

Rebuilding Economic Vitality – REV® the World: How Energy Laws Provide the Solid Foundation and Tools We Need

S.J. Goerner and R. Voller

Chapter Summary:

We face systemic problems — economic, political, social and environmental ones all wound up together. Effective solutions are emerging in all of these domains, but we lack a sound systemic framework to weave them together. Now, however, the laws of energy networks and keen observations of what does and does not work in human networks are uniting in a common vision of how to build lasting economic vitality. This is the story of how this framework:

1. Helps us rediscover the truth and power of free-enterprise democracy;
2. Clarifies the human factors that make Democratic Free Enterprise Networks (DFENs) the innovative powerhouses we know they can be;
3. Provides *quantitative* measures for healthy development to guide our steps.

Introduction

Your people dreamed of huge factories, tall buildings, as many cars as there are raindrops in this river...Now you begin to see that your dream is a nightmare. “How might we make things better?” That’s simple. All you have to do is change the dream... You need only plant a different seed, teach your children to dream new dreams.

Elder of Ecuador’s Shuar tribe, 1991¹

A new dream of “One People, One Planet, One Future” has been growing in the heart of our global civilization for decades already. Inspired by insights from living systems, Natural Capitalists and Circular Economists such as Braungart and McDonough (2002) have brought this vision to business using triple-top-line approaches that value human capital, see small as beautiful and support environmental health by “cradle to cradle” methods such as turning waste into resources and shifting to clean green renewable energy.

Unfortunately, the old nightmare still dominates, and today’s global economic malaise, rising public anxiety and ensuing polarization seems to be making it worse. People afraid for their livelihoods care more about jobs than environment, and they’re apt to vote for those who promise the fastest and most familiar cure — regardless of whether that method actually works. So, paradoxically, in the name of creating jobs by reducing taxes and deficits, we now have austerity measures that eliminate jobs by slashing education, roads, hospitals and police.

How else could free markets work? We believe the best way to stop today’s destructive rush and fully realize the new dream is to repair the *free enterprise* narrative by creating a more empirically precise and persuasive explanation of what really does create lasting social and economic vitality. Today, for example, we know a lot about the specific causes of the derivative bubble that nearly crashed the global economy in 2008, but the Free Market theories that dominate today lack both a technical explanation for the *systemic* causes of the crash, and a compelling human narrative of how to restore vitality. Recent expansions to our understanding of everyday energy laws help us address both of these issues.

Where will we find a more accurate, yet still commonsense narrative of how free enterprise actually works? This article uses the science of energy networks, to: 1) clarify the conditions for lasting vitality in economic networks; and 2) provide a clear, empirical framework for the new

dream; which, 3) confirms long-standing observations and narratives about how human networks work from such notables as Jane Jacobs, Elinor Ostrom and E.F. Schumacher.

Found under different names around the world from the ancient Greek Paedeia to northern Italy's flexible manufacturing networks and Spain's Mondragon cooperative, we will give the target networks a modern title: Democratic Free Enterprise Networks (DFENs). Instead of blaming intractable human defects such as greed and corruption, energy network laws pin today's crisis on two very tractable traditions:

- Neglecting *real-economy networks* built of *real human beings* (DFENs) as the real source of economic vitality, in favor of exaggerated faith in monetary growth (GDP);
- A gross misunderstanding of the social, economic, material and cultural conditions needed to support network vitality.

Creating Economic Vitality: Money versus Networks

... the GDP not only masks the breakdown of the social structure and the natural habitat upon which the economy — and life itself — ultimately depend; worse, it actually portrays such breakdown as economic gain.

Clifford Cobb et al, "If the Economy is Up, Why Do You Feel So Down?" 1995

How do you create economic vitality? Most economists would say the main goal is to increase GDP, that is, to increase the volume of money exchanged in the economy. Beyond this, neoliberal theorists would recommend deregulation, privatization, reducing taxes (particularly on the supply side), rolling back labor and environmental protections, and vigorously pursuing all other such "structural adjustments." If the national debt is high, such theorists would also recommend austerity: cutting government spending on people, pensions and services.

These particular beliefs about how to create economic health have dominated first Western and now global economic policy for over 30 years. Though GDP has grown through most of this time, other indicators give one pause, including jobless growth, the erosion of the middle class, the outsourcing of productive capacity to low wage locations around the world, and increasing concentration of wealth and power in the hands of a very few individuals. Figure 1 shows neoliberalism's impact on American worker wages. Figure 2 shows neoliberalism's impact on the global real economy, that is, on the business networks that produce real goods and services. GDP growth masks these disturbing situations because it ignores the both cause of monetary growth (speculation vs. real) and where the money goes.

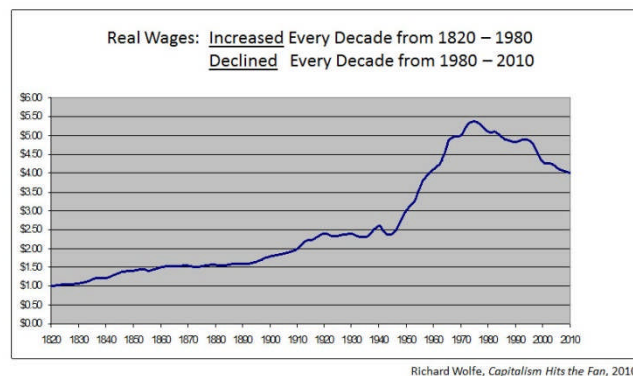


Figure 1. Average Worker Wages in America 1820-2010 (inflation adjusted)

Note that each generation was better off than the last for America's first 150 years, until neoliberalism took control.

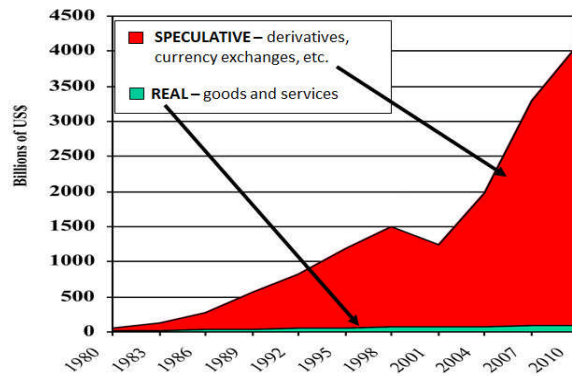


Figure 2. Volume of Money Exchanged in the Speculative Economy vs. the Real Economy

Daily volume of foreign exchange transactions as reported by the Bank for International Settlements (BSI) in April each year versus foreign-exchange transactions based on "real" economic exchanges (1980 – 2010). The temporary dip in 2004 was due to the replacement of 12 European currencies with the euro. (Revised from Lietaer, et al, 2012)

It is time for a change. For 40 years, sustainability activists have been fighting the modern rush to ruin with evidence of impending environmental disasters. It is now time to attack the root cause of this suicidal race: economic beliefs and policies that undermine *human networks* as well as environmental ones.

Thanks to the global economic crisis begun in 2007, a massive rethinking of capitalism has already begun. This article uses everyday energy laws to argue that the problem lies not with free enterprise or even capitalism per se, but with a plutocratic corruption of these that steadfastly ignores the health of the human networks, which are the real basis of all social and economic health and well-being. The resulting empirical framework confirms empirical observations of what makes human networks thrive, while allowing us to reclaim Free Enterprise's original human narrative, now linking it inseparably to democracy.

How could energy networks improve our understanding of economic functioning? Most modern people think about energy in terms of the energy we consume — fossil fuels, electricity, etc. — but physicists think in more universal terms. Here, the very fabric of the universe consists of a dynamic web of forces and flows, where "forces" refers to gravity, electromagnetism etc., and "flows" means the flow of energy and, with it, matter and information.

In this view, energy is literally the stuff of which everything is made, including matter itself. Ecosystems and the carbon cycle are both energy flow networks. Metabolism is the name we give to our body's energy processing system. Global climate change is about disrupting existing patterns of flow by turning up the heat. Even 'information' is now thought to be a response to patterned energy trails such as the chemical gradient we call smell or the photon flow we call light.

More recent discoveries suggest that, instead of a seething disorganized mass, our dancing cosmic energy web is actually filled with intricate geometric order, from the curve of atomic decay and a hurricane's organized swirl to the structure of smart growth in cities. This order fits the ancient Greeks' Sacred Geometries, the new concept of fractals, and Systems Science's original thesis that all systems follow certain *universal patterns* and *principles*. (See Figure 3)

Ilya Prigogine's Nobel-Prize winning work in *self-organizing systems* took this orderly vision to a new level. Here, energy pressures and flow are seen as the driving force behind all *growth*, *development* and *evolution*, literally from the origins of matter and life to the latest cycles of civilizations (Chaisson, 2001; Odum, 2007). In this view, energy pressures and flows form a cosmic self-organizing/ordering process that uses recurrent patterns and principles to build the

world as we know it. Matter was fused in the high-pressure explosion of the Big Bang. Life was forged in the fiery furnace of early Earth, along with the chemical cycles that still span the globe. Civilizations rise and fall through the seething pressures of information, environment, money and power. This last may seem far-fetched, but, as we show below, there is empirical evidence that societies too follow energy laws.

Newer fields such as nonlinear dynamics (Chaos Theory) and Energy Network Analysis provided the final touches: mathematical clarity and quantitative measures. Instead of general patterns, we now have a remarkably rigorous understanding of the universal patterns and principles of growth, development and evolution that apply to all systems, including living organisms, weather systems, city systems, ocean currents and economies. Ecologists, for example, can now assess ecosystem health/sustainability quantitatively by measuring a network's flow volumes and structural stability (Figure 4). Similarly, fractal network findings have been successfully applied to the operation of cities (Salingaros, 2003) and the oscillating behavior of stock markets (Peters, 1994).

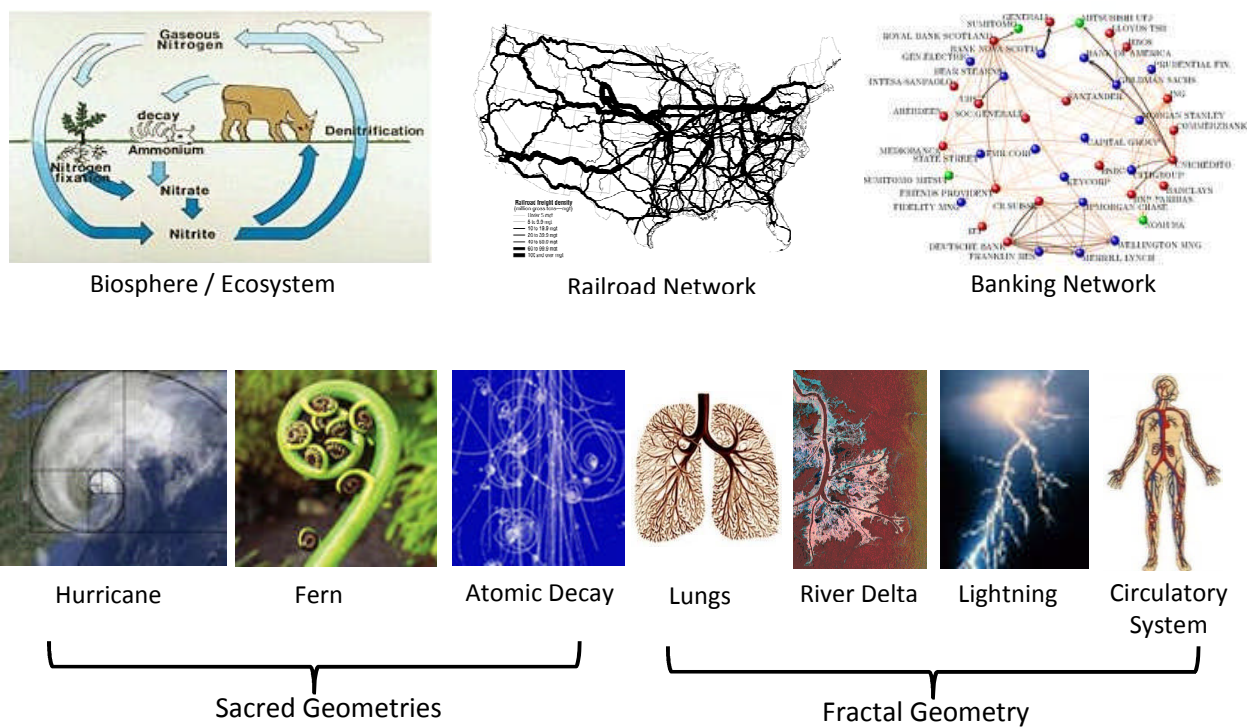


Figure 3 Some Energy Flow Systems and their Patterns

And, ironically, while ecologists are most famous for modeling ecosystems as energy-flow networks — food chains and the carbon cycle, for instance — the first person to apply energy models to orderly complex systems was Russian *economist*, Wassily Leontief in the 1950's.

Note: Though most economists are still trained in the centrality of equilibrium theory, work in such nonequilibrium, dissipative or far-from-equilibrium systems is long-standing and well developed. Furthermore, it is now clear that nonequilibrium is the norm with equilibrium being a rather rare exception. Consequently, instead of using bulky terms like "nonequilibrium," we will simply talk about energy laws and energy network science (ENS).

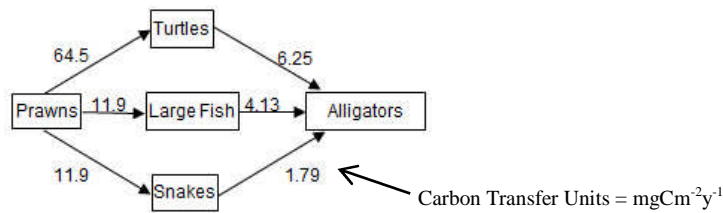


Figure 4 Measuring Network Health as a Function of Structure and Circulation

Ecologists measure structure by counting the number, diversity and size (capacity) of all member components, in this case, alligators, fish, etc. They measure circulation as the volume of chemical flows: carbon, nitrogen, etc. The above chart shows carbon transfer in the cypress wetland ecosystem of south Florida (after Ulanowicz, et al., 1996).

Instead of imagining the economy heading automatically towards equilibrium, scientists who study energy-driven self-organization think of economies in terms of: pressure that drives cycles of change; diversity that seeds new patterns; and instability that may lead to collapse versus the emergence of healthy new organizations and networks.

Pressure builds when too many people have too many unmet needs or perceive too much inequity with other members of the society. Unaddressed pressures that ‘the powers that be’ may attempt to circumvent in the short term, will inevitably come back to haunt in the long term. Self-organization theory says that, eventually, some naturally occurring "diversity" — perhaps a compelling narrative or a confirming scientific discovery — will turn long simmering pressure into relatively abrupt change. The only question is whether this change will bring a healthier stage of development or a snowballing roll towards collapse. On the cusp of great change there is hope, but no guarantees. (See Figure 5)

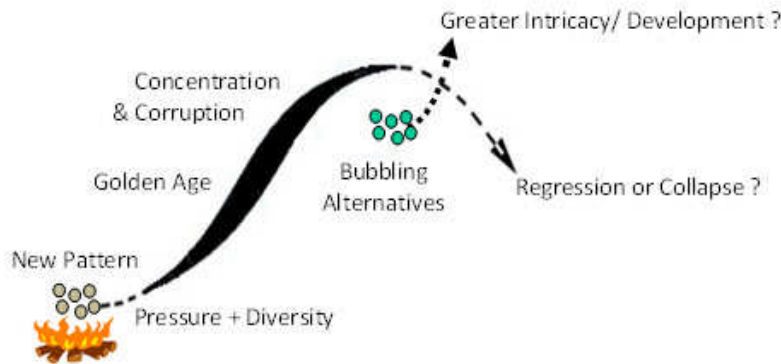


Figure 5 The Standard Cycle of Civilization as Pressure-driven

If you ask this new breed of energy scientists how to create economic vitality, their answers will tend to focus on *circulation* and *network structure*. These features are central to system health because they constitute the network’s form and function, that is, the goal and means for processing and exchange. And, just as form and function are inseparable, so circulation and structure are also entangled such that problems in one cause problems in the other.

Network structure can be understood using the concepts of economic infrastructure and human capital. If you want your local economic network to avoid becoming a house of cards, you will need to keep your human and economic infrastructure robust and resilient. This means, among other things, that you’ll need good roads, bridges, Internet access, phone service, schools, hospitals, banking and investment services. You need robust and resilient structure in all these domains because, if the only bridge into town collapses or the only bank has gone out of business, then your local businesses will produce poorly and many are likely to fail. Network

structure's crucial role in economic health can be seen in the powerful benefits of investment programs such excellent public schools, high-speed rail, and even the Marshall Plan.

For the most part, the energy view of economic circulation follows the equilibrium concepts of supply, demand and distribution. Businesses (supply) take in raw materials and produce goods and services, which they then "circulate" to other stakeholders in the circuit including customers, employees, other businesses and government. Money circulates best when businesses pay salaries, pay taxes, invest in their productive capacity, and buy goods from other businesses. Workers, consumers, businesses and even governments complete the circuit by using the money they received from employment, purchases and taxes to purchase goods and services.

In an energy view, however, Adam Smith's butcher and baker are not alone in their processing and exchange, but part of a vast interconnected circuit. Like organisms in an ecosystem or cells in your body, every agent in an economy depends on the value-add efforts of others and on maintaining robust on-going flow. Here contribution counts, but so too does quality, honesty and otherwise serving the health of the whole system as well as oneself. Consequently, instead of an exaggerated focus on self-interest, here fitness is defined as, "the ability to play a coherent role in the web of processes" (Ulanowicz, 1986).

This common-cause vision makes certain core beliefs from Right and Left seem much less oppositional. The importance of value-add contribution, for example, confirms the conservative position that contribution counts and free-riders are a problem (see also Elinor Ostrom's work). Yet, confirming that all levels count and that nourishment must reach every member also confirms the progressive view of the importance of *commonwealth* infrastructure now expanded from roads and bridges to schools, the media, utilities and banks.

This expanded "it takes a village" view also explains why *where* money goes matters. So, unlike neoliberal theories that emphasize maximum profits for owners only, in an energy view all parts of the circuit count and the key to vitality lies in rapid, robust, *thorough circulation* of money, goods, services etc. *to all stakeholders*. Furthermore, while money is an essential flow, so too are other commonwealth needs such as accurate information, empowering education, accessible energy, clean water and trained people. Should any of these flows be restricted, then the health of the whole will be harmed.

Here, of course, lower wages and closed factories diminish circulation by reducing purchasing power, and Keynesian stimuli are attempts to improve circulation. Yet, circulation and economic health are also diminished by regressive taxation, externalizing costs, usury, and businesses that pay little in taxes or sit on billions in profits they are reluctant to invest.

A key corollary is that excessive concentration at the top will tend to cause erosion of lower level networks due to poor circulation. A banking case from my home state illustrates how this works. Bob Wilkinson¹ was a prosperous, North Carolina builder for 35 years...until the money for small-scale development loans dried up in 2008. The problem wasn't that Bob didn't have collateral or wasn't paying his bills or didn't have a great track record. No, the problem was that the local bank Bob had dealt with for many years had been bought by a bigger bank, which had been bought by a bigger bank still. The new gargantuan bank didn't know who Bob was and didn't care. For them, Bob was too small to be worth the cost of giving him a loan.

Bob and thousands like him are still going out of business because big banks find it too costly to invest in little guys. Unfortunately, a destructive domino effect then follows. When people like Bob go out of business: their employees lose their jobs; their suppliers lose business; the school

¹ This is a fictitious name for a real person.

district loses taxes; and all the businesses that supply food, gas, healthcare, clothing, etc. to all those people lose money as well. As stories like Bob's multiply, local economies become ever more fragile — even as the big banks and corporations accumulate more and more cash that they stash in Cayman Island accounts to avoid paying taxes. The result is withering businesses, bankrupt local governments, crumbling infrastructure and fired teachers.

Thus, a bubble economy is not unstable because there isn't enough money in the system, but because the money is not circulating sufficiently to lower scale producers and consumers. This axiom applies directly to our current economic malaise. There is ample evidence that major corporations around the globe are sitting on billions of poorly circulating profits. Having lost trillions in speculation, major banks and investment houses are also loath to make commercial and housing loans to little guys. Since upper-scale organizations tend to circulate money mostly amongst themselves, reducing taxes on the wealthy leaves even more money stranded in the stratosphere. Instead of nourishing commonwealth infrastructure for all, elite money trickles down poorly through yachts, mansions and gigantic accounting firms that hire relatively a few people and then strive to over-work them.

Austerity programs make matters worse — think Greece. Austerity measures undermine circulation and economic health by slashing the wages, benefits, roads, schools, police and healthcare that support the country's commonwealth infrastructure, while keeping the interest payments to banks and payouts to big corporations that siphon money away from the same.

Unfortunately, since economic systems seem structured to drain wealth from the real economy and concentrate it at the top, it is hard to imagine how else Free Enterprise Networks could work. Luckily, nature provides an answer, which is easily seen in its design of two particularly powerful circulation structures, *fractals* and *intricacy*.

The Structure of Vitality

It's not how big you grow; it's how you grow big.

Jane Jacobs, *Ideas that Matter* conference, 1997

Theory and observation suggest that the only networks that last are ones that maintain:

- 1) Rapid, robust, *thorough circulation* to all parts of the whole; and
- 2) *Structural stability*, that is, ones that avoid becoming unstable like a house of cards.

Fractals and intricacy abound in the real world because they address both of these needs. Their design teaches us a lot about the real causes of vitality (and lack thereof) in human systems.

Their structure and flow characteristics also allow us to define and measure “healthy development” quantitatively. Such measures help transform Jane Jacobs' keen observations and compelling narrative of human networks into the kind of mathematical precision, which economists so often demand.

Intricacy: Small & Connected = Strength & Speed

Cities ... need all kinds of diversity, intricately mingled in mutual support. They need this so city life can work decently and constructively, and so the people of cities can sustain ... their society and civilization. ... I think that the science of city planning ... must become the science and art of catalyzing and nourishing diverse, close-grained working relationships that support each other economically and socially.

Jane Jacobs, *Cities and the Wealth of Nations*, 1961

Jane Jacobs, who penned the opening quote over 50 years ago, was applying the then new concept of *ordered complexity* to her observations of what makes cities work. Intricacy provides an empirical explanation of what she was saying.

Intricacy refers to the lace like network of small, interconnected, synergetic circles that nature uses to weave smaller pieces into ever bigger wholes. Molecules are built of atoms which are built of subatomic particles. Your body is built of organs and tissues that are built of individual cells. Armies are built of divisions, regiments, brigades and platoons. Intricacy abounds because it enhances circulation, resilience and structural stability at the lower levels of an economic system and at the core of any large organization. (See Figure 6)

Reminiscent of E. F. Schumacher, intricacy teaches us that, *small and connected equals strength and speed*. Thus, small, tight teams work better than big bulky ones, but linking small tight teams in a close, synergistic weave works best of all. Because the ties that bind intricate groups must be both strong and flexible, merits such as trust, commitment, quality and integrity all become important to lasting vitality and sustainable economic health.



(a) *A Developing Embryo* starts with a single cell that grows, divides and reconnects with its twin. The process repeats leading to an intricate network of cells.



(b) *Life Cycle of a Flow Structure*: an organization starts small and tight, but as it grows the bonds holding it together become stretched to the breaking point. To continue, it must find a way to restore small, tight circles and link them synergistically or collapse.

Figure 6. Intricacy in an Embryo and a Flow Structure in General

Ever notice that big things are built out of smaller pieces that are built out smaller pieces still? Energy scientists attribute this pattern to an energy rule called the *Surface Volume Law*. Seen in how a single cell develops into a multicellular embryo, this rule says that, as a cell grows, the bonds holding it together becomes stretched until eventually reaching a precise breaking point determined by the ratio of its total volume to its surface area. At this point, the flow structure will either reorganize more intricately or collapse.

Since increasing intricacy marks all evolutionary progression, it also teaches us to see new stages of development as new stages of intricacy. (See Figure 7) A developing embryo shows how intricacy increases. Thus, an embryo starts with a single cell that grows, divides and reconnects with its twin. The process repeats over and over again leading to an intricate network of cells. The energy rule that explains this process gives us new insights into the "what, why and how's" of healthy growth and development.

As seen in the progression from small groups to large, an organization may start small, tight, flexible and effective, but as it grows the bonds holding the group together become stretched, while at the same time its bulk makes it less efficient and responsive (the dinosaur effect). If this cohesion-stretching process continues, the organization will eventually reach a breaking point and a choice point. At this point, it must either: 1) stop growing; 2) find a way to restore small, tight circles and link them synergistically; or 3) face regression and possible collapse.

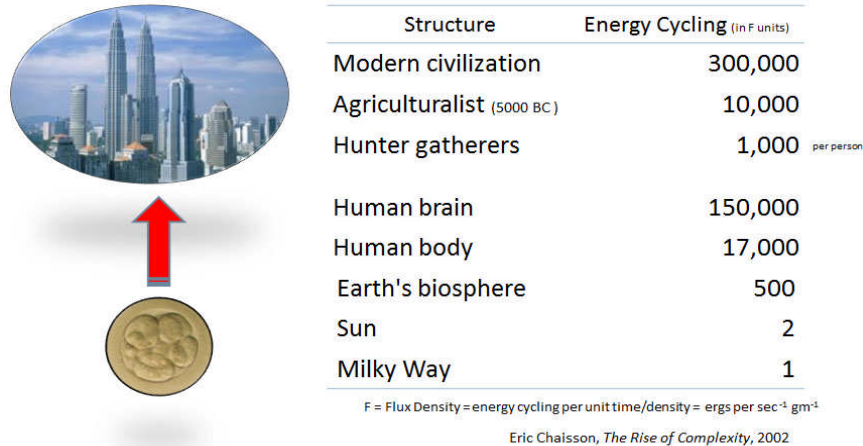


Figure 7 Increasing Intricacy from Galaxies to Civilization, Measured by Energy Cycling Speed Because intricacy's tight weave increases the speed of internal energy circulation, we can measure intricacy using Flux Density ($F = \text{ergs/sec}^{-1} \text{gm}^{-1}$) internal energy cycling speed/ unit time/unit mass. Since energy cycling speed increases in step with stages of development, scientists use Flux Density and intricacy as measures of development.

Human Intricacy at Work

It is perfectly possible to imagine a company with an ambitious strategic intent being effortlessly out-performed by what appears to be a disorganized ... network of companies.

Tom Lloyd, Financial Times, 9/8/95

What does intricacy look like in real life? Ben Cohen, founder of Ben & Jerry's Ice Cream, described business as, "a system of *organized human effort* that produces power." Intricacy suggests a similar view. Here, healthy business networks are:

Intricate webs of human expertise, material infrastructure, behavioral patterns, and cultural systems that have grown up together such that all elements play mutually-supportive roles in the well-being of every member of the social, economic and environmental whole. (Goerner, 2008)

Found from the industrial cities of Bologna and Venice in northern Italy to Silicon Valley in the US and Asian Motors in Japan, intricate networks exhibit high levels of improvisation and adaptation in design, materials, goods, services and methods of production because such creativity happens best in small firms that are close to the problem and not hampered by bureaucracy or corporate norms. Describing intricacy in the "innumerable small firms in a great cluster of small industrial cities in north-eastern Italy," Charles Sabel emphasizes improvisation as an everyday event:

A small shop producing tractor transmissions for a large manufacturer modifies the design to suit the need of a small manufacturer of high-quality seeders. In another little shop a conventional automatic packing machine is redesigned to fit the available space in a particular assembly line ... A membrane pump used in automobiles is modified to suit agricultural machinery. (Cited in Jacobs, 1984)

Because they are small, cooperative, and inter-linked, such enterprises tend to produce very sophisticated, high quality work. Innovation is high because improvisation is a central theme. Quality is high because

craftsmanship is still important. Craftsmanship is important because human ties still bind. Hence, here people pursue quality and integrity, as well as profit.

Quality and creativity are also high because workers and ideas circulate. Such circulation builds expertise, breadth of experience and an invisible chain of valued human connections. Breakaway enterprises spring up easily and often as workers from older enterprises move out to start firms of their own. Such spin-offs often collaborate with the older establishments because they share history and have related work. People in such networks establish their own ‘coherent role in the web of processes,’ while members, information and expertise cycle easily throughout. Members prosper in a synergetic way (not zero sum) because advances anywhere tend to stimulate benefits everywhere.

Such networks achieve tremendous economies of scale not within the framework of huge organizations as conventionally assumed, but rather through large symbiotic collections of small enterprises. Most have but 5 to 50 workers with a few more having one or two hundred. As Sabel says:

The innovative capacity of this type of firm depends on its flexible use of technology; its close relations with other similarly innovative firms in the same and adjacent sectors; and above all on the close collaboration of workers with different kinds of expertise. These firms practice boldly and spontaneously the fusion of conception and execution, abstract and practical knowledge that only a few exceptional giant firms have so far been able to achieve.

Fractals: Cross-scale Integration and Leadership that Serves the Health of the Whole

Fractal structures take this image of synergetic flow to the next level. Seen in the familiar branching structure of your circulatory system (Figure 1) — with a few large conduits (arteries) connecting to successively more numerous and fine-grained smaller conduits (veins to capillaries) — fractal networks provide the efficient cross-scale circulation and unifying core needed to keep large organizations functioning as effective wholes. Also seen in river systems and predator-prey networks, fractals abound in nature because their particular ratio of small, medium and large optimizes circulation to all levels. Big, highly efficient conduits (ones with “economies of scale”) support rapid cross-scale circulation, while the more numerous small conduits bring nourishment to every cell.

Fractals explain why hierarchy and large-scale players are necessary but not sufficient. To be precise, fractals teach us that vitality requires a *balance* of:

- *Big & Little*, supporting the more numerous and resilient small-scale businesses and individuals, not just the big, highly efficient players;
- *Flexibility & Constraint*, nourishing innovation, adaptation and learning (flexibility) while restraining activities that harm the whole;
- *Diversity & Community Coherence*, protecting diversity while forging a daily visible, profoundly trusted sense of common-cause across groups.

Where intricacy taught us about the need for small circles and tight weave, fractals teach us about the need for integration, synergy, trust and integrity across scales. The result is a radically new view of the relationship between top and bottom and of the role of power and leadership in maintaining a healthy whole. Thus, unlike command-and-control hierarchies, fractal networks work best on distributed intelligence and empowerment, with decisions being made at the lowest level possible (subsidiarity). Flexibility and diversity are essential in such systems, but so too are community coherence and constraint from activities that harm the whole. Naturally, in such systems power and leadership aren’t about owning and controlling, but about facilitating the long-term health of the whole by coordinating, empowering, and building trust, integrity and common-cause.

The resulting picture mirrors not only employee-owned enterprises and cooperatives such as Mondragon, but also the portrait of extremely long-lived companies described by Arie De Geus in *The Living Company* (2002). As part of a Shell Oil scenario planning project, De Geus was asked to research why some companies, such as Stora in Sweden and Sumitomo in Japan, live for hundreds of years (both of these were found in the 1200s), while the average lifespan of modern corporations was plummeting and now stood below 20 years. De Geus's findings are stunning. Long-lived companies had a very similar corporate culture, regardless of their country of origin. Perhaps the three biggest keys to longevity appeared to be: 1) valuing people above material equipment; 2) putting the messiness of learning above the orderliness of procedures; and 3) shepherding resources to maintain the long-term health of the whole.

The three balances even provide guidelines for how to get cross-scale synergy and integration to work. For example, where "divide and conquer" is a great way for elites to maintain temporary control, it is a terrible way to create a healthy society. Where freedom (flexibility) is crucial to learning and adaptation, removing too many constraints from big players in particular leads to monopolistic dominance ("might makes right") that destroys learning and adaptation in the society as a whole. Where we once thought economic health came from maximizing profit for owners only, we now realize that vitality only comes from systems that maintain the health and well-being of *all stakeholders*, not just those at the top.

This view also sheds new light on how various economic policies and political positions help or hinder vitality. Here, for example, antitrust laws, progressive taxation and corporate regulation are important not because great wealth, size, power and efficiency are bad per se, but because *too much* of any of these will undermine the health of the whole by starving small-scale diversity and resilience.² Conversely, policies that nourish human capital and small-scale networks by supporting empowering education, living wages, accessible financing etc. also nourish resilience and, from there, systemic social and economic health.

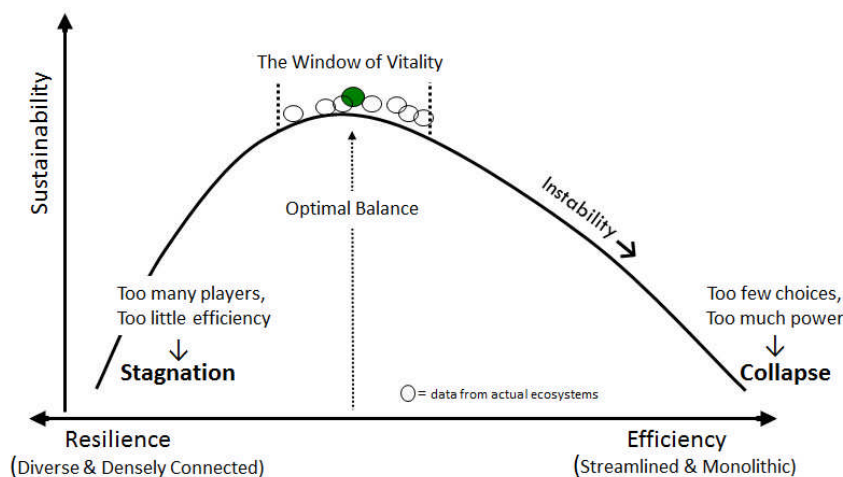


Figure 8 Measuring Economic Sustainability as a Balance of Resilience and Efficiency

The needed balance of big and little is sometimes described as a balance between resilience (densely connected diversity) and efficiency (streamlining/economies of scale). Using data from actual ecosystems, theoretical ecologist Robert Ulanowicz (2009) has shown that "sustainable" systems maintain a balance of a balance of resilience and efficiency that lies within a small range or "Window Vitality" around the optimum. Too much efficiency leads to instability and possible collapse due to too few choices and too much power. Too much resilience leads to stagnation due to too many small-scale players and too little efficiency.

² We call this the "Walmart Effect" because policies that bribe big-box companies like Walmart to set up shop in one's home locale, have been shown to result in just such erosion of the surrounding small-scale business networks.

Furthermore, because fractals follow a mathematically precise (power law) ratio of small, medium and large across scales, we can use nature's system of healthy networks to create precise quantitative measures of healthy *development* in human networks as well. Ulanowicz, Goerner and Lietaer (Ulanowicz et al, 2009; Goerner et al, 2009), for example, used this concept of precise balance to create a quantitative measure of Sustainable Economic Development (QED) in terms of a balance of resilience (diversity) and efficiency (highly efficient flow). (See Figure 8)

Last but not least, understanding how growth pressures drive the emergence of more intricate fractal structures also helps us understand why today's command-and-control hierarchies emerged and why global civilization is due for a fractal shift. In an energy view, social systems are intricate collaborations that need to stay connected, but tend to pull apart as they grow. Villagers in the early agricultural period, for instance, communicated and developed shared understandings easily in the course of constant, close contact. As the population grew, however, this close-weave unraveled. As villages burgeoned into cities, cohesion became harder to maintain.

Anthropologist Robert Carneiro (1967) believes that the hierarchical social structures we use today were pushed into being by the ensuing growth crisis. He suggests that sprawling, poorly-knit agrarian villages would have been easy prey for marauding tribes envious of their wealth. Unable to coordinate well for defense, many would have simply died out. Others survived by inventing a new means of maintaining coordination: hierarchy. Thus, one man deciding for all and using an efficient system of enforcement allowed societies to mobilize rapidly for defense. Sitting atop a hierarchy with information flowing up from all sides also helped people at the top to build a broader picture, while money flowing to the top allowed them to pay for common-cause infrastructure such as roads and armies. Hence, a king with a bureaucracy serves the same role as a brain and nervous system: they help a large complex collective act as a fast-moving, highly coordinated, far-seeing whole.

So the early command-and-control hierarchies did serve the health of the whole by defense, infrastructure projects, and greater focus, vision and coordination. Unfortunately, as chiefdoms grew into kingdoms and then empires, elites tended to grow apart from their own people. Whatever social contract originally held the powerful in check became more and more fragile. As constraints weakened, exploitation, corruption and concentration of wealth grew, and societal vitality plummeted. If uncorrected, unmet pressures would drive the society into one of three futures: regression; collapse; or a transformative upheaval opening into a progressive reform (such as democracy). The result is the familiar rise and fall of oligarchic civilizations.

So, though most modern economists assume today's elite-serving hierarchies are the end pattern of civilization, fractal theorists would disagree. In their view, command-and-control hierarchies are too rigid to handle the pace of change, and concentrating wealth at the top doesn't leave enough circulation to nourish a vast global civilization. Only a more fractal network run on servant leadership, democratic constraints on power, and distributed intelligence and empowerment throughout can address these needs. So though we've been using militaristic hierarchies for 5000 years, we believe pressure is building for a new fractal evolutionary leap.

Changing our Perspective and our Dreams

The gradual development of social equality is at once the past and the future of mankind. To attempt to check democracy would be to attempt to check the will of God.

Alexis De Tocqueville, 1835

The energy view provides a firmer foundation for the dream of “One People, One Planet, One Future,” one that, ironically, adds new rigor and brings a new positive, practical, achievable focus on people and communities as well. In this view, energy flowing through the veins of the universe literally makes us ‘One.’ Here too, constantly channeling major flows towards selfish, controlling, short-term ends leads inevitably to societal self-destruction. This is why past oligarchic civilizations collapsed and it seems to be what we are witnessing today.

In an energy view, economic vitality comes from synergetic networks of individuals, communities, businesses and governments engaged in value-add activities that serve the health of the societal whole as part of their own self-interest. We call this system Democratic Free Enterprise Networks (DFENs) because the ultimate aim of democracy and free enterprise has always been government and economies run by and for all the people, not just the 1%. Big and little; diverse and united; flexible as well as restrained: we now understand the characteristics that build vitality in democratic free enterprise societies a bit better.

Neoliberal theory, however, runs against all this. Instead of balance, neoliberals believe vitality springs from gigantic size, lack of constraint, disregard for other stakeholders and the politics of dominance and division not community coherence. The bankruptcy of these beliefs has become so glaring that future generations will probably wonder why we held them so long and applied them so widely.

This brings us full circuit. In an energy view, the only way to restore lasting vitality is to rebuild intricate, fractal DFENs. Living examples of human intricacy give us hope as well as concrete examples of how this can be done. Fractal networks indicate how power and leadership can help.

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