

Peer to Peer and the Commons: a path towards transition

A matter, energy and thermodynamic perspective

1 Towards an economy that is embedded and recognizes the limitations of our natural world

Céline Piques and Xavier Rizos

with the support of **Michel Bauwens** from the P2P Foundation

<Left blank for 2-page viewing on screen– to be deleted>

Peer to Peer and the Commons: a path towards transition

A matter, energy and thermodynamic perspective

Volume 1: Towards an economy that is embedded and
recognizes the limitations of our natural world

Céline Piques and **Xavier Rizos**

with the support of **Michel Bauwens**, director and founder of the **P2P Foundation**

web version 1.0 - May 2017

P2P  Foundation



CONTENTS

About the authors	4
VOLUME 1 TOWARDS AN ECONOMY THAT IS EMBEDDED AND RECOGNIZES THE LIMITATIONS OF OUR NATURAL WORLD.....	5
Context of this research	6
THE MECHANISTIC VIEWPOINT OF CLASSICAL ECONOMICS: NEWTON VS CARNOT	9
Classical economics was built on Newtonian gravity applied on prices	10
<i>Key point: Classical economics initiated by Adam Smith was built on an analogy with Newtonian mechanics: prices were seen as obeying a kind of law of gravity that would always bring a balance. This gave us two resilient metaphors: the invisible hand of the market, and Homo economicus.</i>	10
From classical economics to biophysical economics.....	12
<i>Key point: The theories developed by the founders of classical economics Smith, Ricardo and Say do not pass the reality test. The development of Thermodynamics in the 19th and 20th centuries and the work of Georgescu-Roegen showed that economics cannot ignore the laws governing Energy and Matter.</i>	12
THE FOUNDATIONAL NOTION OF ENTROPY AND ITS CONSEQUENCE ON ‘SUSTAINABLE DEVELOPMENT’	13
Introducing the notion of Entropy and the limits it imposes on our activities	14
<i>Key point: Our entropic ‘footprint’ reveals our unique human nature. We degrade significantly more energy than the minimum required by our natural metabolism: it is this surplus of degraded energy that has been used to build our civilizations. ..</i>	16
<i>Key point: We consume energy and matter faster than we can regenerate them making ‘Sustainable Development’ impossible.</i>	17
There are ways of slowing down this ineluctable increase of entropy – under specific conditions	18
<i>Key point: While in the very long run entropy will eventually grow to the point of thermodynamic standstill (the death of the Sun and the end of life on Earth), hence respecting the 2nd Law; in the meantime, it is possible to create ‘negentropic cycles’ which can locally bring entropy down and meaningfully buy us time to delay depletion.</i>	18
RE-EMBEDDING THE ECONOMY INTO NATURE AND SOCIETY	21
The mistake of classical economics about ‘Growth’	22

Key point: The Growth Model emanating from classical economics relies on technology innovation as a substitute for natural resources depletion, creating the belief that technical change can effectively de-couple economic growth from environmental services..... 22

So contrary to what classical economics implies, the possibility to decouple growth from resource use is a myth 24

Key points: Natural resources cannot always be substituted by Capital and Labour. Moreover, future generations which are also the people who will need those natural resources in the future are not here to propose their price in the market mechanism supposed to operate this substitution..... 24

The double re-embedding of economic logic – and the modes of exchange..... 25

How to counter this intellectual resilience of the utopianism of market liberalism? Understanding the complexity of the modes of exchange to escape economic reductionism 28

Key point: A way to refute the intellectual resilience of the simplistic utopianism of market liberalism is to show that the ‘market’ is not the alpha-and-omega of our economic and social order, and that other modes of exchanges have existed throughout history across societies. The ‘market’ is only one of many functions that make up our economic and social fabric. Japanese philosopher Kojin Karatani provides useful tools to analyze this. 28

INTRODUCING THE COMMONS..... 31

Hence the work of Elinor Ostrom who helped theorize the Commons..... 33

Key point: Elinor Ostrom shows that ‘the Commons’ are not just the available resources, but also the rules and ways of managing them for the collective interest: without Commons, there is no community; without community, there is no Commons. 33

Why the commons and commons-based peer production are the right paradigms for the new economy..... 35

Key point: Once a proper definition of the Commons enunciated, we move to making the case for the Commons - i.e. explaining why it is the right paradigm to tackle the sustainability issues we are trying to solve. 35

REFERENCES..... 36

About the authors

Céline Piques: Trained in mathematics and economics. Céline Piques lives in Paris where she is a researcher, writer, photographer, and feminist activist.

Xavier Rizos: Trained in mathematics and physics. Xavier Rizos lives in Australia where he is a researcher, writer and practitioner on the subjects of technology, strategy, and innovation.

Michel Bauwens: Peer-to-Peer theorist, co-founder and Vision Coordinator of the P2P Foundation. Michel Bauwens is an active writer, researcher and conference speaker on the subjects of technology, culture and business innovation.

VOLUME 1

TOWARDS AN ECONOMY THAT IS EMBEDDED AND
RECOGNIZES THE LIMITATIONS OF OUR NATURAL WORLD



Context of this research

Our system is stretched ecologically, socially, financially, politically. It has been written, commented upon: our current capitalist paradigm face a multi-dimensional crisis to the point that some commentators have even coined the catchy slogan that “**Capitalism is not in crisis; capitalism is crisis**”.

- The environment and climate crisis have become perpetual headlines. The most recent being the significant reduction of the arctic ice in 2016.
- The competitive quest for energy and material resources is causing wars such as in the Middle East: let’s not forget that civil war in Syria¹ started in the regions most affected by severe drought in decades.
- The financial and economic instability blamed for the Global Financial Crisis has not been resolved²: as illustrated by various examples from Europe’s ongoing austerity crisis, to the more anecdotal but nonetheless dangerous current housing bubble in Australia.
- Inequalities and social disruption have exploded and showed that the promise of a prosperous post-cold war world has not materialized, as highlighted by the work of French economist Thomas Piketty³ who illustrated the exploding disparity of the top 1% share of income with a graph that has become a reference.

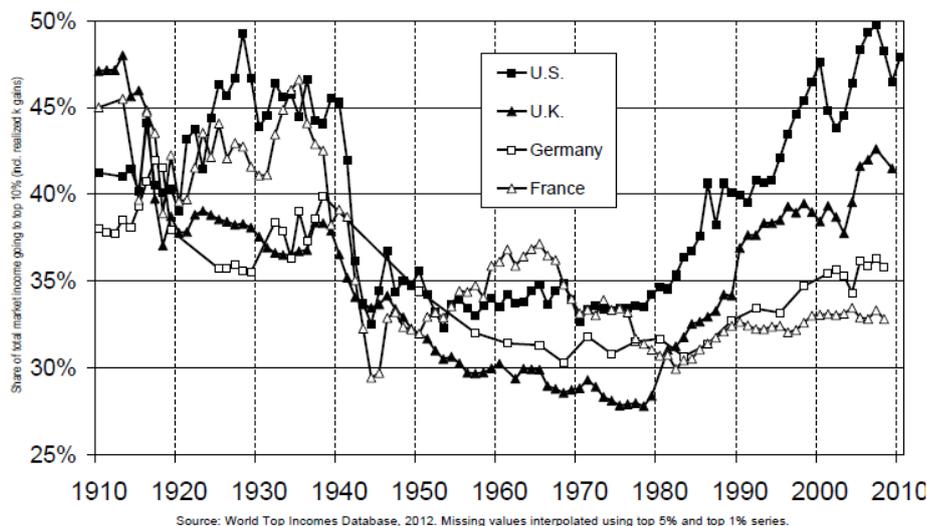


Figure 1- Top Decile Income Shares 1910-2010 (Piketty)

- This is now leading to the quasi-unthinkable just a few years ago: the questioning of the democratic consensus established after WWII with the rise of a proto-fascist populist leader like Trump in the US, the protracted debt crisis in

¹ Tipping point. The Drought That Preceded Syria's Civil War Was Likely the Worst in 900 Years, By Elaisha Stokes, 2016: <https://news.vice.com/article/the-drought-that-preceded-syrias-civil-war-was-likely-the-worst-in-900-years>

² Real estate: Australian banks must learn lessons of US sub-prime crisis, warns ASIC boss: <http://www.abc.net.au/news/2017-04-04/australian-banks-learn-the-lessons-of-sub-prime-asic-medcraft/8413542>

³ Thomas Piketty. Capital in the Twenty-First Century (2013) https://en.wikipedia.org/wiki/Capital_in_the_Twenty-First_Century

Europe, BREXIT and the National Front becoming a mainstream party in France⁴.

While those **symptoms** are clearly identified, western societies are collectively struggling to find a conceptual framework to explain and analyze how a post-capitalist paradigm would work, let alone how we would transition to it.

This research shows that parts of the answer lie in the need to ‘**doubly re-embed**’ the **economy** inside the **human/social sphere** as well as the **bio-sphere**.

We analyze the imperative to create so-called **negentropic cycles**⁵ in order to meaningfully delay the depletion of our natural resources inherent to their **enclosure** and **extraction** on the global industrial scale we are currently experiencing.

To do so, the only viable and sustainable avenue is to promote modes of exchange that part ways with the classical economic objectives of infinite growth.

Once accepted this premise, the question then becomes **what to replace those traditional classical economic objectives with?** What objectives to solve the environmental and social problems we are facing; and how to reach those objectives?

Peer-to-Peer and Commons principles offer a sustainable avenue to transform production

The Commons, as an idea and practice, has emerged as a new social, political and economic dynamic. Along with **the Market** and **the State**, **the Commons** is a third mode of societal organization. The Commons and Peer to Peer (P2P) together form a system based on the practices and needs of civil society and the environment it inhabits, evolving away from obsolete, centrally planned systems or the competitive dictates of market economies.

As the P2P Foundation puts it in their recent study ‘Commons Transition and P2P: a Primer’⁶:

While the Commons is a concept and practice deeply rooted in human history, it is difficult to settle on a single definition that covers its broad potential for social, economic, cultural and political change. The Commons is now demonstrating its power as a “key ingredient” for change in diverse locations and contexts around the world.

⁴ Marine Le Pen lost the vote but she won something better <https://qz.com/975521/marine-le-pen-lost-the-vote-but-she-won-something-better/>

⁵ Céline Piques, Xavier Rizos, Michel Bauwens. **Peer to Peer and the Commons: a path towards transition. A matter, energy and thermodynamic perspective. Volume 1: Towards an economy that is embedded and recognizes the limitations of our natural world.**

⁶ Michel Bauwens, Vasilis Kostakis, Stacco Troncoso, Ann Marie Utratel. Commons Transition and P2P: a Primer: <https://blog.p2pfoundation.net/commons-transition-and-p2p-a-primer/2017/05/09>

Commons can be described as a shared resource which is cogoverned by its user community, according to the rules and norms of that community.

Commons include natural resources, such as the water and land, but also shared assets or creative work, such as cultural and knowledge artefacts.

The sphere of the Commons may contain either rivalrous goods and resources, which two people cannot both have at the same time, or non-rival goods and resources, which are not depleted by use. These types of goods or resources are either inherited or are humanmade.

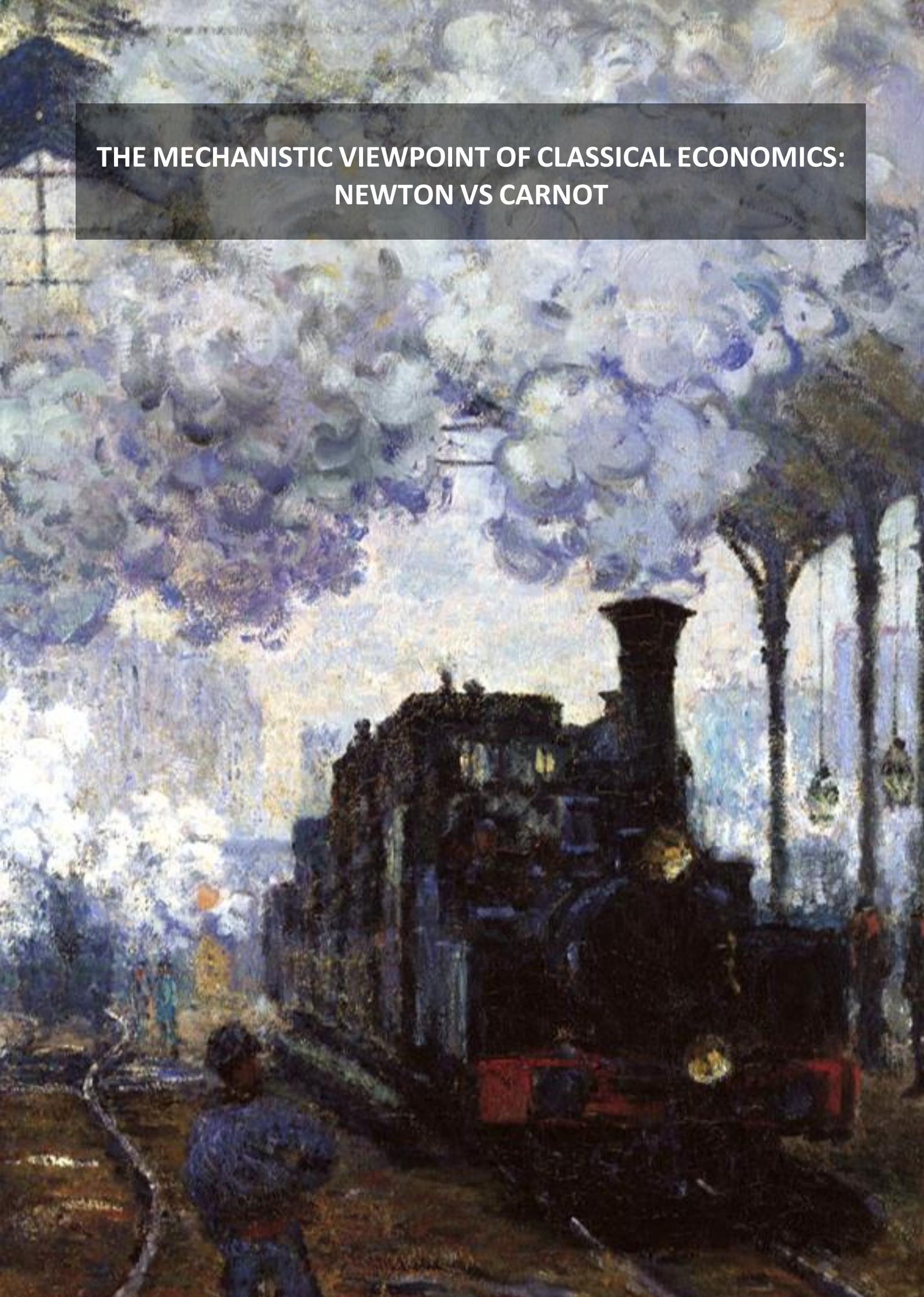
The Commons, according to scholar and activist Silke Helfrich⁷, can be understood from at least four different perspectives. As a whole, they can be perceived and acted upon as:

1. **Collectively managed resources**, both material and immaterial, which need protection and require a lot of knowledge and know-how.
2. **Social processes** that foster and deepen thriving relationships. These form part of complex socio-ecological systems which must be consistently stewarded, reproduced, protected and expanded through commoning.
3. **A new mode of production** focused on new productive logics and processes.
4. **A paradigm** shift, that sees commons and the act of commoning as a worldview.

The purpose of this research is to show that a P2P and Commons approach is fit to deliver the desired ecological and social transitions required to share and manage finite resources.

⁷ Silke Helfrich: <http://wealthofthecommons.org/contributor/silke-helfrich>

**THE MECHANISTIC VIEWPOINT OF CLASSICAL ECONOMICS:
NEWTON VS CARNOT**



Classical economics was built on Newtonian gravity applied on prices

Key point: *Classical economics initiated by Adam Smith was built on an analogy with Newtonian mechanics: prices were seen as obeying a kind of law of gravity that would always bring a balance. This gave us two resilient metaphors: the invisible hand of the market, and Homo economicus.*

Adam Smith initiated classical economics in 1776 with his *Inquiry into the Nature and Causes of the Wealth of Nations*, and from the start, it was profoundly marked by the spirit of its era: the emergence of Newtonian mechanics and the belief that gravity ruled the world.

Gravity is a notion borrowed from Physics. It represents the attractive force that a body exerts on the mass of another body. It belongs to a deterministic paradigm where you just have to know the position of an item and its movement to be able to know the position it had at any point in time in the past, and the position it will have in the future.

French economist **René Passet**⁸ has discussed this analogy between the notion of Newtonian space borrowed from physics and the notion of market developed by classical economics: a space where prices reach equilibrium under the law of supply and demand.



René Passet

This classical paradigm is simple: if an item is over-produced there will not be enough buyers and the price will drop, the production of that item diminishes and will be replaced by the production of other items, which resets an equilibrium. If on the contrary, a good is not produced in enough quantity, its price will go up, which will attract more producers who will increase the output and this will lead to a new equilibrium.

Like an oscillator that always come back to a still state, **the invisible hand of the market** determines the natural price of goods and services to be produced to maintain the equilibrium outside of any human direct planning or intervention. Adam Smith explains this analogy with Newton: *“The Normal Price”*, or as Adam Smith says, *“the natural price is as it were the central price to which the prices of all commodities are continually gravitating. Different accidents may sometimes keep them suspended a good deal above it, and sometimes force them down even somewhat below it. But whatever may be the obstacles which hinder them from settling in this centre of repose and continuance, they*

⁸ René Passet. Les grandes représentations du monde et de l'économie à travers l'Histoire. De l'univers magique au tourbillon créateur. 2010 - ISBN : 978-2-918597-08-7. 948 - PRIX DU LIVRE D'ECONOMIE 2010. Mention spéciale

are constantly tending towards it”.

Just like Newton’s universe is nothing but the sum of its parts, the general interest would come from the spontaneous convergence of individual interests.

David Ricardo⁹ and **Jean-Baptiste Say**¹⁰ went further in talking about **general ‘laws’ of economics**, which would be universal, immutable, and timeless just like the laws of Newtonian physics.

In his *Principles*, **Ricardo reduced the economy to a small number of stable relationships based on postulates such as personal interest and the principles of competition and private property**. In this paradigm, efficiency depends on the division of tasks. The only value considered is the merchant value (or exchange value) defined by the cost-of-production. It is a subjective conception of seeing things in their ability to satisfy needs, which relates to their **utility**. This means that all the things that have a use-value but no exchange value, like the air or water, is ignored by classical economics.

J.B. Say declared that natural resources were infinite which allowed economist to consider nature as a 'free good' which industries should learn to use.

Hence, if considering nature as a free inexhaustible resource was not bad enough, the reduction of our humanity to the selfish pursuit of maximization of wealth achieved to lock the **Law of the Markets** (also called **Say’s Law**) as a quasi-scientific rule.

Thereby homo economicus was born. Classical economics has truly locked itself in a reductionist paradigm which brushes aside the sense of history, its human dimension. In going down that path, classical economics has ignored the precise finalities and goal of human activities, and the issue of finite natural resources.

Consequently, we find the conceptual roots of today’s paradigm in the Newtonian vision of our societies: a world that we have structured in a deterministic way, with a strong mistaken dual belief:

- a first belief in **an equilibrium emanating from the gravity of prices**, i.e. the belief that a balance between scarcity and abundance is mediated by the equilibrium of prices, just like a pendulum.
- as well as **the belief that an economy can grow indefinitely**, as measured by a positive ‘potential growth rate’.

Those **two notions of price equilibrium and unlimited growth** are supposed to underpin the whole economics thinking today and both are at odds with reality.

⁹ David_Ricardo: https://en.wikipedia.org/wiki/David_Ricardo

¹⁰ Jean-Baptiste Say: https://en.wikipedia.org/wiki/Jean-Baptiste_Say

From classical economics to biophysical economics

***Key point:** The theories developed by the founders of classical economics Smith, Ricardo and Say do not pass the reality test. The development of Thermodynamics in the 19th and 20th centuries and the work of Georgescu-Roegen showed that economics cannot ignore the laws governing Energy and Matter.*

Two centuries later, climate change, the destruction of biodiversity, pollution and the depletion of natural resources show that the Newtonian vision of a stationary economy cannot be reconciled with physical reality. Beyond its own sphere, it is in **the biosphere (nature)** that the economy finds the natural resources it needs, and it is in the biosphere which could really be called the *'mater-and-energy sphere'* - that this economic sphere can dispose of the wastes it produces. It is also nowhere else but in **the human sphere (society)** that the economy has its agents and finalities – its *'raison d'être'*. Thus, those two spheres (nature and society) supplant economics at all levels, and obey their own laws which economics cannot understand¹¹.

No price variation set by human made economic process can alter the natural carbon or water cycles (i.e. the way carbon flows through the biosphere, and the way water evaporates to form clouds). To take those natural cycles into account can only be done while respecting their logic and the way they work. In other words, it is the mechanisms of the biosphere that set the limits of what our economic growth can be, and it is within those natural constraints that economics can operate in a legitimate manner, not the other way around.

Had **Ricardo** met **Sadi Carnot** and **Rudolf Clausius**¹², the 'fathers of thermodynamics' who put energy and engine power at the center of their thinking, he might have probably followed a different logic and epistemological pathway.



Nicholas Georgescu-Roegen

It took another century and **Nicholas Georgescu-Roegen**¹³ for a **new bio-economic paradigm** to emerge. **A paradigm that brings together evolutionary biology and thermodynamics, and which is governed by the laws of entropy.**

¹¹ Among the attempts to make 'economics' more cognisant of the human sphere is **behavioural economics**. It studies the effects of psychological, social, cognitive, and emotional factors on the economic decisions of individuals and institutions and the consequences of this to broader economic outcomes. Behavioral models typically integrate insights from psychology, neuroscience and microeconomic theory; in so doing, these behavioral models cover a range of concepts, methods, and fields that is not restricted to standard economic theories. Behavioral economics has grown as an alternative approach to standard economic theory pursuing more experimental, data-driven methods, without strong association to more traditional theoretical models. <http://complexityacademy.io/behavioral-economics/#easy-footnote-bottom-1>

¹² Sadi Carnot: https://en.wikipedia.org/wiki/Nicolas_L%C3%A9onard_Sadi_Carnot
Rudolf Clausius: https://en.wikipedia.org/wiki/Rudolf_Clausius

¹³ Nicholas Georgescu-Roegen: https://en.wikipedia.org/wiki/Nicholas_Georgescu-Roegen

**THE FOUNDATIONAL NOTION OF ENTROPY AND ITS
CONSEQUENCE ON 'SUSTAINABLE DEVELOPMENT'**



Introducing the notion of Entropy and the limits it imposes on our activities

Entropy is an abstract notion that provides a measure of the degree of disorder of a given amount of energy. Or put in simpler words, Entropy enables us to appreciate the ‘quality’ of energy: the higher the entropy the greater the disorder, and the less the available energy can be put to work.

To appreciate the notion of Entropy, a metaphor commonly used – albeit wrong from a rigorous scientific standpoint – is that of a bag of confetti spread on the floor. Once a compact bag of confetti is wide open, they spread all over the floor. The process can be considered irreversible: it takes just one second and very little energy to spread the confetti around, but it would take hours and a lot of effort (energy) to put them back one by one inside the bag. The thermodynamic analogy is that when the confetti were in the compact bag they had a lot of potential energy to give away and low entropy (they were tightly ordered). Once the confetti are spread around, they have given away their energy which is now low, but disorder has increased significantly so entropy is higher.

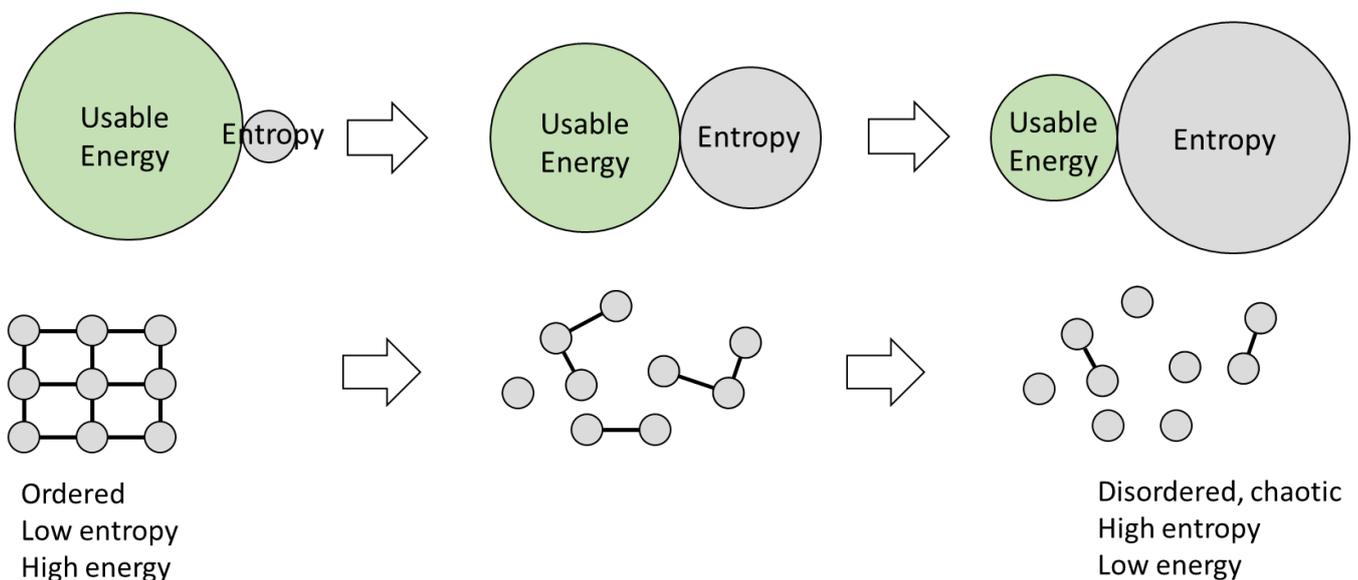


Figure 2- An illustration of Entropy

The most commonly understood aspect of thermodynamics is the 1st Law which is **about energy itself**. It says that in a closed system, energy is conserved: it is the famous “*nothing gets created, nothing gets lost, everything is transformed*” enunciated by French physicist

Antoine Lavoisier¹⁴ just before the French Revolution.

A subtler aspect is the 2nd Law of thermodynamics which is specifically **focused on entropy and irreversibility**. It says that **the entropy of a closed system – i.e. the amount of disorder in this system - inexorably increases**, in an irreversible manner. This is the useful mnemonic to remember about entropy: *it goes from low to high* – i.e. entropy always gets higher. When a piece of coal gets burnt, its chemical energy neither diminishes nor increases (the 1st principle) but the energy it initially contains gets dissipated as heat, smoke, and ashes that cannot be recovered. It is because of this 2nd Law that a steam engine cannot keep running to produce a constant stable motoring force (i.e. a stable temperature) without a constant input of fuel.

A given amount of energy has **low entropy (it is free energy) if it is available to be used** and put to work and produce economic output. It has **high entropy if the energy has become unavailable for economic use**. So this means that all living organisms extract low entropy from their environment to compensate for the higher entropy inexorably created by their metabolism which degrades nutrients and cells.

Or to quote Georgescu-Roegen¹⁵ to plainly grasp those concepts:

“From the viewpoint of thermodynamics, matter-energy enters the economic process in a state of low entropy and comes out of it in a state of high entropy. (...)”

Energy exists in two qualitative states, *available or free energy*, over which man has almost complete command, and *unavailable or bound energy*, which man cannot possibly use. The chemical energy contained in a piece of coal is free energy because man can transform it into heat or, if he wants, into mechanical work. But the fantastic amount of heat-energy contained in the waters of the seas, for example, is bound energy. Ships sail on top of this energy, but to do so they need the free energy of some fuel or of the wind.

When a piece of coal is burned, its chemical energy is neither decreased nor increased. But the initial free energy has become so dissipated in the form of heat, smoke, and ashes that man can no longer use it. It has been degraded into bound energy. Free energy means energy that displays a differential level, as exemplified most simply by the difference of temperatures between the inside and the outside of a boiler. Bound energy is, on the contrary, chaotically dissipated energy. This difference may be expressed in yet another way. Free energy implies some ordered structure, comparable with that of a store in which all meat is on one counter, vegetables on another, and so on. Bound energy is energy dissipated in disorder, like the same store after being struck by a

¹⁴ In French and in Lavoisier’s own words, perhaps one of the most famous scientific proverb taught in High Schools “Rien ne se perd, rien ne se crée, tout se transforme.”

¹⁵ Nicholas Georgescu-Roegen. The Entropy Law and the Economic Problem, 1973:
<http://webpage.pace.edu/dnabirahni/rahnidocs/law802/The%20Entropy%20Law%20and%20the%20Economic%20Problem.pdf>

tornado. This is why entropy is also defined as a measure of disorder. It fits the fact that a copper sheet represents a lower entropy than the copper ore from which it was produced.”

***Key point:** Our entropic ‘footprint’ reveals our unique human nature. We degrade significantly more energy than the minimum required by our natural metabolism: it is this surplus of degraded energy that has been used to build our civilizations.*

Like we explain below, the added twist and specificity of the human species is that we have, more than any other species, developed what is called **‘exosomatic’ processes**, on top of to the purely biological ‘endosomatic’ metabolism of our body which is the 2,400 kcal we burn on average every day. These ‘exosomatic’ processes emanating from our industrious nature irremediably degrade energy, i.e. increase entropy.

Indeed, for most species, the main thermodynamic process is their basic natural metabolism: they feed, defecate, move around, reproduce, and die. **We humans, on the other hand, have added our technological footprint to build civilizations.** So the processes we have developed goes well beyond our bodily metabolism. This is what makes us unique, and this could be really considered as the thermodynamic definition of human civilization: the accelerated dissipation of accessible low entropy resources (wood, fossil fuels) to turn them into higher entropy via exosomatic processes: we burn, extract, degrade at a frantic pace to build roads, to power engines, develop industries to build our civilizations.

The consequence is that the economic theory and **the economic analysis of productive processes cannot be done without taking into account their entropic dimension:** it is because **the creation of higher entropy is the ultimate law that cannot be broken.**

Georgescu-Roegen argued that the economic system is actually a sub-system that must be **re-embedded**¹⁶ inside the Earth’s global ecosystem. He also showed that the inexorable irreversible increase of entropy in a closed system dictated by the 2nd law of thermodynamics also says that at the ecosystem level **there cannot be industrial output without waste**, and **there cannot be 100% ‘clean’ recycling.**

In other words, what the alchemists of past ages were dreaming to accomplish has been finally proven impossible by the 2nd Law of Thermodynamics: **we cannot ‘cheat’ nature.** We cannot create gold out of dirt or rocks; we cannot create a pendulum, no matter how technically perfect it will be, that will work for ever. The energy in every transaction will degrade. Even when we change this tendency in a small neighborhood (i.e. reduce the entropy), in the wider region the entropy will always increase. This is why there cannot be

¹⁶ In the work of Georgescu-Roegen, ‘disembedding’ describes the influence of modernity on social relationships. It also shows how Human-Nature relationships have been affected. Modern societies have become ‘disembedded’ from the context of local ecosystems, resulting in diminishing knowledge of, and attention to, ecosystem services. The emergence of general purpose money is presented as a key factor in the disembedding process because it has brought with it the message of substitutability and the possibility of an increasing appropriation of distant ecosystems.

'clean' or 'sustainable' industrial output.

Critics of this view have retorted that the Earth is not a totally closed system where energy would inexorably degrade and entropy inexorably increase (as per the 2nd Law). The Earth is actually a 'semi-closed system': it is closed in terms of matter, because apart from the asteroids falling from space, the amount of terrestrial matter is fixed. Yet, it is also open in term of energy because it is constantly receiving solar energy in large amounts, and it is dissipating heat in the form of infrared radiation out of the atmosphere into space. The difference between what is received and dissipated is what makes it possible to keep our planet warm for life to develop.

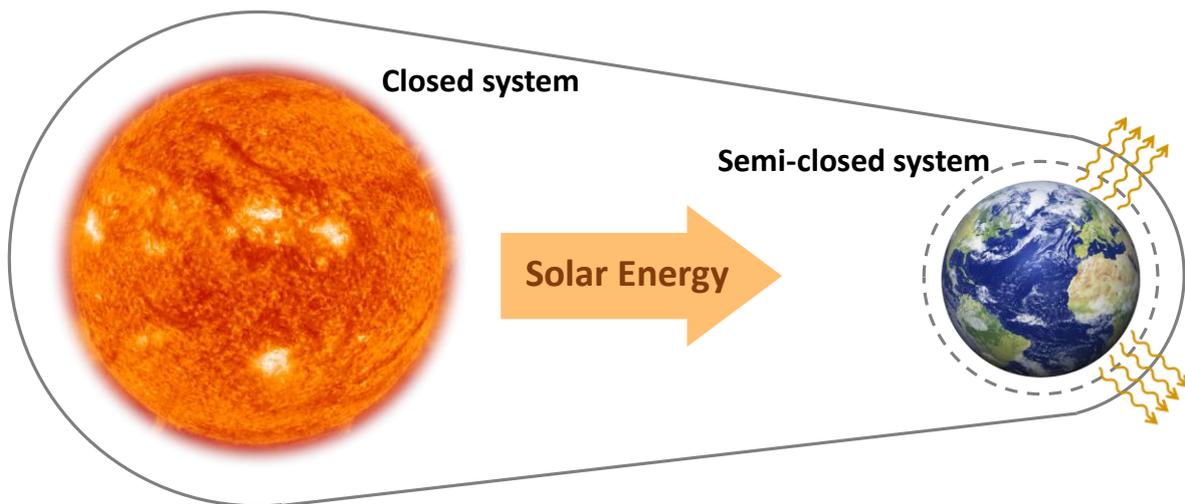


Figure 3 - The Earth is a semi-closed system

However seeing the Earth as an open system receiving infinite energy from the Sun can be misleading and was indeed misinterpreted by industrialists. Their misinterpretation led them to believe that while we are obviously consuming a lot of energy and resources in the process of economic development, conceptually these high levels of consumption do not really matter because the laws of thermodynamics are telling us that:

- 1 – energy is constantly transformed *but never lost* in the closed system that is the Earth. So if energy is never truly lost, why worry?
- 2 – *even if* we did not consider the Earth as a closed system but as an open system receiving energy from the Sun, it would be all the better because that would mean that we are constantly rebuilding our stock of 'burnt' energy, and therefore the Earth gets energy to "heal" or "regenerate".

Key point: *We consume energy and matter faster than we can regenerate them making 'Sustainable Development' impossible.*

The trouble with these views - *and this is a fundamental point* – is that eventual regeneration happens on a much longer time scale than the dissipation. Just think that a piece of coal burns in a few minutes while it would take millions of years to regenerate that rock of coal through the slow degradation of dead plants at the bottom of the sea. Or if an oyster pearl was dissolved in the ocean, it would take infinite time for the fine grains

of calcium carbonate to be reassembled into a new pearl. This is why the thermodynamics laws of irreversibility apply to natural resources, and **why there is a fundamental ontological error inherent to 'Sustainable Development'** that stemmed from the idea that energy could be recycled indefinitely and that human industrial development could be truly sustainable. This hypothesis does not hold true when you consider fossil fuels that eventually get depleted well before the environment has the chance to recreate them.

There are ways of slowing down this ineluctable increase of entropy – under specific conditions

Key point: While in the very long run entropy will eventually grow to the point of thermodynamic standstill (the death of the Sun and the end of life on Earth), hence respecting the 2nd Law; in the meantime, it is possible to create 'negentropic cycles' which can locally¹⁷ bring entropy down and meaningfully buy us time to delay depletion.

The term '**negentropy**' comes from the amalgamation of 'negative' and 'entropy' and makes it important to properly understand the **difference between processes that decrease entropy (hence the vocable 'negentropy'), and processes that increase entropy.**

- **Photosynthesis is the main way to create negentropic cycles on Earth.** Plants store part of solar energy that would otherwise be degraded as heat. This stored energy of high quality is available for a later use for example by eating plants, burning wood, etc. So the creation of biomass through photosynthesis is a negentropic process which produces usable energy linked to low entropy.
- On the other hand, coal is also an accumulation of solar energy but one that took millions of years to build up, while its exploitation and depletion can be accounted for in just a few decades. **So the coal cycle can be considered 'entropic' (i.e. it produces entropy): its regeneration takes so long that its depletion can be considered irreversible.**

This is the fundamental dual picture we face: **the formation of bio-mass contributes to create negentropy in localised pockets, while the broader overall economic process is entropic** because the natural degradation and decay of non-renewable resources increase entropy as a whole in the ecosystem (not to mention the universe), and because the pace of creating negentropy is slower than the pace at which human kind creates entropy.

¹⁷ About the concept of 'local': it is important to clarify that the mention of 'local negentropic cycles' is not a pseudo-scientific argument in disguise to be interpreted as pro-'localist'. What the study of thermodynamics says is that the eco-system as whole increases its Entropy, and any chance to bring it down must happen in pockets, which are by definition 'local'. It doesn't say that the local is '*the*' alternative to the global, but that simple, material production needs to happen at the lowest appropriate level to have a chance to delay the overall increase of entropy.

In conclusion of this section, **Georgescu-Roegen's pivotal contribution has been:**

- **To rewrite economic theory, taking into consideration the constraints and Laws of Thermodynamics.**
- **To extend those thermodynamic considerations from pure energy to 'matter', which degrades and increases its entropy. Georgescu-Roegen's 4th law of thermodynamics says that usable matter also degrades irreversibly just like energy.** This means that 'recycling' or so-called 'low-energy industrial processes' might slow down the depletion of resources but cannot totally stop it. This means that the concept of "sustainable development" as it is presented today is a false promise.
- **However Georgescu-Roegen's work also shows how it is possible to make this slow-down happen.** He concluded that whenever possible energy extracted from Earth's resources should be replaced by solar energy. A crucial aspect is that because solar energy is available as a flux and not as a stock like natural resources, a generation using solar energy cannot confiscate this energy at the detriment of future generations. This might sound obvious in 2017, but back in the 1970s it was fairly ground-breaking and contributed to providing a theoretical foundation to the various environmental movements.

RE-EMBEDDING THE ECONOMY INTO NATURE AND SOCIETY



The mistake of classical economics about 'Growth'

Key point: The Growth Model emanating from classical economics relies on technology innovation as a substitute for natural resources depletion, creating the belief that technical change can effectively de-couple economic growth from environmental services.

Coming back to classical economists, until the 1970s only labour and capital were considered as factors of production, perpetuating the belief that natural resources are unlimited and free. This view made its way in the equations governing classical economics.

For example, **Robert Solow**, creator of the **growth model**¹⁸ which does not include resources at all, articulated in a famous paper in 1974¹⁹ that 'human capital' can substitute 'natural capital', and that:

“As you would expect, the degree of substitutability is also a key factor. If it is easy to substitute other factors for natural resources, then there is in principle no “problem”. **The world can, in effect, get along without natural resources, so exhaustion is just an event, not a catastrophe.** [...] If, on the other hand, real output per unit of resources is effectively bounded - cannot exceed some upper limit of productivity which is in turn not too far from where we are now - then catastrophe is unavoidable. In-between there is a wide range of cases in which the problem is real, interesting, and not foreclosed. **Fortunately, what little evidence there is suggests that there is quite a lot of substitutability between exhaustible resources and renewable or reproducible resources,** though it is an empirical question that could absorb a lot of more work than it has so far.”



Robert Solow

While Solow is often misquoted and demonized for implying that “the world can, in effect, get along without natural resources”, which he never meant, he symbolized the mistakes of classical economics. His real error was not to make the assertion that we don't need natural resources at all, but to be naively technology-optimistic.

To Solow's deference, his paper starts by mentioning the 'Limits to Growth' Meadows

¹⁸ Robert Solow's Growth Model: The Solow–Swan model is an exogenous growth model, an economic model of long-run economic growth set within the framework of neoclassical economics. It attempts to explain long-run economic growth by looking at capital accumulation, labor or population growth, and increases in productivity, commonly referred to as technological progress. Source: https://en.wikipedia.org/wiki/Solow–Swan_model (wikipedia)

¹⁹Robert Solow's Richard T. Ely Lecture, 1974: <http://msl1.mit.edu/classes/esd123/2003/bottles/Solow.pdf>

report to the Club of Rome²⁰. He was also likely inspired by Georgescu-Roegen's seminal book *The Entropy Law and the Economic Process* published in 1971, when he invoked the Laws of Thermodynamics at the onset of his lecture to explain why materials recycling could not prevent the eventual exhaustion of all non-renewable resources and, indeed, why eventually the whole life on earth will come to an end.

However the ecological model behind his analytical effort fails to address all relevant ecological aspects at stake: his Laws of Thermodynamics apply only to ecological efficiency; the continual substitution of new natural resources for depleted ones has no thermodynamic consequence. Indeed he neglected a key dimension of natural resources, as source of ecosystem services, which is inevitably impacted by the resulting increase of the mass-energy scale of the economic process.

Indeed, while Solow had an environmental intuition, his answer was mainly concerned with a classical economics approach. The main issue he had proposed to deal with was not the exhaustibility of natural resources in itself as a limit to the economic process, but the optimal social management of stocks of non-renewable but essential resources.

For Solow, the solution would come from the likelihood of technical progress, especially natural resource saving technical progress - what is called today ecological efficiency of the production process. One of his main argument is the naïve notion of '**backstop technology**'. The naïve idea that when a resource becomes more scarce, its extraction cost increases, which creates the incentive for economic actors to seek and develop alternative technologies – backstop technologies.

The consequence has been a misled interpretation of **standard growth theory**: that substitution and technical change can effectively de-couple economic growth from resources and environmental services. Depleted resources or degraded environmental services can be replaced by more abundant substitutes, or by 'equivalent' forms of human-made capital (people, machines, factories, etc.).

The lack of realism of the ecological model behind Solow's analytical schemes relying on classic economics was first made clear by Georgescu-Roegen in his 'entropic' criticism of economic theory. Not only were the full implications of the Entropy Law to the economic process ignored, but in fact the very existence of critical ecosystem services. Such services emanate from complex and interrelated ecosystems, being exceedingly difficult to replace by capital, and their depletion trajectories follow unforeseeable non-linear patterns due to the ecosystems' property of resilience. The economic consequence of violating critical resilience thresholds is a sudden decrease in markets' own ability to allocate mitigation efforts, thus opening the possibility of feedback mechanisms.

What came to be known as 'Economics of Pollution', as distinguished from 'Economics of

²⁰ The Limits to Growth is a 1972 book about the simulation of exponential economic and population growth with finite resource supplies. Commissioned by the Club of Rome: https://en.wikipedia.org/wiki/The_Limits_to_Growth

Exhaustible Resources’, evolved to deal precisely with this key dimension.

Even ‘mainstream’ economists such as **Joseph Stiglitz**, **Partha Dasgupta** and **Geoffrey Heal**²¹ argued that in Solow’s growth model consumption per capita would eventually decline to zero after an initial period of economic growth because resources and ecosystem services are depleted faster than capital can be accumulated to replace them. They anticipated that if the rate of use of natural resource is constant (or growing) over time, we will eventually run out. The only possible steady state is with natural resource use declining sufficiently rapidly that we do not run out.

So contrary to what classical economics implies, the possibility to decouple growth from resource use is a myth

Key points: Natural resources cannot always be substituted by Capital and Labour. Moreover, future generations which are also the people who will need those natural resources in the future are not here to propose their price in the market mechanism supposed to operate this substitution.

The notion of ‘backstop technology’ resonated with the enthusiasts of **Schumpeterian innovation**²² and its ‘creative destruction’ mantra that posits that technical progress will always enable an improvement in the consumption of resources and that we will ultimately find new sources of energy and new ways to harness them.

The trouble is that if Labour and Capital can be swapped between each other for an efficient allocation of resources (i.e. we can replace a human being by a machine), the same cannot be done for natural resources because they do not operate at the same level of abstraction as Capital and Labour. In fact, not only can natural resources not be substituted by Capital and Labour, but they are also necessary to the renewal of Capital and Labour.

Natural resources’ distinct feature is to be extracted but not produced, and sold for a price to the best bidder. The trouble is that the future generations which are also the people who will need those resources in the future are not here to propose their price.

Consequently, the price of oil is structurally determined by the equilibrium between immediate demand for consumption, and immediate offer determined among other things by the strategic and political choices made by the OPEC countries, and not by the needs of the next generation. This means that the intergenerational consequences of the rapid depletion of the resource are ineffective at influencing the price or at slowing down consumption. So in this market paradigm, ‘price’ is incapable of reducing the rate of

²¹ Joseph Stiglitz: https://en.wikipedia.org/wiki/Joseph_Stiglitz , Partha Dasgupta: https://en.wikipedia.org/wiki/Partha_Dasgupta , Geoffrey Heal: <http://www8.gsb.columbia.edu/cbs-directory/detail/gmh1>

²² Joseph Schumpeter: https://en.wikipedia.org/wiki/Joseph_Schumpeter

depletion of the natural resource.

To fix this, advocates of the various branches of 'sustainable development' propose to pass on the cost of negative externalities like pollution as tax. However even such a measure would be far from perfect: internalizing pollution that way would only take into account the degradation incurred by nature *within the limits of its economic cost as it is (badly) measured today*. It means that everything else, which includes the damages inflicted to the reproduction of the ecosystems would not be covered by this approach: **how do we price the bio-diversity that will never be born in decades because of the damages done today?** How can we conduct evaluations of today's items which are non-commensurable because their valuation cannot capture their long-term issues and future values.

Then once the damages become so important that they really start to have an economic impact, it is too late to react. So, under the pretense of sustainability this approach considers nature only through the present economic mindset and assumes it will be able to fix the very problems it initially created.

British writer **George Monbiot** captured it in a lecture in 2014²³ when he wrote:

“You haven't changed anything by sprinkling money over the problem, you have merely called it something new. You have called it a market as opposed to a political system. (..) But you still need the regulatory involvement (..) to make that market work. Because we persuade ourselves that we don't need it anymore because we have a shiny new market mechanism, we end up fudging the issue of power and not addressing those underlying problems.”

Without the re-embedment of the economic logic into the physical constraints required to sustain the biosphere, and without putting the question of the goal and finality of human activities at the forefront of our logic, the problem cannot be truly resolved.

The double re-embedment of economic logic – and the modes of exchange

This re-embedment (or re-subordination) of economics needs to happen at two levels.

First, the economic logic must be re-embedded inside the human/social sphere.

Second, this human/social sphere must be subordinated to the bio-sphere which runs on natural metabolic cycles ultimately limited by the laws of thermodynamics.

In this system of nested spheres - just like Russian dolls - each sphere, or paradigm, must respect the laws of the upper level.

²³ George Monbiot, The Pricing of Everything: <http://www.monbiot.com/2014/07/24/the-pricing-of-everything/>

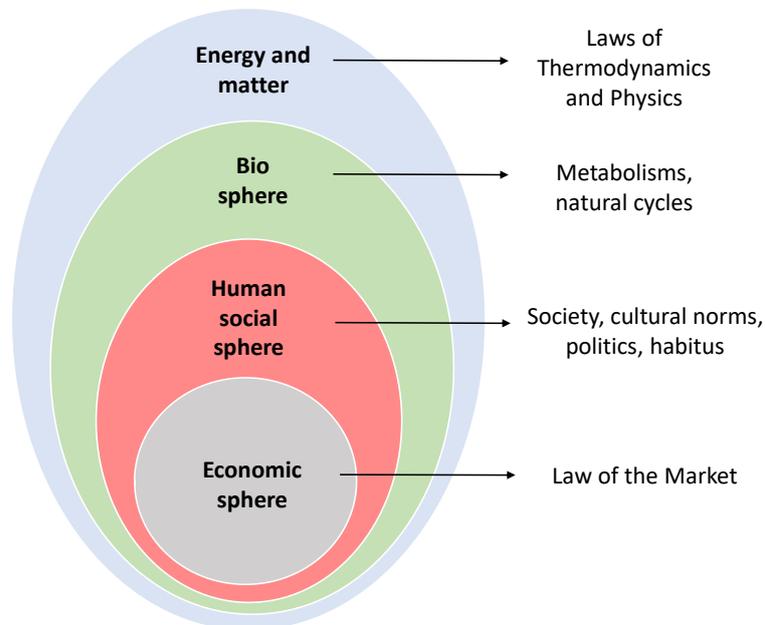
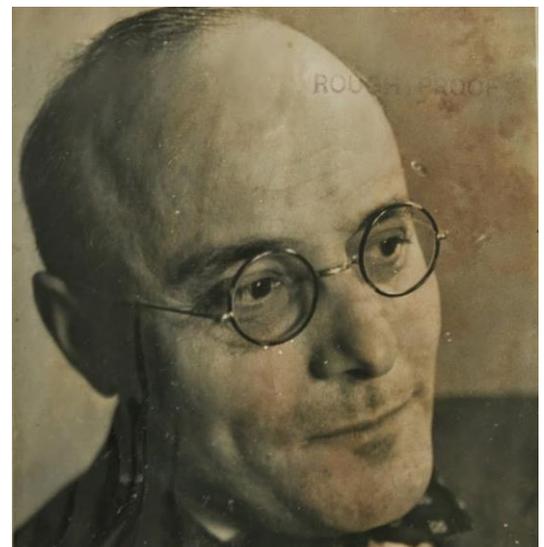


Figure 4- The re-embedding of economic logic inside the human, bio and energy spheres

Regarding the economic sphere, we have traditionally defined the economy as the rational management of useful and rare resources of this world in order to satisfy human aspirations at the optimal price. Economic historian **Karl Polanyi**²⁴ defined “formal economics” as the pure reign of calculating reason in the context of scarcity of goods when the ends are given. However this “pure economics” only covers a subset of all human activities and endeavours: the commercial part. Around this commercial sphere, there are much broader domains that touch the arts, free activities that do not lead to a commercial transaction, and socio-cultural values, which are the values that ultimately give meaning to life and drive behaviours.

Polanyi raised the question of the relationship between society and the market in his book **‘The Great Transformation’**²⁵. He observed that **the market was not a feature exclusive to capitalism. It has always existed but it used to play a secondary role** among other economic and social relations:

« Aristotle was right: man is not an economic, but a social being. He does not aim at safeguarding his individual interest in the acquisition of material possessions but rather at ensuring social good will, social status, social assets. Man's economy is, as a rule, submerged in his social relations. »



Karl Polanyi

For Polanyi, economies are embedded and enmeshed in social relations and institutions.

²⁴ Karl Polanyi: https://en.wikipedia.org/wiki/Karl_Polanyi

²⁵ The Great Transformation: [https://en.wikipedia.org/wiki/The_Great_Transformation_\(book\)](https://en.wikipedia.org/wiki/The_Great_Transformation_(book))

Economics and its 'obsolete mentality' are valid as long as one is sufficiently myopic to see the unsustainable market system of the 19th century in all economic life. The 'self-acting device' of the 19th century - the market system - cannot be the reference point for grasping 'the reality of society' in economic life because, before its rise, markets were isolated and regulated by other social institutions.

Indeed, the issue with a pure 'financial' mindset applied to economics is that it ignores the number of **non-commercial activities that abound around us**. Tribal communities are obvious examples, but even in the modern western world families and circles of friends are prime cases of social structures where interactions between individuals are based on gifting and sharing communal resources.

This means that instead of being restricted to pure monetary and financial calculations, the economic logic must take into account the energetic and material dimensions of the resources which enable the flows it is measuring. In other words, and to link it back with the work of Georgescu-Roegen, economics really needs indicators about the flows of matter and energy. It must also reflect the time horizon of natural cycles. A renewed economic logic must also integrate the human dimension and systemic complexity that make up society. **In other words, the question here is of restricting the possible scope of 'classical' economics while introducing a degree of anthropological complexity.**

So from a scientific standpoint, the efforts of free market theorists to put the economy on top are doomed to fail. **However, the very misleading simplism²⁶ of market liberalism is a source of its extraordinary intellectual resilience.**

Only after the last tree has been cut down
Only after the last river has been poisoned
Only after the last fish has been caught
Only then you will find out that money cannot be eaten
*Native American saying which pretty much captures
in four lines the essence of Polanyi's thesis*

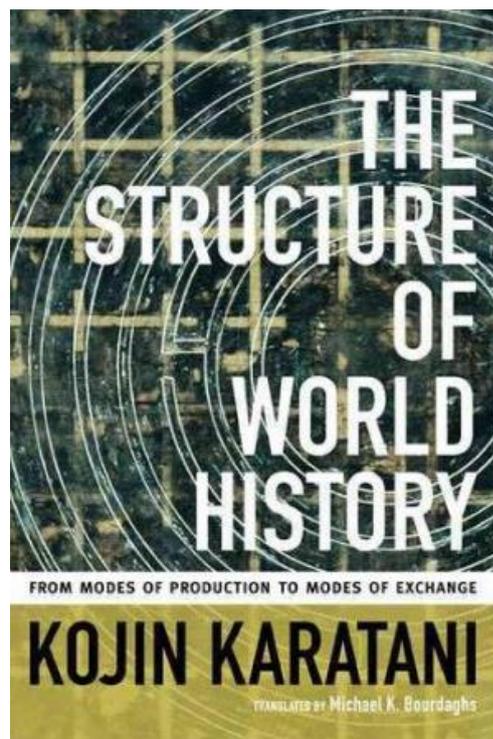
²⁶ Definition of simplism: the act or an instance of oversimplifying; especially the reduction of a problem to a false simplicity by ignoring complicating factors. <https://www.merriam-webster.com/dictionary/simplism>

How to counter this intellectual resilience of the utopianism of market liberalism? Understanding the complexity of the modes of exchange to escape economic reductionism

Key point: A way to refute the intellectual resilience of the simplistic utopianism of market liberalism is to show that the 'market' is not the alpha-and-omega of our economic and social order, and that other modes of exchanges have existed throughout history across societies. The 'market' is only one of many functions that make up our economic and social fabric. Japanese philosopher Kojin Karatani provides useful tools to analyze this.

A useful perspective to understand how those spheres function is the notion of “mode of exchange” developed by Japanese philosopher **Kojin Karatani**²⁷ in his “*The Structure of World History: From Modes of Production to Modes of Exchange*”. He distinguishes four such modes of exchange: ‘the community’, ‘the state’, ‘the market’, and a fourth hypothetical mode made of a mix of those first three and that is meant to transcend them.

Those modes of exchange can be explained through an historical approach. **Michel Bauwens** and **Vasilis Niaros** from the P2P Foundation have summarized Karatani’s conclusions²⁸ who recognizes different major transitions throughout History: each modality changes as it is constrained by the domination of other modalities. For example, the form of community is first the band (under nomadism), then the tribe, then the agricultural or territorial community under imperial systems, which eventually becomes the nation under the domination of capitalist systems.



- The form of community is the first stage under nomadism: this is where the pooling of resources is the dominant modality. A first transition occurs when the **pooling of resources** in nomadic bands is replaced as a dominant modality of exchange by the **reciprocity-based gift economies of tribal systems**. This allows a scaling from bands to clans, tribes and inter-tribal systems and, therefore, creates a world that consists of a collection of tribal mini-systems

- Then tribes become agricultural or territorial communities under imperial

²⁷ Evolution of the Structure of World History Through Modes of Exchange:
http://wiki.p2pfoundation.net/Evolution_of_the_Structure_of_World_History_Through_Modes_of_Exchange

²⁸ Value in the Commons Economy. By Michel Bauwens and Vasilis Niaros - co-published by Heinrich Böll Foundation and the P2P Foundation: <http://commonstransition.org/value-commons-economy/> - Michel Bauwens the P2P Foundation: <http://commonstransition.org/#team2>

systems. With this second transition the reciprocity-based systems of tribes is replaced by **state systems**, based on the logic of ‘plunder and redistribute’ or ‘rule and protect’. This allows scaling to inter-tribal and inter-community levels and, thus, creates a world of world-empires that compete with each other.

- The empire eventually becomes the nation under the domination of capitalist systems. This third transition occurs when imperial systems are replaced by the **market form** as the dominant form of exchange. This creates a global world-market system in which nation-states compete with each other, which Karatani characterizes as a world-economy.

- Finally, Karatani posits a new transition towards a mode of exchange that integrates the preceding ones but is dominated by the pooling that was originally dominant in the early nomadic groups. Karatani calls this modality ‘associationism’.

Once enunciated those modes, it becomes easy to recognise them as ‘elementary bricks’ underpinning all societies across various historical periods. It also confirms - if needs be - that with respect to the history of humanity, capitalism is really recent and so should not be considered as the “only alternative”

This is a first key point in Karatani’s thesis: the fact that the four modes can and will coexist and interwork. This means that **in today’s Capitalist paradigm the market mode dominates** but does not exist on its own. The State which “plunders and redistributes”, and the reciprocity of gift between people which operates for example in the family structure and communities are still key modes of exchange.

As for the strength of the “Market Mode”, it comes from its support from **the triarchy Capital, Nation and State**, which reinforce each other and act as a mutually interrelated system to protect the Capitalist system.

Michel Bauwens highlights that it is quite different to see capitalism as a mere mode of production, and then to declare the state and the nation as mere epiphenomena of capital (as marxists used to do), or to insist (as Karatani does) that capitalism is really a triarchy combining Capital-State-Nation. Though ‘capital’ dominates, the two other modalities are just as essential for the survival and organization of the system as a whole.

This constitutes an essential second point emanating from Karatani’s work. Today we are in a singular situation where the Market has colluded with the State, which explains why the State is not the solution to the issues we are trying to address. And hence the ongoing disappointment with the current Left political parties, which systematically betray the general interest to favour the interests of the elite – precisely because of this Capital-Nation-State collusion. As illustrated by a recent study²⁹ conducted in the US which shows

²⁹ Testing Theories of American Politics: Elites, Interest Groups, and Average Citizens, by Martin Gilens and Benjamin I. Page, 2014: https://scholar.princeton.edu/sites/default/files/mgilens/files/gilens_and_page_2014_-_testing_theories_of_american_politics.doc.pdf

that economic elites and organized groups representing business interests have substantial impacts on U.S. government policy, while average citizens and mass-based interest groups have little or no influence.

To quote Michel Bauwens’s analysis of Karatani: *“the Capital-Nation-State trinity is so strong, because each will always come to support when the other ones are threatened.”*

Bauwens explains that faced with the strength of that trinity, the focus on the P2P triarchical model of productive commons-organized civil society, cooperative marketspace, and enabling ‘partner’ state models makes sense *“since the attempts to change the capitalist nation-state, seem so impossible today. Karatani makes the strong and in my view realistic point, that the community integrating functions of the nation are not likely to disappear, nor the redistribution functions of the state.”*



Michel Bauwens

This is in effect a call for new (multimodal) balance instead of a unipolar dominance of either Capital or State or Market-power. So the question becomes how we allow those other modes already *cohabitating with market mechanisms* to grow and reach critical mass *to displace market capitalism as the dominant form* and shift the system beyond capitalism?

To do this, it now flows logically that the laws economics must remain “embedded” inside society (to use Polanyi’s concept), and the way to achieve it is *to augment the voice of the non-market modes in the TIMN quartet (Tribes, Institutions, Markets, and Networks)*³⁰.

The following table summarizes Karatani’s modes of exchange:

Types of mode exchange	Mode A: Community	Mode B: State	Mode C: Market	Mode D: Association
Description	The reciprocity of the gift (or ‘pooling’ through commons)	Ruling and protection (also called: ‘plunder and redistribute’)	Commodity exchange (capitalist market)	It transcends the other three (the return of mode A at a higher level of complexity)

Table 1 - Modes of exchange The four types of Kojin Karatani for the evolution of the means of exchange (Karatani, 2014).

³⁰ David Ronfeldt, “Institutions, Markets, and Networks: A Framework about the Evolution of Societies” (1993): <https://www.rand.org/content/dam/rand/pubs/papers/2005/P7967.pdf>, David Ronfeldt on the TIMN Framework: http://wiki.p2pfoundation.net/David_Ronfeldt_on_the_TIMN_Framework

INTRODUCING THE COMMONS



After discussing the **mechanistic origins of classical economics**, its **contradictions revealed by thermodynamics**, and the **necessity to displace market capitalism as the dominant form of exchange**, we now conceptualize what a **systemic alternative to displace capitalism** across key domains would represent.

At one end of the spectrum described by Karatini we find the ‘capitalist market’ supported by the Nation-State and the unsustainability of this format that generates biospheric destruction and social and psychic dislocation as attested by the current backlash spreading across western democracies: the moderately radical Syriza movement in Greece was put under a European protectorate and had to abandon Greek sovereignty; progressive governments in Latin America are struggling to effect change. While the electorate may vote for parties that promise to change the status quo and eventually bring to power movements like Podemos, a Labour Party under the leadership of Jeremy Corbyn, or a Democratic Party strongly influenced by the Sanders movement, their capacities for change are severely restricted³¹.



Figure 5 – Bernie Sanders at a Black Lives Matter³² protest

On the conservative side, the likes of Trump and Le Pen represents the ‘national’ business interests, trying to mobilize behind their interests the declining white middle class and workers.

The key insights from this global trend is that the direction at the city and nation-state level should be to increase the capacity for the autonomy of citizens and the new economic forces aligned around the Commons. Simply initiating left-Keynesian state policies will not be sufficient and will, in all likelihood, be met with stiff trans-national opposition from the financial oligarchy.

This is the core idea behind aligning around the Commons: to displace the **structures of**

³¹ Syriza: <https://en.wikipedia.org/wiki/Syriza>, Podemos: [https://en.wikipedia.org/wiki/Podemos_\(Spanish_political_party\)](https://en.wikipedia.org/wiki/Podemos_(Spanish_political_party)), Jeremy Corbyn: https://en.wikipedia.org/wiki/Jeremy_Corbyn, Bernie Sanders: https://en.wikipedia.org/wiki/Bernie_Sanders

³² Black Lives Matter: https://en.wikipedia.org/wiki/Black_Lives_Matter

extraction, the **structures of oppression** and the **ideological structures** underpinning them.

Hence the work of Elinor Ostrom who helped theorize the Commons

Key point: Elinor Ostrom shows that 'the Commons' are not just the available resources, but also the rules and ways of managing them for the collective interest: without Commons, there is no community; without community, there is no Commons.

The 2009 Economics Nobel Prize laureate³³ focused on examining how common pool resources could be managed. She explained that common pool resources included lakes and fisheries because they could not be easily divided into private property, meaning they had to be managed by some form of collective agreement. She highlighted **modes of exchange which are not based on individual interests and mercantile value**. Her theory of the Commons marked the limits of a strictly economic logic. She was recognised for showing how shared assets can be efficiently managed by associations of users.



Ostrom compared the attempts of our contemporary capitalist system to privatise and control access to contemporary Commons such as knowledge, the natural environment, or networks, to the **English enclosures**³⁴ of the 17th and 18th centuries. This movement led by landowners (*propriétaires fonciers*) aimed at ring-fencing communal land and resources (such as grazing fields and dead wood in forests) in order to prevent farmers and commoners from using them for free. The goal for the landowners was to privatise those resources in order to make a profit from them. This was **the starting point of the primitive**

³³ Elinor Ostrom: https://en.wikipedia.org/wiki/Elinor_Ostrom

³⁴ The Enclosure movement: <https://en.wikipedia.org/wiki/Enclosure>

accumulation of capital that enabled the development of modern Capitalism.

Ostrom also refuted the “free rider” neoliberal thesis of sociologist **Garret Hardin**³⁵ who argued that selfishness drives human to over-exploit resources without looking after them, until they are exhausted; hence penalising the whole community. Her refutation was concerned with two essential problems: how resources could be managed in an ecologically sustainable way, and how a self-governing system could be promoted.

She showed that **‘the Commons’ are not just the available resources, but also the rules and ways of managing them for the collective interest.** This is the core of her legacy: to show there are no Commons without community, and there is no community without strong collective rules that go beyond individual profits. It is this mindset that is paramount when it comes to managing natural resources.

		EXCLUSION	
		Difficult	Easy
RIVALRY (SUBTRACTABILITY)	RIVALROUS (Low subtractability)	<p>Common pool (or common property) resources e.g. Land, air, water, irrigation systems, fish stocks, wild game, pastures, forests, natural resources, libraries</p> <p>If those resources are subordinated to markets, their exploitation generates negative externalities worn by people who don't interact on those markets.</p>	<p>Private Goods All good traded on markets: e.g. food, clothing, cars, everyday electronic devices.</p>
	NON-RIVALROUS (High subtractability)	<p>Pure Public Goods e.g. Immaterial common goods such as un-encoded media, but also street lights, useful knowledge, sun-light.</p> <p>Everything is that non-rivalrous and non-excludable cannot be anything else but a commons.</p>	<p>Toll or club goods e.g. Journal subscriptions, paywalled media, most social services</p> <p>These are paying goods and services which marginal cost is null.</p>

Table 2- Commonly used “Spectrum of Rivalry” which helps understand Ostrom’s work – adapted from “Introduction: An Overview of the Knowledge Commons - Charlotte Hess and Elinor Ostrom”

Ostrom showed that a commons is either **an open-access resource, freely available to all, or a common-pool resource, regulated by rules of use.**

Her work alongside researcher **Charlotte Hess**³⁶ highlighted specific examples of the

³⁵ Garrett Hardin and the Tragedy of the Commons: https://en.wikipedia.org/wiki/Tragedy_of_the_commons

³⁶ Charlotte Hess: http://wiki.p2pfoundation.net/Charlotte_Hess

natural commons and the Knowledge Commons:

- **The natural commons** (such as water and the air) are to be managed with an objective of sustainability: Ostrom's used the example of water resources managed by a community.
- **The information and knowledge commons** that are non-rival and non-excludable which have exploded with the development of the internet: a prime example is Wikipedia which knowledge production is based on voluntary contribution allow free and accessible knowledge for all.

Why the commons and commons-based peer production are the right paradigms for the new economy

Key point: Once a proper definition of the Commons enunciated, we move to making the case for the Commons - i.e. explaining why it is the right paradigm to tackle the sustainability issues we are trying to solve.

One evolution for collective action around the commons theorized by Ostrom has been **Commons-Based Peer Production**, a term coined by Harvard Law School professor **Yochai Benkler**³⁷ who – partly relying on the work of Elinor Ostrom - developed it between 2002 and 2006, as a way to grasp the characteristics of a new model of production that loomed behind the surprising success of experiences, like the **Free/Libre and Open Source Software**³⁸(**FLOSS**) and Wikipedia. It describes a new model of socioeconomic production in which large numbers of people work cooperatively, and has been made possible on a global scale for the knowledge commons thanks to the development of the Internet.



Yochai Benkler

³⁷ Yochai Benkler: https://en.wikipedia.org/wiki/Yochai_Benkler, Yochai Benkler. The Wealth of Networks: How Social Production Transforms Markets and Freedom: https://cyber.harvard.edu/wealth_of_networks/Main_Page

³⁸ Free and open-source software: https://en.wikipedia.org/wiki/Free_and_open-source_software, FLOSS and FOSS by Richard Stallman: <https://www.gnu.org/philosophy/floss-and-foss.en.html>



Figure 6- Illustration of the delimitation of Commons-Based Peer Production. Mapping 30 areas of activity³⁹.

Benkler’s notion had the merit of highlighting the emergency of the ‘information commons’ as detailed in his seminal book **‘The Wealth of Networks: How Social Production Transforms Markets and Freedom’**. Since Benkler outlined the notion, the understanding of Commons-Based Peer Production has continued to progress.

The Commons, as an idea and practice, has emerged as a new social, political and economic dynamic. As shown by Kojin Karatani, along with **the Market** and **the State**, **the Commons** is a third mode of societal organization. The Commons and Peer to Peer (P2P) together form a system based on the practices and needs of civil society and the environment it inhabits, evolving away from obsolete, centrally planned systems or the competitive dictates of market economies.⁴⁰

If **“Commons”** is the **“what”**, **“P2P”** could be considered the **“how”**⁴¹. P2P - “peer to peer”, “people to people”, or “person to person” - can be called a relational dynamic through which peers freely collaborate with one another to create value in the form of shared resources, circulated in the form of Commons.

The relationship of P2P with the Commons is one of enabling capacities for contributive actions. P2P facilitates the act of “commoning,” as it builds capacities to contribute to the creation and maintenance of any shared and co-managed resource (a Commons).

In brief, P2P expresses an observable pattern of relations between humans, while the Commons tell us the specific **what (as in resources)**, **who (the communities gathered**

³⁹ Delimiting Commons-Based Peer Production: <https://p2pvalue.eu/delimiting-commons-based-peer-production/>

⁴⁰ Michel Bauwens, Vasilis Kostakis, Stacco Troncoso, Ann Marie Utratel. Commons Transition and P2P: a Primer: <http://commonstransition.org/commons-transition-p2p-primer>

⁴¹ *Idem*

around the resources) and how (the protocols used to steward the resources ethically and sustainably for future generations) of these relational dynamics.

Basing civil society on P2P dynamics and Commons practices could enable a more egalitarian, just, and environmentally stable society; this is the aim of a Commons transition.

We will now use the terms **Commons-Based Peer Production**, **Peer-to-Peer** and **P2P** interchangeably.

There is no shortage of analysts to lay out a moral and political argument for P2P. Much has been written about the *political intuition* and the case for the Commons (Elinor Ostrom, Michel Bauwens, David Bollier, Pierre Dardot and Christian Laval⁴²) so there is probably little value in repeating it here.

However one particular angle might be worth reinforcing here: it is the question of the sense of urgency and depth of the post-capitalist transition. The current political and environmental crises present us with choices along a few dimensions:

1 – **a shift of one’s form of civilization** (i.e. “changing the frame itself⁴³”), *as opposed to a change within* the same form of civilization (i.e. “changing within the same frame”). This dimension is basically calling for truly radical alternatives, as opposed to just accommodate the existing system and do “green and social washing”. This advocacy of a radical transformation is for instance the line followed by French economist Frédéric Lordon, major figure of the “Nuit Debout” movement of 2016⁴⁴.



⁴² David Bollier: <http://www.bollier.org>, Pierre DARDOT, Christian LAVAL. COMMUN, Essai sur la révolution au XXIe siècle: <http://www.editionsladecouverte.fr/catalogue/index-Commun-9782707169389.html>

⁴³ In the words of French philosopher Frédéric Lordon: <https://scinfolex.com/2016/06/28/ce-que-lon-apprend-sur-les-communs-en-lisant-frederic-lordon/> (article in French)

⁴⁴ Nuit Debout is a French social movement that began on 31 March 2016, arising out of protests against proposed labor reforms known as the El Khomri law or ‘Loi travail’. It has been compared to the Occupy movement in the United States and to Spain’s anti-austerity 15-M or Indignados movement: https://en.wikipedia.org/wiki/Nuit_debout

2 – a rapid concerted **conscious civilisation change**, as opposed to a slow **unconscious change** (i.e. ‘suffered’ vs ‘chosen’)

This last point about the ‘conscious’ argument is crucial. The conscious vs unconscious implies the eminently political nature of the argument. It is not a thermodynamics argument; it is a political argument supported by thermodynamics findings.

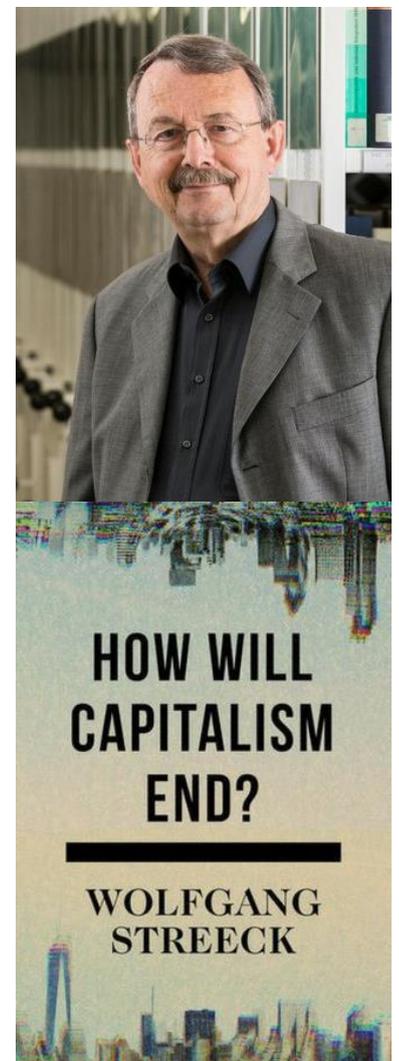
The need to ‘**shift in one’s form of civilization**’ (i.e. to displace market capitalism as the dominant form of exchange and shift the system beyond capitalism) and to do it in a ‘**conscious manner**’ (i.e. in a political manner) makes the thermodynamics approach work the other way around: we first need to declare the goals (*e.g. we want a system with the lowest possible externalities - i.e. a system with the lowest possible entropy degradation – which would translate into “we want 100% renewable energy”*), and then examine which type of mode of exchange system fits best our goals for each social activity, with the view of following a P2P/Commons approach when it makes sense.

This point is far from being rhetorical or splitting hair on logic. It is for example at the heart of the impasse of Sustainable Development which has not delivered on its expectations. The Laws of Thermodynamics on energy and matter give us the framework and parameters we need to consider to shift model, but they do not give us ‘*how*’ it should be done, except from displacing market mechanisms as the dominant form of exchange, which will primarily remain a political topic.

So what might happen if we don’t do it consciously? To echo the works of analysts who have focused on systemic collapse (such as **Wolfgang Streeck**’s *How Will Capitalism End*⁴⁵, **Thomas Piketty**⁴⁶’s analysis of the consequences of inequalities) the adjustments will be imposed on us violently, such as what happened in the 20th century and before:

- through ecological collapse and resources depletion,
- through social collapse, explosion of populism flirting with fascism embodied by Donald Trump.

Once established this strategic intent about the transition, we can now focus on what the Commons propose in effect.



⁴⁵ Wolfgang Streeck. *How Will Capitalism End*: <https://www.theguardian.com/books/2016/dec/09/wolfgang-streeck-the-german-economist-calling-time-on-capitalism> <https://newleftreview.org/II/87/wolfgang-streeck-how-will-capitalism-end>

⁴⁶ Thomas Piketty. *Capital in the 21st century*: <http://piketty.pse.ens.fr/en/capital21c2>

REFERENCES



Tipping point. The Drought That Preceded Syria's Civil War Was Likely the Worst in 900 Years, By Elaisha Stokes, 2016: <https://news.vice.com/article/the-drought-that-preceded-syrias-civil-war-was-likely-the-worst-in-900-years>

Real estate: Australian banks must learn lessons of US sub-prime crisis, warns ASIC boss: <http://www.abc.net.au/news/2017-04-04/australian-banks-learn-the-lessons-of-sub-prime-asic-medcraft/8413542>

René Passet Les grandes représentations du monde et de l'économie à travers l'Histoire. De l'univers magique au tourbillon créateur. 2010 - ISBN : 978-2-918597-08-7. 948 - PRIX DU LIVRE D'ECONOMIE 2010.

The Entropy Law and the Economic Problem - Nicholas Georgescu-Roegen: <http://webpage.pace.edu/dnabirahni/rahnidocs/law802/The%20Entropy%20Law%20and%20the%20Economic%20Problem.pdf>

Robert Solow's Richard T. Ely Lecture, 1974: <http://msl1.mit.edu/classes/esd123/2003/bottles/Solow.pdf>

The Limits to Growth is a 1972 book about the simulation of exponential economic and population growth with finite resource supplies. Commissioned by the Club of Rome: https://en.wikipedia.org/wiki/The_Limits_to_Growth

Joseph Stiglitz: https://en.wikipedia.org/wiki/Joseph_Stiglitz , Partha Dasgupta: https://en.wikipedia.org/wiki/Partha_Dasgupta , Geoffrey Heal: <http://www8.gsb.columbia.edu/cbs-directory/detail/gmh1>

Joseph Schumpeter: https://en.wikipedia.org/wiki/Joseph_Schumpeter

George Monbiot. The Pricing of Everything: <http://www.monbiot.com/2014/07/24/the-pricing-of-everything/>

Karl Polanyi: https://en.wikipedia.org/wiki/Karl_Polanyi

The Great Transformation: [https://en.wikipedia.org/wiki/The_Great_Transformation_\(book\)](https://en.wikipedia.org/wiki/The_Great_Transformation_(book))

Kojin Karatini. Evolution of the Structure of World History Through Modes of Exchange: http://wiki.p2pfoundation.net/Evolution_of_the_Structure_of_World_History_Through_Modes_of_Exchange

David Ronfeldt, "Institutions, Markets, and Networks: A Framework about the Evolution of Societies" (1993): <https://www.rand.org/content/dam/rand/pubs/papers/2005/P7967.pdf>, David Ronfeldt on the TIMN Framework: http://wiki.p2pfoundation.net/David_Ronfeldt_on_the_TIMN_Framework

"Value in the Commons Economy" By Michel Bauwens and Vasilis Niaros - co-published by Heinrich Böll Foundation and the P2P Foundation: <http://commonstransition.org/value-commons-economy/>

Testing Theories of American Politics: Elites, Interest Groups, and Average Citizens, by Martin Gilens and Benjamin I. Page, 2014: https://scholar.princeton.edu/sites/default/files/mgilens/files/gilens_and_page_2014_testing_theories_of_american_politics.doc.pdf

Elinor Ostrom: https://en.wikipedia.org/wiki/Elinor_Ostrom

Garrett Hardin and the Tragedy of the Commons: https://en.wikipedia.org/wiki/Tragedy_of_the_commons

Vincent Ostrom: https://en.wikipedia.org/wiki/Vincent_Ostrom

Charlotte Hess: http://wiki.p2pfoundation.net/Charlotte_Hess

Yochai Benkler: https://en.wikipedia.org/wiki/Yochai_Benkler

Michel Bauwens, Vasilis Kostakis, Stacco Troncoso, Ann Marie Utratel. Commons Transition and P2P: a Primer: <http://commonstransition.org/commons-transition-p2p-primer>

David Bollier: <http://www.bollier.org>

Pierre DARDOT, Christian LAVAL. COMMUN, Essai sur la révolution au XXIe siècle: <http://www.editionsladecouverte.fr/catalogue/index-Commun-9782707169389.html>

Michel Bauwens, Vasilis Kostakis, Stacco Troncoso, Ann Marie Utratel. Commons Transition and P2P: a Primer: <http://commonstransition.org/commons-transition-p2p-primer>

Frédéric Lordon: <https://scinfolex.com/2016/06/28/ce-que-lon-apprend-sur-les-communs-en-lisant-frederic-lordon/> (article in French)

Wolfgang Streeck. How Will Capitalism End: <https://www.theguardian.com/books/2016/dec/09/wolfgang-streeck-the-german-economist-calling-time-on-capitalism> <https://newleftreview.org/II/87/wolfgang-streeck-how-will-capitalism-end>

Thomas Piketty. Capital in the 21st century: <http://piketty.pse.ens.fr/en/capital21c2>

With special thanks to **Alekos Pantazis** (http://wiki.p2pfoundation.net/Alekos_Pantazis) and **Jose Ramos** (http://wiki.p2pfoundation.net/Jose_Ramos) from the **P2P Foundation** for their inputs.

