acquaintances may ease the tension of resource conflicts. In fact, many resources are actually local, though nation-states have appropriated these for themselves and turned them into national patrimony. The Regalian doctrine that favor national over local control of resources is, in many countries, vestige of their colonial past. The continuing debates between local and national decision-making in the case of forests, dams and mine sites reflect this ongoing tension between local and national management of sources of abundance. This conflict becomes every more complicated with the entry of corporations, who range the globe for resources to tap until these are depleted and move on. Some sources of abundance, like seas and great rivers, bring benefits to more than one country, and therefore require even more delicate and sensitive negotiations. Resource conflicts may erupt into wars, especially with resources which are being gradually depleted. The truly global sources of abundance, like our atmosphere and the oceans, require complex international management, as can be seen today in the climate change negotiations. Each of these types need skill and knowledge not just in the scientific aspects of abundance but in a whole range of areas that include political, economic, social, cultural and historical perspectives.

Negotiations between potential beneficiaries and other stakeholders involving spatially-limited abundance can be highly unequal due to existing assymetric power relations. This is even truer in the case of abundance that is spread over the time dimension, as explained below.

Time. Is the abundance precarious? Precarious abundance is one whose collapse is imminent

and might be gone soon, and we had better do something about it quickly if we want to continue enjoying its benefits. Is it temporary? This would refer to phenomena that last for less than a human lifetime, perhaps a gold rush in some mountainside, or a discovery of a huge pile of guano in an isolated island or cavern. Will it last for a few human lifetimes? Then it is a short-term abundance, like oil is turning out to be. If it will last many lifetimes more, then it is a medium-term abundance, like, possibly, coal. Forests, rivers, lakes, inland seas and other long-term sources of abundance should last beyond human existence. But because of our own profligacy, ignorance or indifference, these long-term resources have instead been turned into short-term resources that will be gone in a few generations. This are huge challenges, which should be of interest to all. How do we stop a precarious resource from imminent collapse? How do we turn a temporary abundance into a long-lasting one, that can serve not only a few but many generations, if not every generation that is yet to come. The seventh generation principle of native American Indians, it is said, reckoned decisions in terms of their effects up to the seventh generation.⁴ Shouldn't we, given the greater power of our technologies, look even farther into the future?

Future generations cannot negotiate for themselves. Neither can plants and animals. Thus, some humans must take up the cudgels for these voiceless stakeholders. Negotiating for access is hard enough when a resource is abundant, how much more when it becomes scarce, and furthermore, one has no voice? This situation demands not only the utmost of cross-species and cross-generation empathy from us but also the deepest appreciation of the interconnectedness of generations and species.

Social sectors. Certain types of abundance are accessible to all, other are accessible only to those who have the wealth to exploit them. When the sun is up, poor and rich alike can enjoy the tan, the warmth and the Vitamin D. Anyone can set up a solar water heater, a solar food cooker, or a photovoltaic panel. But only corporate giants can access the oil and gas within the deep bowels of the earth, and the process these into the various fuels they need. It should thus be obvious which abundant energy source should receive the highest priority in terms of government research, subsidy and preference.

Across species. Appropriating the world's abundance exclusively for the human is a utilitarian perspective that is increasingly under question. A less anthropocentric view concedes the right of other species to exist, and therefore to survive. It further concedes other species the right to their own living space, a concession that everyone must eventually make, if not for the sake of these species, then also for the sake of future generations. This explicit concession is already enshrined in the design principles of at least one farming system. Permaculture parcels every farm into several zones. Zone 5 is wilderness, a cascade of abundance reserved for other species and not to be casually intruded upon even by its so-called human owners, and then only as visitors.⁵ Reserved wilderness areas within the permaculture farm allow us to witness, study and appreciate at close range how nature's abundance, left to its own, plays itself out.

Elemental basis. Pre-history has seen a stone-based as well iron-based eras featuring a specific set of abundance that characterize them. Information abundance is silicon-based, dependent on technological advances in semiconductors, of which silicon is one, together with the benefits of

4 Harvey Martin Jacobs. *Who Owns America: Social Conflict Over Property Rights*. University of Wisconsin Press: 1998, p. 221.

5 Bill Mollison. *Permaculture: A Designer's Manual*. Deccan Development Society, Hyderabad: 1990, p. 50.

digitalization, which made the reproduction of any number of identical copies over unlimited generations a possibility. Ecological abundance is carbon-based. Carbon's natural affinity to hydrogen and oxygen created organic substances that formed the basis of life and of reproductive processes. These led to the great abundance in nature that is ultimately our very own basis for existence. The abundance of solar energy is hydrogen-based. Hopefully, in the future, another hydrogen-based energy economy, using hydrogen extracted from water to run fuel cells, can replace the unsustainable fossil fuel-based energy economy we have today.⁶

Five types

Taking into account these various ways of classifying abundance, we suggest the following tentative classification to highlight the differences among the various types. The first three, in a way, represent the three fundamental building blocks of the universe: matter, energy and information. The last two take care of opposite or orthogonal concepts and ensure conceptual completeness.

1. Material abundance

Matter exists both in animate and in inanimate – living and non-living – form. Biological goods become abundant because they have evolved, over eons, the built-in means to reproduce themselves and yet to maintain a dynamic balance that does not overwhelm the finite world in which they exist. While the means of reproduction of information goods is external, usually through human agents or automatons on the information network, the means of reproduction of biological organisms is internal. They contain their own programs for reproducing themselves.

Ecological abundance. Maintaining ecological abundance is less a problem of ensuring the right conditions for the reproduction of life and more a problem of ensuring that we humans do not destroy those conditions which are favorable to the reproduction of life. Over millions of years, various life forms have evolved to optimize their capacity to reproduce themselves under existing ecological conditions. All we need to do is to respect these conditions and make sure our human activities do not modify them to the extent of threatening the ecological abundance that promises us a perpetual stream of ecological benefits. Furthermore, we must learn from the way ecological systems reproduce themselves indefinitely without having to grow without limit. The secret is in establishing closed material loops fuelled by the sun. These closed loops are circular food chains that encompass every element of the system. Together, they form a food web that eventually reaches a dynamic balance highly resilient to environmental stresses.

Think of depositing money in the bank, where it earns a fixed interest. As long as you don't touch the principal and withdraw only the interest earnings, you will get a perpetual stream of benefit out of that fixed amount. This used to be the situation in most of the living world, where our natural capital gave us a perpetual flow of natural income. As long as human civilizations protected the principal and withdrew from nature only a small portion of its products, we would have been able to enjoy nature's abundance in perpetuity. Today, in most of our renewable resources, we are drawing not only the interest but portions of the principal. In the future, there will be less interest earnings to enjoy,

⁶ For a thorough discussion, see Jeremy Rifkin. *The Hydrogen Economy*. Tarcher/Penguin, New York: 2002.

and if we go on our unsustainable way, the principal itself will soon be gone. This is the situation today in many of our renewable resources.

Do not take the principal-interest analogy too literally because of a moral hazard: banks are often engaged in unsustainable lending due to the fractional reserve principle, which creates a financial bubble. Matter and energy cannot be created and we have to live with the material and energetic limits handed on to us by nature. Money, however, can be created by the privileged few, who become scandalously rich by simply creating more money for lending and earning interest from, while everybody else has to work hard and make sacrifices to earn a living.

Mineral abundance. Though non-living objects like metals, sand, rock and so on, do not reproduce, there are other means of keeping them abundant. We must remember that matter is never created or destroyed, only transformed. Consider metals. Even if the world's metallic reserves were all eventually mined and used up (this would be an environmental disaster!), the metals will not be gone. The millions of tons of gold, silver, iron, copper, aluminum, tin and other metals which have been mined from the bowels of the earth for human use on the ground will still be around us. All we need to do is locate them, gather them and reprocess into usable forms once again. The key to abundance in inanimate matter is durability, reusability and recycling.

Imagine a programmable weaving machine with built-in facilities to cut and sew, such that threads go in at one end of the machine, and shirts, pants, coats, dresses and other wearables come out at the other end. The process is software-driven. You can go to the Internet, where people might share their own designs for a particular style of wear, download the software freely, customize the dimensions to your specific requirements, and run the program on the machine. One can easily imagine a similar programmable fabricator for, say, wood. Give it a piece of plywood or a length of 2x4, as many as necessary, and with the right program downloaded from the Internet, you can make your own chair, frame, shelf, table and other furniture or toys. This approach is already possible with metal, using software-controlled universal milling machines.

Instead of cutting, chipping or scraping away material from a workpiece, one can also work from the other end and add material to a workpiece. As early as the 1990s, a "3-d" printer that deposited epoxy layer by layer to a workpiece, to build up any three-dimensional shape, was already commercially available.⁷ It could make toys, gears, intricate parts, moulds and a thousand other things. The only limit was one's imagination, captured in software. Such 3d printers have since become common commercial items. If the working raw material were made recyclable too, then this can be another answer to the challenge of making material abundance accessible to more people. Enabling the machine to handle a mix of plastic, wood, metal and electronics can turn it into a software-controlled personal fabricator. This is what MIT's Media Lab has been working on since the turn of the century.⁸ It doesn't even have to be a *personal* fabricator. A whole community can share one.

2. Energy abundance

Renewables. Although it is one of the least tapped by modern technologies, our greatest source

⁷ Neil Gershenfeld. *When Things Start to Think*. Henry Holt and Co., New York, 1999, p. 71.

⁸ See above.

of energy abundance is the sun.

Solar energy is a source that is incredibly immense and practically infinite in terms of human scales. It continuously provides a steady source of diffuse energy, from a distance that is far enough to spare us most of the damaging side effects of the infernal processes that fuel the stupendous generation of that energy. Through the appropriate use of collectors and concentrators, the sun's diffuse energy may be transformed into medium- to high-quality heat which can then be converted into other forms for a wide range of uses.⁹

Solar energy is still not absolute in abundance. It is not available at night, for instance.¹⁰ So, in addition to collectors and concentrators, storage devices are also needed to make it available when the sun is below the horizon.

Non-renewables. Non-renewable sources of energy are a special challenge. Once gone, they are gone forever. That is a huge ethical burden to a society with a conscience. We have built our civilizations on the shaky and short-term foundations of fossil fuels or the shakier foundations of radioactive fuels. As a result of this flawed decision, we have reached a dead-end, ending up with a global greenhouse problem resulting in climate change, sea-level rise and other threats to our very survival. There is urgent need to shift gears, change direction and to focus on various renewable energy sources that can provide us comparable abundance in the long-term rather than the short-term.

Non-renewable abundance is like keeping your money in a private vault, where it earns no interest. The total amount diminishes every time you withdraw some. However large your initial store of money is, you will sooner or later exhaust it and end up with nothing. This is the situation with our non-renewable energy resources such as oil and gas. However abundant they are today, once used, they are gone forever.

Only the energy from sun, perhaps, given its stupendously massive stock of hydrogen, can be considered as good as infinite, even if it will likewise use up its fuel billions of years from now.

Paul Hawken has proposed guidelines for managing non-renewables that can be the starting point for an ethical management of non-renewable energy resources.

3. Non-material abundance

Information abundance. This is truly a special type of abundance, because information is not lost whenever it is shared. In fact, sharing information multiplies it, and enables everyone to create even more of it. Because of what economists call the “substitution effect” (consumers tend to shift from higher priced goods to lower-priced ones that can more or less do the same job or fulfill the same need), the information content of other goods will also keep rising as long as using information is cheaper than other approaches. Information abundance can be expected to lead to a cascade of other types of abundance.

⁹ Barry Commoner. *The Poverty of Power: Energy and the Economic Crisis*. Knopf, New York: 1976, p. 135.

¹⁰ Strictly speaking, reflected solar energy is also available on some nights as lunar light. This is the basis for a number of agricultural practices based on the phases of the moon.

The main problem today with information abundance is the mismatch between the two trends: diminishing cost and the promise of universal access on one hand, and, on the other hand, the legal regime of IPRs which threatens information abundance with restrictive laws that unrealistically prohibit sharing, copying and other forms of reproducing information. The second challenge is how to encourage intellectual activity without intellectual property. The success of free/open source software and the extension of this concept to other fields has already shown that monopoly is not the only way, or even the best way, to encourage intellectual activity. More varied ways of rewarding intellectual work need to be evolved.

Psychic abundance. The term “psychic” is used here not in the ESP sense but in the same psychocultural sense as “psychic rewards” (i.e. non-monetary, non-material), . It refers to certain human feelings and concepts, variously described as “emotional” or even “spiritual”, which are not captured by the term “information”. Psychic abundance covers phenomena which cannot be digitized, copied or reproduced like information. These include love, happiness, companionship, peace, joy, tranquillity, beauty, wisdom, and related concepts. These concepts are often associated with a certain kind of abundance. Many references to abundance on the Internet are of this kind. These references clearly express certain human needs that cannot be met with information, energy or material phenomena but require a special human response that, like the rest, also needs to be studied, learned and mastered.

4. Non-abundance (scarcity)

Included for completeness, this refers to our old friend scarcity. Obviously a spectrum of possibilities lie between absolute abundance and absolute scarcity, and most of what we need and want lie somewhere along this spectrum. Thus a full consideration of what needs to be done to reduce scarcity and enhance abundance requires a study of the causes, conditions and consequences of these complementary phenomena. Economics, which has been studying scarcity from the earliest times, must now expand its coverage to include abundance.

5. Negative abundance

Again, for want of a better term, this refers to an abundance of “bads”, like poisons in the environment, garbage, pollution, greenhouse gases, and various undesirables, which today are often the side-effects of the production of desirables. In some cases, we are so overwhelmed by these “bads” that the entire production process has to be radically overhauled to find ways of producing the goods minus the bads.

Institutional mechanisms for managing abundance

The phenomenon of abundance that benefits a section, if not the whole, of society creates a commons. It management can therefore learn from historical experience as well as recent lessons in managing commons and common pool resources.

Historically, the management of abundance have been approached in various ways:

Market competition. Market-based approaches rely on free interactions between self-interested sellers and buyers to determine access, levels of exploitation and other parameters. The government defines, protects and enforces private property rights but otherwise interferes minimally in the market.

Private monopolies. The government bids out the management of the resource to private monopolies who ensure the protection and maintenance of the resource while they make reasonable profit in managing it.

Government control. The government itself takes over the resources, relying on a bureaucratic command structure to implement policies, rules and regulations. Government utilities and services, for instance, like the common pool approach below, can provide a more equitable allocation under conditions of scarcity – important for essential goods – in contrast to market approaches that allocate goods based on capacity to pay.

Common pool resource. Management relies on rule-based arrangements enforced collectively or by a community. Common pool resources (CPR) have gained much attention in the past few decades with the debate about the “tragedy of the commons”. More recent studies have debunked the idea that commons management will necessarily end in a tragedy.¹¹ The success of the GNU Public License, a CPR version of free software, Wikipedia and other information and Internet commons have given a new impetus to the commons approach.

Free/open access. These arrangements essentially involve opening up a resource to anyone, with a minimum of rules governing access. This approach may apply to certain universally accessible resources like solar energy and wind energy. Likewise, access to public domain software and certain versions of free software fall under this category. Where a resource is local, limited or in a precarious state, this approach may indeed lead to a collapse.

Changing mindsets. Cultural approaches have also been tried successfully in many cases. These approaches enhance the community spirit, develop an ethic of sharing and cooperation, reduce consumption and demand by extolling simpler lifestyles, and as a result prolong the life of non-renewable resources and reduce the pressure on renewable resources. While most of the approaches are mutually exclusive, this approach can complement any of the other approaches listed above, though it may work better with some approaches than with others.

The choice of the most appropriate institutional mechanism or combination of mechanisms should be based on which can best attain the following goals of abundance management:¹²

11 Elinor Ostrom, Thomas Dietz, Nives Dolšak, Paul Stern, Susan Stonich and Elke Weber (eds.). *Drama of the Commons*. National Academy Press, Washington DC: 2002.

12 These goals are explained in detail in Roberto Verzola, “Undermining Abundance” in Gaelle Krikorian and Amy Kapczynski (eds.). *From Intellectual Property Rights to Access to Knowledge*. Zone Books (in press). This paper also covers other aspects of the political economy of abundance, including the role of corporations in undermining abundance, the importance of reliability alongside efficiency as a goal of abundance, and the emergence of the commons.

1. make the resource accessible to a greater number of people;
2. make sure the resource will last for generations, preferably indefinitely;
3. build a cascade of abundance;
4. to develop an ethic that nurtures abundance; and
5. to attain a dynamic balance.

The overall goal of any management scheme should be to ensure the reliability of the resource by protecting it from failure or from any threat, potential or existing, that can lead to failure.

The matrix below includes the author's initial judgments about the suitability of specific institutional mechanisms for managing abundant (as well as scarce) resources. They are not the definitive word in evaluating the suitability of various institutional mechanisms but are meant more to generate debate about these mechanisms.

	Market competition	Private monopolies	Government control	Common pool resource	Changing mindsets: more sharing, less consumption	Free/open access
Information abundance	good	poor	poor	fair	good	good
Ecological abundance	poor	poor	fair	good	good	poor
Mineral abundance	fair	fair	fair	good	good	poor
Energy abundance	fair	fair	good	good	good	fair
Emotional/spiritual abundance	poor	poor	poor	fair	good	good
Non-abundance (scarcity)	good	fair	fair	good	good	poor
Bads: negative abundance	poor	poor	good	good	good	poor

Conclusion

The abundance we see on the Internet should help open our eyes to other form of abundance which we often ignore or take for granted. These include the abundance inherent in biological system and arising from the built-in reproductive processes in every form of life. We must also not forget that

we enjoy an abundance of solar energy, the source of other renewable forms like wind and falling/flowing water, and even non-renewable forms like fossil fuels.

In becoming aware of various phenomena of abundance, we should realize that such phenomena deserve careful study, so that we may learn how to create, maintain, prolong and even build a cascade of them, for our own benefit.

Societies and civilizations have evolved various institutional mechanisms of managing abundance. We should learn from our rich trove of experiences, and from the future field of abundance studies to master this phenomenon for the human good.