**The economy is an ecosystem: A new economic paradigm for a humane and ecological civilization**

“We have it in our power to begin the world over again”, Thomas Paine wrote in 1776, but we also have it in our power to kill the planet. Which one will we choose? Much of our choice depends on what kind of economy we have – one that is ecologically sustainable into the indefinite future, vs. the one we have now that gives profit-obsessed corporations overwhelming decision-making power.

As John Feffer [wrote](https://fpif.org/the-black-death-killed-feudalism-what-does-covid-19-mean-for-capitalism/) recently:

“The global economy remains market-centered, even though the evidence has been mounting that these markets are failing us and the planet. Tweaking this model isn’t good enough. We need a new Copernicus who will provide a new theory that fits our unfolding reality, a new environment-centered economics that can maximize not profit but the well-being of living things.”

Copernicus, the 16th century astronomer who first proposed a framework for understanding that the planets revolve around the sun, was the main subject of the philosopher Thomas Kuhn’s groundbreaking book, “The Structure of Scientific Revolutions”, in which he introduced his conception of a ‘paradigm’. A paradigm is a set of interconnected ideas that have a logical cohesion. There may also be many ‘anomalies’, as Kuhn called them, which can be covered up by ‘tweaking’. Even if some of the ideas fail, the whole maintains its capacity to explain and make sense of a part of reality. He argued that scientists don’t leave their old paradigm, as creaky and riddled with problems as it may be, until they are confident that there is a new paradigm that does a better job of explaining their domain of study. In the same way, John Kenneth Galbraith argued that people retain what he called ‘conventional wisdom’ until they find a better alternative. Oceans of ink have been spilled or pixelated critiquing economics, but none of that will matter unless we find a better alternative to today’s dominant economic paradigm, neoclassical economics.

Any economic paradigm will inevitably include a political agenda within its framework. In the case of neoclassical economics that agenda is hiding in plain sight: the logic (of microeconomics at least) is to argue that the less the government intervenes in the economy, the better (Keynes created an exception to this rule). In addition, it generally seeks to justify the current distribution of wealth and income. In other words, it is the intellectual core of modern-day conservatism, both conventional and neoliberal. When progressives try to offer solutions based on this paradigm, they get sucked back into the conservative mind-set.

Partly as a result of this paradigm, many of our systems are run to maximize short-term profits, not long-term efficiency. The public health system has been continuously starved of funds and has been denied the extra capacity that a resilient system would possess, resulting in a botched response to the pandemic. As government in general is cut back, poverty increases, violence escalates and the only sectors of the state that are given free reign are the military and police, who often fill in for inadequate social services. The industrial base has been slipping away for decades, not because it was unprofitable, but because it was more profitable to outsource. The effect has been, first, to impoverish communities of color, whose workers are first to be fired, and eventually, to destroy the economies of white working class communities as deindustrialization spreads, leading to a neofascistic reaction and the election of Donald Trump. Maximizing profits has meant maximizing greenhouse gas emissions, which are [more profitable than sustainable options](http://unionsforenergydemocracy.org/resources/tued-publications/tued-working-paper-10-preparing-a-public-pathway/), while huge swaths of irreplaceable forests are torn down in order to make cheaper hamburgers.

Without a new economic paradigm, the Left can only resort to tweaking a collapsing system, making the descent as comfortable as possible. Each broken system is addressed separately, with no or little capacity to gain from interlocking solutions. The big questions of economic growth and the health of the economy are left to the ‘experts’, who counsel patience while the market allegedly does its magic.

**A new center**

Just as premodern astronomers mistakenly thought that the universe revolves around the Earth, neoclassical economics argues that the economy revolves around markets and exchange. Just as we now know that the planets revolve around the Sun, I will argue that *the economy revolves around the production of wealth -- by governments, ecosystems, and manufacturing*. The market can only exchange that which has been produced. Had a perfect market system been set up in ancient Rome, it would *not* have led to a modern economy. Only technological advances in manufacturing and the construction of modern infrastructure by governments has made the construction of a modern economy possible. We have been blindly extracting the riches of nature and using its services, but now we have the science to understand how to redesign the global civilization in concert with nature so that our human ecosystems will not collapse as other civilizations have in the past.

The first civilizations used public works – infrastructure – as a way to create an agriculture-based economy, which created the surplus to keep the whole system going. But they often undermined the ecological foundation of their economy, until they collapsed. They used very inhumane production methods to create this surplus, including slavery, which increased the fragility of their economy – all the way up to the pre-Civil War American South.

When governments are democratically elected, a paradigm centered on production can put people at the center of an economic system, replacing profits as the highest economic priority . Governments controlled by ‘we the people’ can reconstruct the economy in such a way that everyone can enjoy ‘life, liberty, and the pursuit of happiness’; or put another way, to quote another ‘founding father’, we can construct a society in which everyone is ‘healthy, wealthy, and wise’. Technology has created such powerful forces that the public will be able to choose well-designed sets of plans to reconstruct the economy by building new infrastructure systems that work *with* nature, instead of against it. This in turn means that engineers and scientists should have more to say about economic policy than neoclassical economists; but whatever plans they come up with must be both comprehensive *and* comprehensible to the public, because the pushback against the construction of a sustainable society will be so intense that only an enthusiastic public will be able to win with such an agenda at the ballot box.

Ideally, this process of reconstruction will be encouraged by the democratization of the firm. If companies are owned and operated by their employees, they will clearly put the needs of people before profits, and such firms would support a program of reconstruction instead of opposing it.

Democracy can be viewed as an example of humans recreating the necessary cycles that exist in natural ecosystems. Economies can be viewed as a kind of ecosystem, and by doing so we can see how to integrate human ecosystems into natural ones. But in order to do so, we need to change the concept of a system that we use to view the economy, in order to create an alterntive paradigm.

**The Neoclassical mechanical world**

Neoclassical economics developed in the late 19th century, at a time when physics was developing. In particular, a field called statistical mechanics was emerging. It became possible to explain the behavior of systems containing a huge number of elements, like the molecules of water in a system of pipes or the molecules of various gases in a container. Writers like Alfred Marshall and Leon Walras used [the mathematical models of statistical mechanics](https://www.amazon.com/More-Heat-than-Light-Perspectives/dp/0521426898) to add to the classical economists, mainly David Ricardo, to form a synthesis called neoclassical economics. The problem is that the model assumes that all the elements, in this case firms, are basically the same and have very little power over the market. That means that there is no difference between a manufacturing firm and a tourist firm as far as the model is concerned, and it also becomes almost impossible to figure out why there is a growth in economic output, since everything is supposed to stay the same – in fact, technology is assumed to be stable, as the economy is modelled as occurring as a sequence of short-term events.

To make matters worse, one of the main ideas retained from Ricardo is the idea of diminishing returns, that is, as one factor of production increases, say land, the returns from that factor diminish. This idea was used by John Bates Clark and others at the turn of the century to argue that everyone receives income according to how much they add to the economy. Clark explicitly used this idea to try to [counter Marx](https://www.encyclopedia.com/people/social-sciences-and-law/economics-biographies/john-bates-clark), who wanted to construct a society to do just that. But since you can’t explain how something increases if your only tool is to explain how things decrease, you can’t explain economic growth. When Robert Solow elaborated the modern theory of economic growth in the 1950s, he could only account for about [12% of growth](http://repec.org/esNASM04/up.24481.1075493216.pdf) -- and even that is suspect if you don’t believe that everyone receives that which they put into the economy.

I always thought that the theory of economic growth was the Achilles heel of neoclassical economics – there have been virtuouso attempts to explain growth [statistically](https://www.nber.org/papers/w5698), but these attempts do not use any theoretical causation. Still, economists are happy to argue that free trade, or privatization, or deregulation or lower taxes will lead to greater long-term economic growth, even though there is virtually no theoretical justification for their statements. Economic growth is the most spectacular process that occurs in modern economies, so not having a coherent theory is like arguing that physics is a science even if it couldn’t explain the movement of the planets – which Copernicus was able to do hundreds of years ago.

The economic growth we have been experiencing since the 1970s, however, has had two deleterious effects: [it has mostly gone to the top 1%,](https://www.epi.org/publication/decades-of-rising-economic-inequality-in-the-u-s-testimony-before-the-u-s-house-of-representatives-ways-and-means-committee/) and it is leading to ecological catastrophe. If we take a different approach to how systems work in economies, however, we can see how to attain economic growth that will benefit the 99% and will allow us to live gently on the planet.

**The economy is an ecosystem**

At the same time that neoclassical economists were plumbing the depths of statistical mechanics, another revolution was going on in biology, the Darwinian revolution. Along with the development of theory of evolution came the field of ecology. What developed from this path of study was the concept of an ecosystem that is composed of a set of functions, called niches. Each ecosystem is composed of equivalent niches that are occupied by different kinds of organisms, but those organisms generally fulfill similar functions when they are in the same niche. For instance, in some ecosystems bears eat the big plant eaters, while in others cougars do so.

These sets of niches can be further organized into what is called trophic levels, that is, plants such as grass and trees form what is called the primary producer level, herbivores like dear eat these plants to form the primary consumer level, carnivores like bears then eat the herbivores to form the secondary consumer level, and then recyclers like worms and fungi break down the dead matter from all these levels to form the detritivore level.

It is this last level, the detritivore level, that makes it possible for ecosystems to thrive for long periods of time by closing the circle of production of the ecosystem. Otherwise the production of the ecosystem could overwhelm the ecosystem and choke it, the way algae can choke a pond if they get out of control – or the way humans are upending the climate by pumping it full of greenhouse gases. Ironically, [it is the inability of ecosystems 300 million years ago to do this](https://www.nationalgeographic.com/science/phenomena/2016/01/07/the-fantastically-strange-origin-of-most-coal-on-earth/) recycling for the newly evolved trees that led to the creation of the coal that is now part of the cause of global warming. But humans are also tearing down ecosystems and destroying them by extracting resources to use as input to their production system, or to create sprawl or industrial agriculture. If we are to live on this planet the input for our production system, as for natural systems, should come from either renewable sources like the sun, or from the output that is recycled, as soil is made up of the composting of trees and other organic matter, and we will need to retreat from ecosystems in order to let them restore themselves. Economies will need to add this recycling level, to create what is called a [circular economy](https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy).

Thus we can say that *the economy is an ecosystem* because like a natural ecosystem it also has a set of trophic levels and is made up of functional niches which are all necessary for the long-term survival of the system. At the outermost level, the economy produces goods and services that the people consume, the consumer level. On the next level down, firms produce the industrial machinery that is used to produce consumer goods, which we can call the production machinery level. At the center of our human ecosystem sit certain classes of industrial machinery that collectively are used by skilled workers to either make more of these kinds of machinery or more of the production machinery that is then used to make goods and services. These I call reproduction machinery, and they have a very special place in the economy.

**Reproducing wealth**

At the reproduction machinery level, machine tools are used to make the metal pieces of all machinery, including machine tools and production machinery. Steel-making equipment is used to make steel, which is then input into machine tools to make more steel-making equipment, or to make more machine tools, or to make a huge range of steel products. The same applies to electricity-generating equipment, which we want to shift from coal-run steam turbines to wind turbines, for instance. Then there is the semiconductor-making equipment that is used to run most machinery digitally. While reproduction takes place in a natural ecosystem at all levels, in a human ecosystem it is at the reproduction machinery level that the reproduction that causes most economic growth takes place.

When there are technological improvements in this reproduction machinery, the effects reverberate out to the rest of the economy, and whole new eras are born. The invention of steel and electricity turbines created what is often called the second Industrial Revolution, and improvements in machine tools enabled the creation of [Henry Ford’s assembly line with interchangeable parts](https://en.wikipedia.org/wiki/Assembly_line) and the era of mass production. The development of semiconductors led to computers, the internet, and the mobile device. All of these niches together form what are called positive feedback loops of innovation, within the levels and between them, that power economic growth.

**Globalization vs. state-led continental economies**

Further, just as an ecosystem is composed of niches that all reside in the same geographic area, so these virtuous circles of technological innovation and reproduction perform better when they are closer together, on a continental or subcontinental level. That is why there is an American economy and a European economy and an African economy. It is devastating for an industrial economy to have its manufacturing and machinery industries ripped apart and sent overseas, the way the U.S. has done, and it has been tragic that Africa and other poor regions have been suffered from ‘[structural disarticulation’](https://www.sas.upenn.edu/~dludden/UnevenDevStructDisarticulation.pdf), the lack of an industrial base. Economies that have a full suite of industries – Germany, Japan, now China – have growing middle classes and in the case of China, have become the most powerful country in the world, while the U.S. continues to decline, as it loses more and more industrial machinery and manufacturing industries.

The state must also tie together this regional economy by creating public works, like the Interstate Highway System, high-speed rail systems, electrical networks and now the internet. Throughout history, the advance of manufacturing technology has led to new infrastructure systems, and in return the new infrastructure systems have helped advance manufacturing technological development. There is a [virtuous circle](https://prospect.org/article/what-else-could-we-do-19-trillion) between manufacturing and the state constructing regional infrastructure systems.

And yet Ricardo’s [concept of comparative advantage](https://en.wikipedia.org/wiki/On_the_Principles_of_Political_Economy_and_Taxation), which supports the entire edifice of trade theory, is based on the idea that each country should specialize on one industry – which led him to the self-serving conclusion that his home country, England, should specialize in manufacturing, while backward countries like the new United States and Poland should specialize on grain. Fortunately for the United States, Alexander Hamilton had prefigured this argument by advocating for the national development of manufacturing, an idea which the pre-Republican Whigs picked up on and used to formulate what Michael Lind describes as ‘[The American School](http://www.newamerica.net/index.cfm?pg=article&DocID=1080)’ of economic thought, involving infrastructure building, tariffs, and industrial subsidies. Unlike Ricardo, in ‘Democracy in America’ de Tocqueville noticed that Americans were very good at ‘Industrial Arts’, and predicted that the U.S. would eventually become one of the world’s most powerful countries. When the Republicans came to power with Lincoln, they encouraged the construction of rail and canals and set up a university system, while in Europe, the writings of Friedrich List, who was influenced by Hamilton, helped propel Germany to become the continent’s leading industrial power.

Many other economic thinkers have noted the importance of the government in constructing infrastructure and encouraging manufacturing. Thorstein Veblen wrote about ‘Industrial Arts’ at the same time as Alfred Marshall was formulating neoclassical economics, and even Marshall eventually came to appreciate the importance of proximity in his formulation of ‘[Industrial Districts](https://en.wikipedia.org/wiki/Industrial_district)’. After WWII [Seymour Melman](https://www.counterpunch.org/2018/01/02/more-power-to-the-workers-the-political-economy-of-seymour-melman/) argued that worker control of an enterprise was more efficient than managerial control, and showed how the military industrial complex crippled industrial competence. [Jane Jacobs](https://www.amazon.com/Cities-Wealth-Nations-Principles-Economic-ebook/dp/B01IZTCFNM/ref=sr_1_6?dchild=1&keywords=jane+jacobs&qid=1593307292&s=books&sr=1-6) focused on production in her books about cities and their importance to national economies. [Alice Amsden](https://www.amazon.com/Asias-Next-Giant-Industrialization-Paperbacks-ebook/dp/B001ODEPP8/ref=sr_1_1?dchild=1&keywords=alice+amsden&qid=1593307253&s=books&sr=1-1) explained the central role of the state in South Korea’s rise to industrial prominence, as [Robert Wade](https://www.amazon.com/Governing-Market-Economic-Government-Industrialization/dp/0691117292) did more generally for east Asia. [Erik Reinert](https://www.amazon.com/How-Rich-Countries-Poor-Stay/dp/1845298748/ref=sr_1_1?dchild=1&keywords=erik+reinert&qid=1593307345&s=books&sr=1-1) has tried to put together what he calls an ‘Other Canon’, that concentrates more on increasing returns, as opposed to Ricardo’s decreasing returns, explaining how countries actually develop. However, none of these thinkers put together a paradigm, a set of interlinking ideas, that could be used as an alternative policy guide to the neoliberal/conservative economic consensus.

In order to show the usefulness of an economic paradigm, we need to show how it would work in practice. This means we need to explain how we can rebuild a manufacturing ecosystem while making the economy more equal and saving the planet at the same time. I’ve been developing a [Green New Deal plan](https://www.greennewdealplan.com/) and [budget](https://howiehawkins.us/the-ecosocialist-green-new-deal-budget/) for several years, beginning with my [book](https://economicreconstruction.org/ManufacturingGreenProsperity) in 2010 and in [various](file:///What%20a%20Green%20New%20Deal%20should%20look%20like/%20filling%20in%20the%20details) [articles](file:///Saving%20the%20Green%20New%20Deal/%20The%20Green%20Economy%20Reconstruction%20Program%20and%20Budget) (you can see more details in the plan). Here I will explain how the Federal government, adding about 20% to the economy, could implement the paradigm that I have sketched above.

**A state-led, production-centered Green New Deal**

Since the Interstate Highway System was probably the largest public works project in human history, let’s say we would build – and by we, I mean the government – an Interstate Renewable Electricity System that would strategically place wind and solar farms around the country, mostly in the Great Plains, so that there would always be enough wind blowing and enough sun shining somewhere to fill all our energy needs. Note that the market cannot do this because it cannot plan and create such a large system (it would work even better if it [extended](https://www.nrel.gov/analysis/naris.html) to Mexico and Canada).

We could therefore have a sustainable source of power – using the same solar energy that ecosystems use – to use as input to several other parts of the production system. An Interstate High-Speed Rail System could use renewable electricity and replace most air travel, and if it carried freight it could replace long-distance trucking. Manufacturing would use renewable electricity, which would mean a fair amount of swapping out of old machinery for new machinery (which is going on constantly in a healthy industrial system anyway). The new machinery could also be designed to remove all air and water pollution and ensure worker health and safety. Most critically, in order to create a circular economy in the same way ecosystems are circular, the machinery could output products that could be recycled or reused, thus avoiding the need for most mining, which is the cause of much of our ecosystem destruction.

The current progressive model for making this happen is to lean on regulation, that is, mandate that companies reach a particular goal at a particular time. However, considering the resistance this would entail, and more importantly the amount of financial capital this would require, it would be much more straightforward if the Federal government simply paid for all this new equipment. The resultant products would be cheap, because the equipment would be free, leading to a higher standard of living and erasing our trade deficit because domestic goods would be cheaper than imports. The government could trade this investment in the firm for some percent of ownership, which it could then hand over to employees and bring us closer to a worker coop ownership model. The government could also perhaps receive income from their investment, or some combination of the two.

The same model could be used to convert the other main pillar of production, agriculture. Agriculture accounts for about 1/7th of greenhouse gases, pollutes the water, and is in the process of destroying the soil that is the basis of all plant life. In addition, the crowded and unhealthy way livestock are raised greatly increases the risk of a new pandemic. So the government could buy all the equipment needed to convert to healthy, organic, artificial-fertilizer-free and affordable produce, and switch to sustainable livestock regenerative agriculture, including buying land for farmers near and in cities and towns. A new Civil Conservation Corps, similar to the one in the New Deal, could restore ecosystems around the country.

Government planning and ownership could also overcome several problems at once by constructing tens of thousands of large, comfortable apartment buildings to create dozens of walkable neighborhoods in town and city centers. Housing could finally be affordable again for most families, thus increasing the standard of living. The practicality of transit would increase, since [you need a certain level of density for transit to work](http://www.accessmagazine.org/spring-2012/transit-d-word/), and that would mean most transportation would be electric. People could use bikes and walk more, increasing health outcomes. The civil engineers at [StrongTowns.org](https://www.strongtowns.org/) have been arguing that suburbia is economically unsustainable because of the expense of spread-out infrastructure, and densifying those areas would put our fiscal house in order as well.

For those who would still want cars – and if walkable neighborhoods were affordable and comfortable, that particular requirement might decline in popularity – the government could provide large subsidies to buy electric cars, and the Interstate Renewable Electricity System could extend down to the house, allowing people to lease solar panels and electric charging stations so that they could benefit from the lower operating costs of electric cars.

This model could be extended to the entire planet if the rich countries provided the poorer countries with green industrial machinery, so that they could construct their own sustainable production systems, in return for which the poorer countries would protect their ecosystems and retreat from them whenever possible. For example, much of the trade in wildlife meat that has caused the recent diseases such as Covid-19 have been the result of [people who were formerly able to survive from farming being forced to trade wildlife instead](https://www.theguardian.com/world/2020/mar/28/is-factory-farming-to-blame-for-coronavirus).

All of this rebuilding would require a large-scale retraining and updating of the skills of tens of millions of Americans, so that the educational system would have to be reconfigured to upgrade the skill level of the United States. This is what the original public college and school systems did, but we need to extend this model so that there is lifelong learning, starting at birth, with more technical schools available, all for free. Anchoring this system could be an Interstate High-Speed Internet System, that would provide better, faster service, either for free or at reasonable prices, with a certain amount of storage and processing on the web (on the cloud) for schools, individuals, and government.

The outcome of all these systems, designed with all the other ones in mind, is that many positive outcomes *emerge* from the system. The health of the population could improve to such an extent that a Medicare for All or National Health Service system would be much more affordable, since the food would be healthier, pollution would be eliminated, and people would walk and bike more (and might not be subject as much to the death and destruction wrought by cars). The causes of global warming would disappear. Ecosystem destruction would stop as we retreat from ecosystems and stop deforestation and mining. The financial system could be overhauled to emphasize public banking, [as Ellen Brown has argued](http://www.webofdebt.com/), and to allow the Federal government to create the investment money to build these systems, as [Stephanie Kelton](https://www.amazon.com/Deficit-Myth-Monetary-Peoples-Economy/dp/1541736184/ref=sr_1_1?dchild=1&keywords=stephanie+kelton&qid=1593308164&s=books&sr=1-1) and other MMT advocates have explained.

But the most politically attractive aspect of a plan such as this would be the number of good jobs that would be generated. That is, there would be enough long-term, high-skill, well-paid jobs that all unemployment and even all underemployment and undesired part-time work would be eliminated. The category of ‘working poor’ would cease to exist because there would be no more poverty. A Federal Jobs Guarantee could be put in place in order to insure that nobody would have to worry about finding a job, and a basic income could be established for those who could not work. The demand for labor would be so great that the balance of power between employers and workers would shift decisively towards workers. As [Richard Wolff](https://www.counterpunch.org/2020/06/26/how-racism-is-an-essential-tool-for-maintaining-the-capitalist-order/) has explained, racism has served the function of using people of color as an excess supply of labor, to be thrown off when needed; in a people-centered economy, everyone’s potential would be realized in order to make the transition to a sustainable society, and then to keep us there.

Economic growth would not destroy the planet, the way it is doing now, because the inputs and outputs would be clean and circular, like a natural ecosystem. So where would growth come from? It would not come from expanding suburbs, building huge McMansions, ever bigger SUVs, and [ever cheaper burgers](https://globalforestatlas.yale.edu/amazon/land-use/cattle-ranching#:~:text=Cattle%20ranching%20is%20the%20largest,quarter%20of%20the%20global%20market.), which is where perhaps most of the ecological destruction that comes from economic growth is concentrated. The production system constantly increases in productivity because engineers and skilled workers are constantly tweaking the machinery, and sometimes inventing whole new categories of machinery, without using more resources (Seymour Melman and I calculated that manufacturing productivity increases by about 3% per year owing to this underlying technological process). Growth would be mainly caused by improvement in quality, not increases in quantity.

Growth could be equitably distributed because national planning could guarantee that every part of the country gained employment equally. For instance, according to my calculations each Congressional district could have 10 1,000 person new factories, and 200 new 250-unit apartment buildings. The workers for these could be mandated to be hired from their community, thus insuring that communities of color would gain the benefits of reconstruction. Workers in fossil fuel industries could be guaranteed new, equivalent jobs in other industries because that could be part of the national plan. The same could be done for workers in military industries, thus giving the political space to use the military budget for civilian goods. Everyone would get a good education, and could look forward to advancing their career, if they so chose. The surplus from all this economic activity could be put into other social welfare goals, such as doubling Social Security and providing high-quality elder care. The benefits must be made clear to 99% of the public – of all communities, genders, orientations, abilities.

I hope I have shown that it is possible to conceive of a different and more useful way of looking at the economy. By reorienting the economy to revolve around the government-led, manufacturing-centered and sustainable creation of wealth, we can reconstruct the broken systems that are causing so much misery and distress. But to achieve this, a vast majority of the public has to understand the benefits of this new economy, and work to elect governments that will create the new world that Thomas Paine envisioned. This has to be a truly democratic scientific, economic, and political revolution.