The tragedy of modern economic growth: A call to business to radically change its purpose and practices

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Abstract: It is now clear that endlessly growing consumption of resources in the global human economy imperils Earth's life-sustaining biosystem and threatens human existence as we know it. Long-term sustainability of human and non-human life can be achieved only by creating an entirely new economy that eschews the current economy's pursuit of continuous growth and concentrates, instead, on re-focusing human activities from the global to the local level in organizations that exist to fulfill genuine and concrete human and non-human needs, not to maximize financial wealth of corporations, their shareholders and their top managers. However, impeding this move to a new economy is the widespread belief that "accounting is the language of business." This article proposes that the concrete ecological principles underlying Earth's life-restorative natural ecosystems provide a much more appropriate language to guide a sustainable human economy than the abstract language of accounting and finance.

> ***What is man? Storyteller, mythmaker, and destroyer of the living world. Thinking with a gabble of reason, emotion, and religion. Lucky accident of primate evolution during the late Pleistocene. Mind of the biosphere. Magnificent in imaginative power and exploratory drive, yet yearning to be more master than steward of the declining planet*** (E.O. Wilson 2016:1)**.**

Introduction

In his latest book, *Half-Earth: Our Planet's Fight for Life*, the eminent biologist and environmentalist E.O. Wilson asks the question, "What is man?" His answer acknowledges that humans, capable of wondrous achievements, have chosen to create a growth-oriented economy that vandalizes Earth, forcing decline of the living world. I share Wilson's profound distress that human beings have long acted as destroyers, not stewards, of Earth and its inhabitants. I believe that an extremely important contribution to this unfortunate treatment of Earth are the financial practices of accountants, economists, and business leaders that have been the main subject of my

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research and writing for over 40 years. My goal here is to reflect on how those present-day business and economic practices hasten Earth's decline and how radically new thinking might change those practices in ways that safeguard the planet.

From 1960 to the mid-1980s I pursued a career in accounting as a financial accountant and auditor (CPA) and as a university professor of management accounting and accounting history. Educated in economics, accounting, and finance, I accepted the use of accounting information to evaluate companies and to help managers achieve desired financial results. Indeed, I firmly believed that the purpose of business was to earn ever-increasing profit and that accounting gave managers an essential tool to achieve profit goals.

In the early and mid-1980s, however, I met people outside the world of accounting and economics who introduced me to subjects that caused me to question the power of accounting and to reconsider the purpose of business.[2] At their prompting I explored works by many writers that began to change my thinking about the role of profit and the role of accounting in business.[3] In previous articles, I describe how studying ecology, sustainability, and evolutionary cosmology changed my perspective on business and accounting (Johnson 1999, 2002, 2014). Here my goal is to reflect particularly on how my continuing study of these topics – sustainability in particular – causes me to feel more urgently than ever the need for a radical change in how society views the purpose of economic and business activity and the role of accounting. Consider first the present condition of accounting and business.

Accounting and business: the current state

While most people today believe that accounting numbers such as revenue, cost, profit, and investment give useful information about the financial condition of businesses in a money-

[2] . Robert Hall, Kazuhiro Mishina, Richard Schonberger, and members of the Northwest Earth Institute.
[3] . Thomas Berry, Fritjof Capra, Joanna Macy, Arne Naess, E.F. Schumacher and Brian Swimme.

exchange economy, I regard such accounting information as too abstract to reveal how business activities – e.g., employment, construction, financing, production, transportation, selling, buying – affect real conditions faced by individuals, communities, and nature. However, my view is not shared by most business leaders who regularly view the performance of their organizations through the lens of accounting numbers. Indeed, they too often seem to act as if those abstract financial quantities comprise the reality underlying business. Sadly, they seldom acknowledge all the ways that their management of financial results adversely impacts real concrete conditions that determine quality of life for employees, people in their communities, and in nature.

Top management of course focuses its primary attention on accounting abstractions largely because respected financial economists in leading universities since the 1960s have persistently argued that the purpose of business is to earn increasing profit for owners (Friedman 1962: 133-135; Jensen 2001). Business leaders, knowing that their careers depend on fulfilling society's expectations, strive to boost profit by relentlessly increasing revenue and decreasing cost, the two primary accounting abstractions that constitute profit.

Unfortunately, the steps managers take to drive accounting revenue and cost in the directions necessary to increase profit affect far more than abstract accounting results. Those steps also diminish the well-being of human and non-human life and degrade Earth's life-sustaining biosphere. To increase revenue, for example, businesses produce and sell ever-increasing quantities of goods and services across ever-expanding territory, causing over-consumption of Earth's finite resources and threatening the well-being of all life. To decrease cost, on the other hand, businesses shift employment to lower-wage countries, they push communities to reduce taxes, and they work with legislatures and media to minimize business regulations, resulting in the diminished well-being of humans everywhere.

Perhaps the most damaging consequence of using profit to define the purpose of business is that it obscures reality. Profit, an abstract financial quantity that can increase without limit, invites people to assume there are no limits to the real materials, energy, habitat, workforce mobility, and other resources required to steadily increase accounting revenue and decrease accounting cost. However, Earth's physical resources actually do have finite limits that restrict the revenue and cost components of financial profit.

To relentlessly increase profit, businesses produce and sell ever- increasing quantities of goods and services that consume more from Earth's finite supply of life-sustaining resources than what is required to sustain all species of life on Earth now and in the future. All things equal, this reduction of resources assures there will be continuing extinction of living species over the long-run. However, Earth's richly evolving life system did not succumb to such a dire outcome in the 4 billion or so years that life thrived on Earth before the coming of humans and their modern economic system. The reason, of course, that life flourished so remarkably before the modern human economy appeared is that Earth's regenerative ecosystems, powered by a daily flow of energy from the Sun, ensured a steady (not growing) supply of life-sustaining resources by always restoring, on a timely basis, the resources that living systems consumed in order to survive and thrive.

The problem today is that our modern growth-oriented economy consumes resources at a rate faster than Earth's ecosystems can currently regenerate, using the daily supply of energy from the Sun. In short, the relentless raiding of Earth's life-sustaining resources, fed largely by the insatiable demand for business profit "without limit," is now overwhelming Earth's capacity to renew used resources at the rate needed to sustain all life now existing on Earth. For the first time in history, human economic activity now consumes each year more life-sustaining resources

than Earth can regenerate in a year or, in many cases, in decades or centuries. (Vitousek, et. al. 1986: 368-373; Rockstrom, et.al. 2009; Meadows et. al., 1972) The inevitable result is a decline in the diversity and resilience of life species, including *homo sapiens*. Cultural historian and eco-theologian Thomas Berry starkly and succinctly described this consequence of modern economic growth when he said that "inhabitants of the Western world. . . have been so transfixed with the glory of the human . . . that they have missed the point as regards humans and their relationship to the Earth. In the 20th century the glory of the human has become the desolation of the Earth, and now the desolation of the Earth is becoming the destiny of the human." (Webb 2006)

In a similar vein, the renowned agriculturalist and environmentalist Wendell Berry (not related to Thomas Berry), vividly describes what happens to people and the planet when businesses are driven only by abstract numbers that define profit while ignoring concrete reality (Berry, W. 2012):

> [*Corporate industrialism*] *has failed to sustain the health and stability of human society. Among its characteristic signs are destroyed communities, neighborhoods, families, small businesses, and small farms. It has failed just as conspicuously and more dangerously to conserve the wealth and health of nature. . . .The evidences of it are everywhere: eroded, wasted, or degraded soils; damaged or destroyed ecosystems; extinction of species; whole landscapes defaced, gouged, flooded, or blown up; pollution of the whole atmosphere and of the water cycle; dead zones in the coastal waters; thoughtless squandering of fossil fuels and fossil waters, of mineable minerals and ores; natural health and beauty replaced by a heartless and sickening ugliness.*

This statement expresses a basic truth that business leaders must absorb: To ensure sustainability of Earth's life system, human economic activity must never consume resources at a faster rate than Earth can restore on a timely basis to meet the current needs of all life, human and non-human. If businesses ignore this truth and continue using abstract accounting quantities

to define limitless financial goals and to assess their operations, they risk overpowering and diminishing the life-enhancing capacity of Earth's *natural* economy, thereby threatening the ability of life to survive and flourish.

Those who view the purpose of business through the lens of limitless financial results – the power brokers in business and government who use financial accounting information to achieve business results that gratify only the rampant greed for financial wealth of a small minority – need a new goal. Their goal must be to value and benefit the entire world, human and non-human. They need to manage businesses so that people connect and interact with each other and Nature, thereby reducing the likelihood of compromising the ecological capacity of Earth's biosphere. They need to reject the belief that achieving desired business goals requires nothing more than adding and subtracting financial quantities (Cobb 2009).

The belief that a business succeeds primarily by constantly increasing a financial quantity reflects the mechanistic worldview shaped in the 17th-century by Western scientists such as Galileo, Descartes, and Newton. These scientists saw the world as a collection of independent inert objects that move only under the influence of external force, according to mathematical laws inferred from measurement of a single object's motion. Mechanistic thinking improved our understanding of motion in the solar system and on Earth and it opened doors to modern engineering technology and the scientific study of mechanical industrial processes. However, the mechanistic view of reality does not apply to organic living systems. When mechanistic thinking guides managers of an organic living system such as a business organization, the long-run effects are invariably destructive.

Thanks to work by 19th- and 20th -century researchers, scientists today recognize that reality in our universe is not simply a mechanistic collection of independent inert objects responding

only to external force. On the contrary, their work shows that reality is organic. In fact, the universe and all it contains, including Earth and its inhabitants, is an organic, holistic community of infinitely interconnected parts held together by a universal pattern of relationships embodied uniquely in each part (Berry T 1999; Swimme B and Berry T 1992; Whitehead 1978). This organic worldview provides a comprehensive and impressively validated understanding of reality in our universe. It describes how living systems operate in the real world. In doing so, it shows that it is erroneous to apply mechanistic thinking to a complex self-organizing human social system such as a business organization. Although mechanistic thinking does explain to a useful degree the motion of large inanimate objects on Earth or in the solar system, it does not provide a comprehensive grasp of non-linear, organic processes that shape the entire universe.

To conduct business sustainably today, managers must regard business in concrete human and environmental terms, not in abstract accounting and neoliberal managerial terms. They must see the world as organic and business as composed of concrete, complex processes and interdependent relationships among humans and Nature. Certainly financial and governmental institutions in our money-exchange economy can require businesses to cast results in financial terms for legal or statutory reporting reasons. However, businesses must not use such financial data to drive and assess concrete business operations. Indeed, it is time to dispose of the mistaken idea that accounting information is "the language of business" (Davidson et. al. 1984; Johnson 2014). At best, accounting quantities provide an abstract map of financial transactions, but "the map is not the territory" of real business activity (Korzybski 1933: 58; Bateson 1970).

Indeed, as the path-breaking research of Rob Gray and Jan Bebbington reveals, the burgeoning academic literature on "environmental accounting" (e.g., corporate social reporting, triple-bottom line accounting, accounting for "externalities" and much more) considers revisions

to traditional accounting that address environmental concerns **only** in the context of "aiding the pursuit of the traditional goals of business and economic organization." Those traditional managerial and neoliberal economic goals, focused on endlessly increasing financial returns, have systemically led, of course, "to environmental degradation . . . , the inevitable consequence of our system of organization." (Gray and Bebbington 2000).

Viewing the activities of a business through the lens of accounting information reveals only if those activities have enabled the business to meet abstract financial targets. It reveals nothing concrete about how those activities affect the condition of humans and Earth. A much richer picture of business reality requires a narrative describing the way people perform work and how their work affects humanity's well-being and that of Earth's living biosphere.

Moving business toward a sustainable future where management is guided by concrete reality, not abstract financial quantities

In the 1980s and 1990s I discovered a unique example of how a very successful company narrates its operations in concrete verbal terms rather than abstract financial terms in my study of the Toyota Production System (TPS), created by the Japanese auto maker in the 1950s and 1960s (Johnson and Broms 2000; Johnson 2012). Unfortunately, this narrative was interrupted briefly after the late 1990s when a few top managers, influenced by short-term American financial-management thinking, diverted Toyota from its TPS philosophy for nearly a decade. However, these managers were removed in 2009 and Toyota management returned to its long-run goal of sustaining the company financially by continuously improving its workplace operations (Ohnsman, Lippert and Inoue 2009).

Toyota's goal has never been to maximize profit in the immediate short-run. Instead, the goal is to earn sufficient profit to sustain the organization as an on-going entity for the very long-run. Accordingly, Toyota pursues long-term profitability not by working to increase accounting

revenue and to decrease accounting cost endlessly, but by working continuously to improve in the workplace concrete nonfinancial conditions that produce vehicles that meet or exceed each customer's requirements for high quality and low cost. Those conditions, which Toyota defines as "True North," provide nonfinancial information for a narrative that guides Toyota's daily operations in the direction that will achieve sufficient financial results in the long-run.

The concrete conditions of True North point Toyota's daily operations in a direction ensuring that the hundreds of steps that transform raw material and parts into a finished automobile will meet a buyer's particular specifications. Those conditions include performing all work at a uniform rate, to customer demand, in a continuous flow one order at a time, in customer-order sequence, while consuming the least resources necessary. In essence, every step in the flow of operations mirrors the conditions of True North by embodying a pattern of relationships in which each worker (or work station) is seen as both a downstream customer whose demand pulls work from an upstream supplier and an upstream supplier whose work answers the demand of a downstream customer. In this way customer demand ("external" final demand or "internal" downstream demand) initiates all work, and all work responds to each customer's demand in sequence, one at a time, according to standardized methods set by the workers and their managers, who work alongside them.

The key virtue of organizing work as an uninterrupted continuous flow is that it makes visible, in real time, how work is proceeding in each step. Making each step in the flow of work visible makes it possible to answer in real time questions such as: Is work proceeding without defects (i.e., without deviations from established standards)? Is it moving on time to meet customer delivery requirements? Is it performed safely? Does it consume the least resources necessary? By making defects, delays, excess resources, or unsafe conditions visible when and

where they occur, continuous flow permits workers on the line to promptly identify causes of problems and to act quickly to solve problems, doing so, if necessary, even by halting work on the line.

Because all the information needed to move work from the customer order to final delivery is visible in the work itself, Toyota needs no expensive accounting cost control systems or computer scheduling and routing systems that direct work with delayed signals from a source external to the work itself. And because problems are seen and removed as they occur, not covered over with rework or work-arounds that allow problems to grow, Toyota avoids the longer lead-times, extra personnel, warranty work, and other costs of waste that accountants invariably classify as "overhead." By striving endlessly to perfect the production system itself, to achieve True North, rather than run operations erratically at varying speeds dictated by financial variance budgets and conventional accounting cost control systems, Toyota has become the world's lowest-cost producer of high-quality automobiles.[4]

Observing Toyota's production system radically altered my understanding of the role of business and accounting. I realized that the ideas implicit in Toyota's practices reflect discoveries in modern life science and evolutionary cosmology. These sciences tell us that in Nature any non-human living system, a tree for example, survives and flourishes by consuming the least matter and energy necessary, in continuously regenerating flows, at a pace tied to actual and reasonable needs. Because Toyota's very successful man-made production system echoes

[4]. An American auto maker will often claim to make a car at lower cost than Toyota by comparing the average accounting cost per unit of, say one month's production of one of its models, with Toyota's total cost of resources consumed to make one unit (an engineering calculation) of a comparable model. Thus, the American company can report lower **unit** cost (an accounting abstraction) by increasing a period's total output. But more output means more real cost in that period, which means the American company reduces abstract **accounting** cost per unit by producing more output, thereby increasing real total cost. Meanwhile, Toyota, focused on achieving the conditions of True North in all its operations, **directly reduces actual total** cost of a car (a real concrete outcome) by reducing **actual** resources consumed.

many features in Nature's living system, it suggests that Nature is a worthy model to emulate in all man-made social systems that comprise the human economy and modern business (Senge 2006: 364-367).

A similar idea was expressed many years ago by ecologist and systems thinker Gregory Bateson when he said, "the major problems in the world are the result of the difference between *the way nature works* and *the way humans think*" (Devall and Sessions 1985).[5] Increasingly I concluded that the problems caused by regarding business through the mechanistic quantitative worldview of economics and accounting – "the way humans think" – can be mitigated by conducting business operations according to the organic pattern that shapes and sustains living systems on Earth – "the way nature works." To a very large degree, Toyota's operating system embodies that pattern, even if unintentionally and imperfectly, and for that reason, apparently, the TPS caused Toyota to become by the 1980s, and to remain year in and year out, the most profitable vehicle maker in the world. It seems reasonable to conclude that by emulating nature's pattern – "the way nature works" – all business organizations are capable of producing similar long-term results.

However, while this conclusion may apply to an organization's operations – the "production system" in Toyota's terms – it does not necessarily apply to the final product or service produced by those operations. Left unanswered here is "how well does the final consumers' use of that product or service conform to 'the way Nature works'?" Unfortunately, quite poorly when one considers the damage wreaked on Earth's life-supporting ecosystem by automobiles.

Can Earth's life system and all that depends upon it be saved by business operations that imitate "the way Nature works?"

[5]. Emphasis added. To avoid gender specificity, "humans think" replaces "man thinks" in the original.

No matter how excellent Toyota's business may be because its production system (TPS) emulates conditions found in Nature, we must ask, "Is that company helping to sustain a healthy planet simply by conducting its operations in accord with 'the way Nature works'?" Toyota's operations, after all, produce and sell growing quantities of automobiles that are inherently destructive to Earth's biosphere. By definition, a company that produces and sells ever-growing quantities of almost any product today is not helping to sustain a healthy planet in the long run.

In fact, Earth's limited resources cannot sustain all living species if human economic activity continues at its current pace. Endless growth of human economic activity is an unfortunate legacy of Western economic and business thinking that has shaped global business organizations for the last century. Sustainability will not be achieved by improving the financial performance of today's global, growth-oriented institutions, although an alarming number of academic authorities in accounting and economics continue to think that Earth can indefinitely sustain ever-increasing financial results (Orr 1992: ch. V). Sustainability can be achieved only by creating, as noted environmentalist Naomi Klein observes, an entirely new economy (Klein 2014: 152-160). In my view, an "entirely new economy" means "without growth." Wendell Berry, renowned writer and environmentalist, forcefully articulates what transforming an entirely new economy from our present growth-oriented global economy might entail (Berry, W 2012):

> *The losses and damages characteristic of our present economy cannot be stopped, let alone restored, by 'liberal' or 'conservative' tweaking of corporate industrialism, against which the ancient imperatives of good care, homemaking, and frugality can have no standing. The possibility of authentic correction comes, I think, from two already-evident causes. The first is scarcity and other serious problems arising from industrial abuses of the land-community. The goods of nature so far have been taken for granted and, especially in America, assumed to be limitless, but their diminishment, sooner or later unignorable, will enforce change.* [*Second,*] *a positive cause, still little noticed by high officials and the media, is the by now well-established effort to build or rebuild local economies, starting with economies of food. This effort to connect cities with their surrounding rural landscapes has the*

> *advantage of being both attractive and necessary. It rests exactly upon the recognition of human limits and the necessity of human scale. Its purpose, to the extent possible, is to bring producers and consumers, causes and effects, back within the bounds of neighborhood, which is to say the effective reach of imagination, sympathy, affection, and all else that neighborhood implies. An economy genuinely local and neighborly offers to localities a measure of security that they cannot derive from a national or a global economy controlled by people who, by principle, have no local commitment.*

The economy Berry describes functions *as Nature works*, **not** *as mankind thinks*. Without doubt, the modern science of evolutionary cosmology provides the most comprehensive view of "how Nature works." In that view, the universe originated some 13.75 billion years ago when an infinitely small, infinitely hot, and infinitely dense plasma of virtually homogeneous radiation unfolded and began to expand in all directions at the speed of light (Swimme B and Berry T 1992). A pattern present since that expansion began has guided the evolution of the universe ever since. Thus, with expansion came a sudden and stunning fall in temperature and density that uncoupled matter and energy from the originating plasma of mass-energy and produced fields of attraction and repulsion that forced matter and energy to interact and transform into what became a continuously-evolving array of increasingly complex and diverse forms such as sub-atomic particles, atoms, galaxies, stars, planets, and, on our planet, life as we know it. Modern evolutionary cosmology views the central feature of this now 14 billion year expansion of the universe to be its transformation of a fixed supply of mass-energy into continuously evolving forms that manifest ever-increasing interconnectedness, awareness, and diversity.

Over the past 4 billion years, Earth and its life-enhancing economy emerged as part of this evolving universal process. Like the parent universe as a whole, Earth uses energy, in this case supplied daily by the Sun, to transform a fixed budget of resources into a continually evolving array of new life forms that embody the universal pattern of ever-increasing awareness,

interconnectivity, and diversity. All the energy and matter on Earth today existed at the beginning. None has ever been added or taken away. There have been changes in form and in quality, but not in quantity. Nature's evolutionary process as revealed in modern science is undoubtedly the finest example of sustainability there ever will be.

Indeed, the keystone in Nature's process of sustainability as we see it on Earth is the nutrient cycling and energy flow inherent in ecosystems that enable living organisms to exist everywhere on Earth (Jackson 2010: 49-59). Overtaxing the ecological processes in those ecosystems is perhaps the greatest deficiency of the modern growth-focused human economy and should be the main concern of any future economy. Without those natural ecological processes there is no way that high-energy food resources, when consumed and turned into low-energy "waste" by living organisms, can be recycled into high-energy form again to provide a continuing supply of food. In other words, Earth's ecosystems sustain a constant supply of high-energy food by providing the capacity to restore life-giving quality to Earth's high-energy food resources that life forms have consumed.

Profound differences separate a constructive human economy that contributes to the future well-being of Earth and our present wildly destructive global economy that reflects the will of business leaders, financial economists, and accountants. (Daly 2009) One difference between a desirable future economy and our current economy is that the future economy would use Earth's finite resources only to satisfy genuine human needs that grow in quality, not in quantity (Cobb 1995). That future economy would satisfy genuine human needs while preserving and enhancing Earth's life-regenerating ecological processes, the processes that continuously renew the resources which all species, human and non-human, require to survive and flourish.

To achieve that future state will require, more than anything, a profound change in how we define human needs and how we interact with Nature to satisfy those needs (Skidelsky and Skidelsky 2012). Striving to reduce costs or improve efficiencies in present-day businesses without altering the growth-oriented thinking that modern business practices embody can only reduce what is bad, not increase what is good. Never-ending growth of physical production and consumption is unnecessary, undesirable, and unsustainable. We humans must think about how to conduct economic activity in ways that emulate how modern science portrays living systems.

An important first step towards thinking differently about economic activity is to replace the mechanistic thinking derived from 17th- and 18th-century science, that reduces reality to a collection of inert independent parts, with organic thinking derived from 20th- and 21st-century life science and evolutionary cosmology that views reality as a whole that emerges from a community of endlessly interacting parts. In Thomas Berry's words, mechanistic thinking views Earth as "a collection of [separate and inert] objects" that humans manipulate with external force guided by impersonal mathematical laws, while organic thinking views Earth as "a communion of [interconnected and unique] subjects," each one embodying a spirit of consciousness and creativity that generates constant change and increasing diversity in the whole (Swimme and Berry 1992: 243).

The remarkable ability of humans to interrelate, think, and create enables them to reject mechanistic thought and to choose behavior that cherishes Earth. They can choose to understand evolution as a process that produces ever-increasing complexity and diversity from a finite body of resources, not endless growth of homogeneous artifacts from an infinite stream of new resources. They can choose to recognize that human beings must be part of Earth's life-sustaining process, which their economic activities must not disrupt. They must recognize that

sustainable economic activity is not what we see being done in large corporations that pursue endless quantitative growth to satisfy ever-growing wants, often extravagant wants.

On the contrary, we must re-think how to do business in ways that no longer pillage Earth's energy and resources. For example, producing more goods and services in local areas where their consumption takes place would reduce dependence on life-destroying global shipping by air, train, truck, and ship. Reducing the extreme separation in distance and time between production and consumption would also help people see that the concrete foundation and substance of the human economy are human beings and Earth's resources, not abstract and illusory "free" markets, not manipulated market prices, financial instruments, or global corporations that relocate to escape local regulations that challenge their narrow financial interests. If more people worked locally to meet their economic needs they would be in a better position to influence quality. Indeed, regular interaction with those who make what we consume and with their work increases awareness of, affection for, and caring for those individuals and how their work affects the natural non-human world where we live (Berry W 2000 and 2012).

Over a long period of time, through careful attention to working in harmony with Earth's systems, perhaps it is not too much to expect that an entirely transformed, completely unexpected, Earth-friendly, new economy will evolve. This new economy would be designed to protect Earth's alarmingly depleted biosphere, to preserve, if it is not too late already, the health of the atmosphere, the hydrosphere, and the lithosphere (especially its life-giving soil). This new economy would strive to curtail: the use of automobiles, trucks, aircraft, and ships to transport products and resources; the extraction of minerals and fossil fuels from Earth; human occupation and development of coastal areas and wetlands; recreation and tourist activities that require fossil

fuel consumption; non-bank finance and non-local banking; construction of high-rise buildings; construction of river dams, mega-tunnels and bridges.

Clearly, these ideas sound outrageous and impossible today. It seems beyond reason to believe there could ever be an Earth without densely populated and sprawling urban settings dominated by high-rise structures, connected by continuous and unbroken webs of massive concrete, asphalt, and iron roadways beneath skies filled by a virtually continuous flow of high-speed aircraft over most of Earth. In fact, the mere suggestion of such ideas invariably causes people to say, derisively, "you must be insane to expect us to go back to such primitive conditions."

Who can say with certainty, however, that informed action today might not gradually lead to viable new conditions that support a sustainable economy, even with population at (probably not above) present levels (Foreman 2014)? Perhaps a useful way to define and strive for sustainability in the human economy is to emulate the way that Toyota strives to achieve True North in their production system. Thus, given the conditions that define True North for Toyota's operations, everyone's attention in all their work is focused on systematically and relentlessly identifying and removing impediments that stand in the way of achieving those conditions (Rother 2010). Similarly, the pathway to a life-sustaining economy would be marked by identifying and then relentless removing impediments to achieving the conditions of "True North" in the human economy. As I have listed in more detail elsewhere (Johnson 2008), those impediments might include, among other things: a corporation and its executives having legal rights to commit with impunity acts that would be deemed criminal behavior if committed by an individual person; separation between actions and consequences in distance, time, and perception of reality that enable corporations to ignore the costs of their abusing of the environment,

communities, individual persons, and the well-being of life in the future; a false perception that abstract financial quantities are a full measure of reality, causing business leaders and economists to believe in limitless economic growth and act accordingly; laws that allow capital to escape the constraints that communities impose on businesses to ensure that public interest and the interest of sustainability supercede capital's global race to the bottom in its search for the lowest costs and the highest financial returns; and the increasing economic inequality and poverty experienced in the past two generations that probably cannot be alleviated without getting everyone to accept the idea that many still need more, while many more can do with far less.

To reduce and reverse impediments to achieving conditions for sustainability in the human economy will be an awesome task calling for dedicated effort by humans everywhere. By using knowledge of Nature's processes gained from modern life science, cosmology, and the skills that past generations took for granted to supply food, clothing, shelter and other basic needs, future generations have real hope of achieving long-term sustainability in local economies built to human scale that do not rely on fossil fuels, fossil water, mined minerals and ores, wasted resources, degraded ecosystems, and giant global business organizations focused only on abstract accounting and financial demands. The task will not be easy, nor can it be carried out in the short-run. However, the work must begin soon.

In very general terms, human kind's goal must be to reduce human resource consumption to the levels permitted by Earth's regenerative capacity. One obvious benefit of reducing humanity's radical depletion of Earth's resources would be to curtail the extinction of nonhuman species that require those resources to survive. Reducing over-consumption of resources could be accomplished by scaling all human economic activities to a human scale of size, speed, and range. Ideally, that human scale is attained by having human activities powered only by the daily

flow of energy that Earth and all its life forms receive from our Sun. The sooner that can happen, the greater are the chances for achieving true long-run sustainability.

To achieve sustainability in the human economy within a century or so will require a local, collaborative, dedicated, and careful approach to change. This approach will entail countless small steps to be identified and carried out by communities at the local level all over the world. If planning and experimentation occur on a local human scale, gradually, over generations, new conditions have a chance to evolve that offer a new, human economy consistent with Earth's systems. This new human economy will supplant today's global business and political institutions, large national systems of government, multinational corporations, and other transnational entities. The hope is that they will be found one day to be no longer useful and will simply disappear.

If we adults become informed about Earth's systems, and if we encourage our children to understand the messages of modern science about Earth's economy, then it is conceivable that generations from now, people will look back on our time as the age that literally saved the Earth, the time when its citizens realized that humans exist to co-create Earth as a home for all species of life, human and non-human, living and yet-to-be-born. Perhaps our descendants will look back with gratitude and praise because we began to replace resource-extravagant "man-in-space" thinking with a life-sustaining and far more fulfilling commitment to "man-on-Earth" thinking.

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