

Understanding Biosphere Entrepreneurship through a Framework Approach

Including Implications for Entrepreneurship Education (USASBE)

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“What’s the business case for ending life on earth?” Ray Anderson, Chair, President’s Council on Sustainable Development, CEO Interface (Henderson & Sethi, 2006, p. x)

Abstract

Entrepreneurial activity may be inconsistent with the need to conserve the planet and prevent environmental damage. This article provides the theoretical basis for Biosphere Entrepreneurship, which goes beyond business and social entrepreneurship. It theoretically justifies entrepreneurial activity that adds value to Earth. Extending the work of Kuratko, Morris, and Schindehutte on ontological frameworks (2000; 2001; 2015), we combine entrepreneurship, climate change economics, and sustainability research in an attempt to build a theoretical base for biosphere entrepreneurship. In the Implications, we ask, what can educators do to help biosphere entrepreneurs address the existential and catastrophic risks facing humanity?

Keywords

Entrepreneurship, biosphere, framework analysis, ontology, theory-building, ecosystem, sustainability, ecosystems, resilience, sustainable development

Executive Summary

This article combines entrepreneurship research with climate economics and sustainability to build a new theory of biosphere entrepreneurship. Going beyond business and social entrepreneurship, which add value to private and community domains, respectively, biosphere entrepreneurship is entrepreneurial activity that adds value to the biosphere and ecosystem services.

The purpose of this article is to devise mental models (frameworks) relating entrepreneurship and climate change to facilitate theory-building. Using images and visual depictions, the article envisions a theoretical model of entrepreneurial ecology or biosphere entrepreneurship showing how the Earth, humanity, and the economy are connected through negative entrepreneurship and positive

entrepreneurship. It extends extant frameworks-- entrepreneurial risk and survival frameworks; financial and capital frameworks; entrepreneurial growth frameworks; socio-cultural frameworks; and entrepreneurial opportunity frameworks—to theoretically justify entrepreneurial activity that adds value to Earth.

The article uses entrepreneurship ontology in the tradition of Kuratko, Morris, and Schindehutte (2000; 2001; 2015) to describe phenomena in a way to identify and classify concepts and relationships about which increasingly are reaching consensus. The purpose is to use ontological framework analysis to convert abstraction into order, prioritize variables, and identify relationships within a new field of biosphere entrepreneurship. We seek candidate frameworks combining the domains of entrepreneurship, climate economics, and sustainability to expand a theory of biosphere entrepreneurship.

The article concludes with implications for entrepreneurship education. If biosphere truly go beyond business entrepreneurs seeking private gain, and social entrepreneurs adding value to social communities, what are educators doing to help our young entrepreneurs see climate change as market failure, identify market opportunities, and come to grips with existential and catastrophic risk?

The framework approach to biosphere entrepreneurship

Ontological analysis seeks to build frameworks to describe phenomena that can be said to exist (Hofwebwer, 2004). A framework is an abstract construct (often using images and visual depictions) that researchers devise to identify, compare, and contrast components of concepts and relationships about which experts and observers increasingly have reached consensus. This work follows in the tradition of Kuratko, Morris, and Schindehutte (2000; 2001; 2015), who have taken the lead in using ontological framework analysis to convert abstraction into order, prioritize variables, and identify relationships within the field of entrepreneurship.

Using frameworks, we can develop theories that can explain and predict phenomena. Since any single framework covers only particular aspects of a phenomenon, the goal, according to above authors, is to generate a “meta-framework of frameworks” to create mental models through which partial observations are juxtaposed to be helpful in theory-building (Warriner, 1984, p. 34). The purpose of this article is to identify ‘fit’ frameworks may have explanatory or predictive power, or simplicity, or they may integrate well into or extend elegantly from existing frameworks. We seek candidate frameworks combining the domains of entrepreneurship, climate economics, and sustainability to expand a theory of biosphere entrepreneurship.

What is biosphere entrepreneurship?

Considerable research (Azmat, 2013; Kirkwood & Walton, 2014; S. Majid & Yaqun, 2016, 2016; Markman, Russo, Lumpkin, Jennings, & Mair, 2016; Schaper, 2016; Thurman, 2016; Walton & Kirkwood, 2013) has shown that entrepreneurs play a role in the transformation towards sustainability. Yet one might ask whether some entrepreneurial activity can sometimes be inconsistent with the need to conserve the planet and prevent environmental damage. There is a multitude of examples where entrepreneurs have achieved success by plundering Earth's resources with impunity thus contributing to existential risks (Frederick, O'Connor, & Kuratko, 2016, pp. 3–4, 48, 64, 74–75, 129–130, 139–141; Penn, 2003). As Shepherd et al. (2013, p. 1251) argue, “some . . . entrepreneurs decide to act in ways that result in harm to the natural environment . . . perceive[ing] opportunities that harm the environment as highly attractive”.

The impact of economic livelihood on the natural environment dates back millennia (Crate & Nuttall, 2016). On balance over time entrepreneurs have undervalued the biodiversity, ecosystems and means of survival that nature provides, including resources such as energy, water, free space and materials. They have not valued nature as a living ecosystem and as a source of natural capital for entrepreneurial endeavors. Rather than adding value to living materials they have only aimed to reduce the quantity of dead resources. In the end, society through government has had to implement complex regulations, incentives and tools to penalize entrepreneurs or to encourage them to reduce waste and mitigate the effects of negative entrepreneurship.

Previous writings such as Malthus (1878), Carson (1962), Ehrlich (1968), Club of Rome (1972) presage the development of the modern literature on sustainability and the economy. But many authors (Burns & Witoszek, 2012; MacNeill, 2013) consider the sustainability literature to have truly begun with *Our Common Future* (1987), also known as the Brundtland Commission Report. This work examined the inter-relations of natural systems, environmental health, and the economy, and it outlined how the world's population was already living well beyond the planet's means to replenish natural resources, absorb pollution, and regulate important climatic conditions. The report defined sustainability as “[meeting] the needs of the present without compromising the ability of future generations to meet their own needs” and argued that it was not too late for technology and society to improve the environment while at the same time achieving economic growth (Brundtland, 1987, p. 3.27). Two decades later, in the same tradition, the Stern Review on *The Economics of Climate Change* (2007) asserted that climate change was the greatest market failure ever seen. By 2014, the second Stern Commission report (2014) expanded the argument that in fact there was no need to choose between fighting climate change and growing the world's economy. One could do both at the same time.

Our Common Future and the Stern Reports connected environmental degradation to the economy. But many authors have suggested that in existential risks nonetheless provide opportunities for entrepreneurs (Dean & McMullen, 2007; Grisham, 2009; Lowitt, 2014; Nagler, 2012; Patchell & Hayter, 2013; Rodgers, 2010). Elkington and Burke's *Green Capitalists* (1989) argued that environmentalism is in the entrepreneur's best long-term interests. Bennett's *Ecopreneuring* (1991) focused on opportunities for innovative entrepreneurs to create growth-oriented eco-businesses. Berle (1991), Blue (1991) and Anderson and Leal (1997) used terms like enviro-capitalists, environmental and green entrepreneurs. Porritt's (2007) *Capitalism as if the World Matters* argued that the only way to save the world from environmental catastrophe was to embrace a new type of capitalism.

To distinguish this field from business entrepreneurship, which seeks to add value to the private purse, and social entrepreneurship, which seeks to add value to the community and society, the present author argues that we should now use the term *biosphere entrepreneurship* to describe entrepreneurial activity generating value for the biosphere and ecosystem services. The key characteristics of biosphere entrepreneurship include: adding value to the biosphere rather than irreplaceably extracting resources from it; improving human well-being while safeguarding natural ecosystems; utilizing biosphere resources, such as ecosystem services, and returning them to nature; upcycling of waste (producing a product of higher value than the original) in supply chains; balancing the relationship between humans and nature; promoting resilience (ability of the planet to recover); solving problems related to the biosphere and to sustainability dimensions (ecological, social and economic); and putting profits into generation/regeneration of ecosystem services (See Bergstrand, Björk, & Molnar, 2011; Björk, 2011; Björk & Olsson, 2013; Fry, 2013; Swedish Ministry of Environment, 2014, pp. 75, 102).

Research questions

In establishing a third kind of entrepreneurship beyond business and social entrepreneurship, the research questions are exploratory. Is there something there? Can we sort observations into categories? Can we extending existing frameworks? Can we envision a “framework of frameworks” that ties together disparate threads, each of which explains a portion of the phenomenon? As Kuratko et al. (2015, p. 3) maintain, “new opportunities for entrepreneurship theory . . . will be based on both expanding the contexts of entrepreneurship as well as a deepening of the existing theoretical approaches”. The purpose of this paper is to present a series of candidate frameworks that suggest the emergence biosphere entrepreneurship theory as it manifests in this century.

The learnings in this section are that entrepreneurs, as they seek and recognize opportunities, should look beyond adding value to the business and societal spheres. They can and should choose climate-resilient pathways that add value to the biosphere. Stressors that affect Earth's resilience are challenges and

opportunities that can animate entrepreneurs. These stressors are the ‘pains’ that entrepreneurs love to solve.

Candidate frameworks for biosphere entrepreneurship

The entrepreneurial process is dynamic and has not remained static over time. This paper’s goal is to examine emerging frameworks within the field of entrepreneurship research that explain outcomes of entrepreneurial efforts and distinguish the context in which they occur. The present research maintains that Morris et al. (2001, p. 47) were only partially right when they wrote: “entrepreneurship is a meaningful concept at the individual, organizational, and societal levels, and the frameworks perspective is applicable at each of these levels”. In the present age, we must extend entrepreneurship theory beyond these levels to the realm of the biosphere. Both theory and practice point us in that direction.

In the present exegesis, we examine various frameworks that explain or can be extended to explain biosphere entrepreneurship. We begin with entrepreneurial risk frameworks and then move on to frameworks that deal with finance and capital, growth, society and culture, and opportunity.

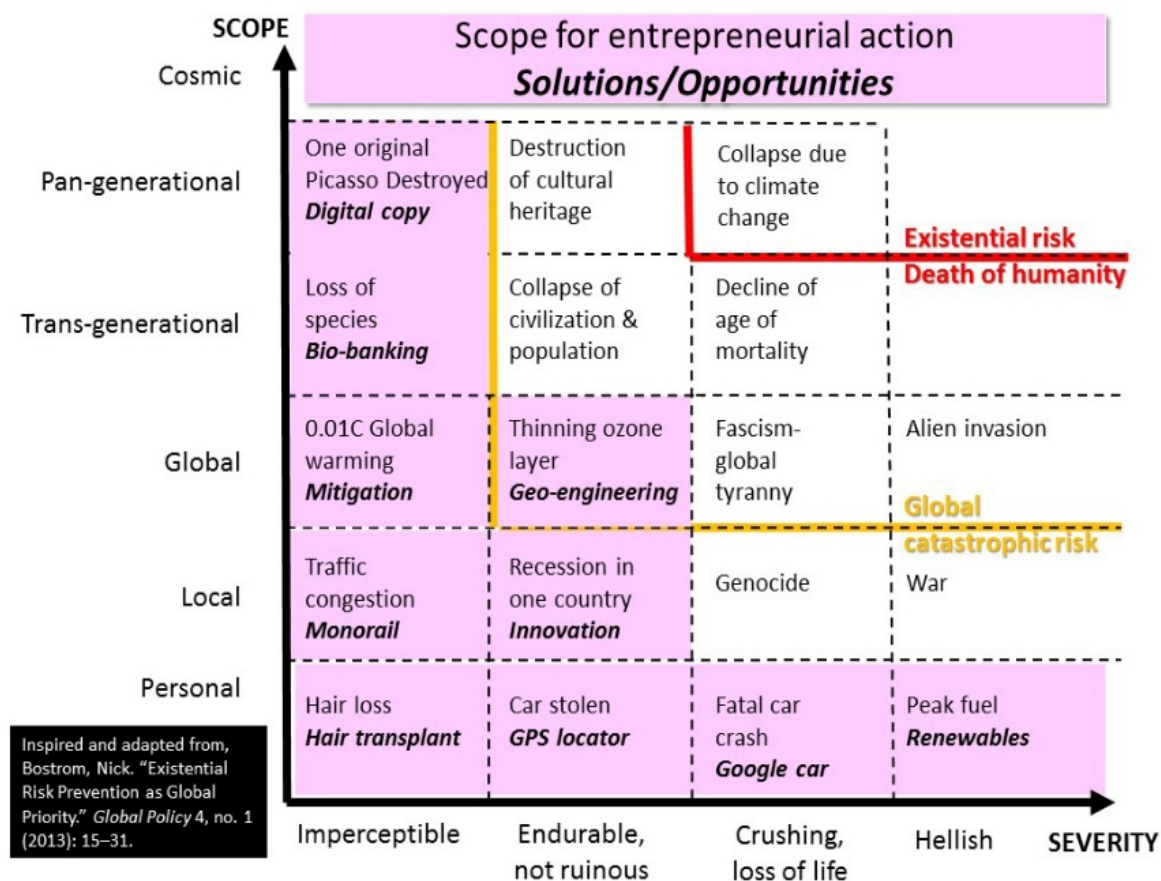
Entrepreneurial risk and survival frameworks

Researchers have long used frameworks to categorize and explain the many entrepreneurial risks at the micro- and meso-levels. Janney and Dess (2006) listed financial, career, family, social, and psychic risks. Ebben (2005) added market, operational, financial model, financial, and opportunity risks. Vonortas and Kim (2015, p. 123) listed technology, timing, competition, market, and IPR risks. Mason and Harrison (2004, pp. 317–318) added management, agency, market, technology, valuation, project, growth, and timing risks.

These risks take place at the level of the individual level or at the level of the firm and economy. To date, entrepreneurship researchers have failed to investigate entrepreneurial risks at the existential level of global catastrophes. Existential risks are those that threaten the entire future of humanity through threats such as climate change. Figure 1 depicts the scope for entrepreneurial action amidst these risks. This framework visualizes global catastrophic risks over a range, from crushing, yet endurable; to hellish and life-extinguishing. Some of these risks impact humanity across multiple generations through such dangers as nuclear warfare, global tyranny, disappearance of the ozone layer, destruction of culture, and pandemics. The Stern Review on the Economics of Climate Change estimated a 9.5% risk of human extinction by 2100 (2006, p. Chapter 2, Technical appendix, 47). Estimates of 10-20% total existential risk are fairly common (Bostrom, 2013; Bostrom & Cirkovic, 2011; Cotton-Barratt, Farquhar, Halstead, Schubert, & Snyder-Beattie, 2015; Sandberg & Bostrom, 2008). The question is where and how do these catastrophic and existential risks affect entrepreneurial action. What actions can entrepreneurs take to adapt to or mitigate these risks?

Adapting Bostom (2013), we see that entrepreneurs have been able to take action on only some of the risks and calamities that face mankind (Figure 1 in pink). Entrepreneurs have designed solutions (**in bold italics**) at the personal, local and global levels, especially at the level of “imperceptible” severity. However, as we move toward the upper right, entrepreneurial action has had less to offer, with geo-engineering entrepreneurs perhaps the first to cross into action on global catastrophic risk (Bethune, 2016; Fountain, 2012; Frederick et al., 2016, pp. 103–107; “Geo-engineering,” 2009, “List of proposed geoengineering schemes,” 2016; Lukacs, 2012; Morton, 2015). The questions remain open whether entrepreneurs can address their higher-order global catastrophic risks not to mention crushing and hellish existential risks.

Figure 1 Existential risk and scope for entrepreneurial action



Survival frameworks

Most entrepreneurship research on survival has focused only “firm survival”, or the demise of a venture due to outside factors (Baggs, 2005; Esteve-Pérez & Mañez-Castillejo, 2008; Lewis & Churchill, 1983; Stearns, Carter, Reynolds, & Williams, 1995). Another research track in this vein has focused on “survival entrepreneurs”, namely necessity entrepreneurs who have no other choice for work and are eking out their survival through entrepreneurial activities (J. Bennett, 2009; Berner, Gomez, & Knorrninga, 2012; Garoma, 2012; Kanothi, 2009; Liedholm, 2002). Finally, some work examined entrepreneurs in times of natural disasters (Chamlee-Wright & Storr, 2009; Dinger, 2015; Solomona, 2013; Zolin &

Kropp, 2007). Only a few commentators have caught the connection. One space industry observer discussed the “exit strategy” of the human race to extraterrestrial settlements (Valentine, 2012). The famous Interface carpet entrepreneur Ray Anderson, a champion of sustainability once quipped: “What’s the business case for ending life on earth?” (Henderson & Sethi, 2006, p. x).

In sum, the treatment of entrepreneurship related to existential threats is limited. Previous entrepreneurship research on survival has not yet treated the impact of entrepreneurs on the survival of the human race. Few researchers have investigated how new entrepreneurial ventures can “contribut[e] to human wellbeing and the functioning of ecological systems . . . adapting human activities to correspond with that aspired future” (Parrish, 2007, p. iii, 37). Entrepreneurs still act as if no crisis existed. Indeed, little of the extant literature examines how entrepreneurship affects the terms and conditions of human survival or appreciates, in the words of Campbell (2008, p. 165), “enterprise that recognizes the necessary interdependence of human development, economic activity and our place on Mother Earth”. Unlike evolutionary economics, which has extensively treated the subject (Gowdy, 2013; Mulder & Van Den Bergh, 2001; Safarzyńska & van den Bergh, 2010; Van den Bergh, 2007a, 2007b; Van Den Bergh & Gowdy, 2000), our research-- the exceptions being Potts, Foster, and Stratton (2010) and Breslin (2008)-- is poor in mapping entrepreneurial action against energy and material flows, system resilience, and co-evolutionary processes, and especially how entrepreneurship is constrained by and affects Earth’s carrying capacity,

In sum, this section shows the outlines of future entrepreneurial survival research. Expectation of ecological destruction alerts entrepreneurs to opportunities (Boons & Wagner, 2009). Entrepreneurial action can adapt to or mitigate a stressor rather than be limited by it (Rammel, 2003). Impending ecological collapse presents entrepreneurial opportunities. In states of uncertainty, entrepreneurs recognize negative environmental effects which, when revealed, stimulate entrepreneurial activity that mitigates such effects (Potts et al., 2010). If entrepreneurship is, indeed, responsive to environmental degradation, it can be argued that a co-evolutionary connection exists between economic and ecological systems. This co-evolution centers upon the growth of knowledge about environmental degradation and the capacities of entrepreneurs to take the opportunities that are presented.

[Financial/capital frameworks](#)

The entrepreneurial capital/finance framework focuses on the venture funding process through the different stages of growth, from seed capital to IPOs (Aggestam, 2014, 2014; Brophy & Shulman, 1992; Erikson, 2002; Kuratko et al., 2015). At its base, capital is seen as any resource used to create other goods or services (Sullivan & Sheffrin, 2003). But the classical framework typically views entrepreneurial capital as purely finance/money as well as industrial/manufacturing plants, and it has not considered new forms of capital.

Researchers now refer to entrepreneurial capital much more expansively (Forum for the Future, n.d.; Porritt, 2007; Tuazon, Corder, & McLellan, 2013). We look beyond the canon frameworks to look at two novel capital frameworks addressing biosphere entrepreneurship.

The first is the Five Capitals Framework derived from Boulding (1970, pp. 1, 11) and Diesendorf and Hamilton (1997). In this view, five types of entrepreneurial capital arise from three ‘spheres’. At the outside is the *biosphere*, which consists of all of the living and non-living things on Earth. The *sociosphere*, where social entrepreneurship exists, is composed of all the people in a social system, all the roles they occupy, all their inputs and outputs. The *econosphere*, where business entrepreneurship exists, is that subset of the sociosphere that is engaged in exchange mediated through prices.

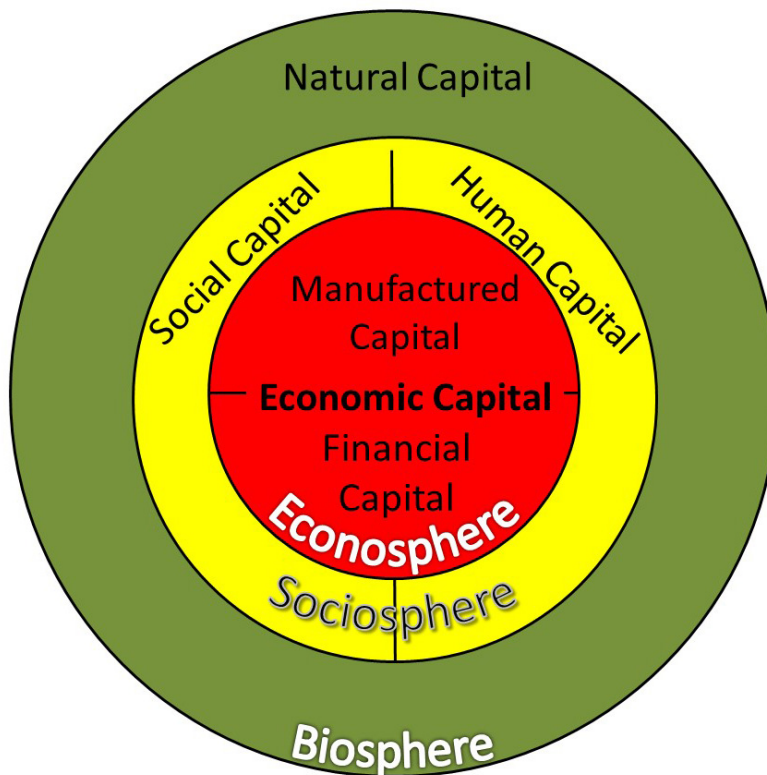
Each sphere yields different forms of capital (see Figure 2).

- The **econosphere** yields both *finance capital* and *manufacturing capital*. Financial capital, also known as ‘money’, is the core of what entrepreneurs use to leverage other resources. Manufactured capital is made up of physical goods (ironically known as ‘the plant’) such as machinery, boats, computers and so forth that contribute to production rather than being the output itself.
- The **sociosphere** contributes two forms of capital. *Human capital* refers to the knowledge, skills, intellectual outputs, motivation, and talent that we carry around inside us. We call this human resources or labor. *Social capital* refers to the collective value of social networks and relationships among people, and to the inclinations that arise from these networks to do things for each other.
- The **biosphere** yields *natural capital*, or the stock of natural ecosystems services that entrepreneurs use to create goods or services for their markets. Natural capital supplies entrepreneurs with a multitude of ecosystem services ranging from waste recycling in mangrove swamps, to carbon sinks that absorb greenhouse gases, as well as water supply and erosion control. Natural capital is different from other forms of capital in that it cannot be produced (only destroyed) by human activity. Well-managed, natural capital can be indefinitely sustainable.

This exercise has led to a re-consideration of capital/finance performance measures beyond “profit” and shareholder value. These three spheres of entrepreneurial activity merge into the Triple Bottom Line (TBL) framework (Figure 3), a phrase coined by Elkington (1994, 1997). TBL typically looks at the three P’s: Planet (biosphere), People (econosphere), and Profits (econosphere). The difference with the classical capital/finance performance framework is that TBL serves not only a company’s shareholders its stakeholders, with the “natural environment as the primary and primordial stakeholder of the firm” (Driscoll & Starik, 2004). Thus defined, a primordial stakeholder is any living thing that is influenced, either directly or indirectly, by the actions of the firm. TBL uses concrete performance measures such as life-cycle analysis; gap analysis, such as eco-efficiency ratios and measures; industrial ecology and supply

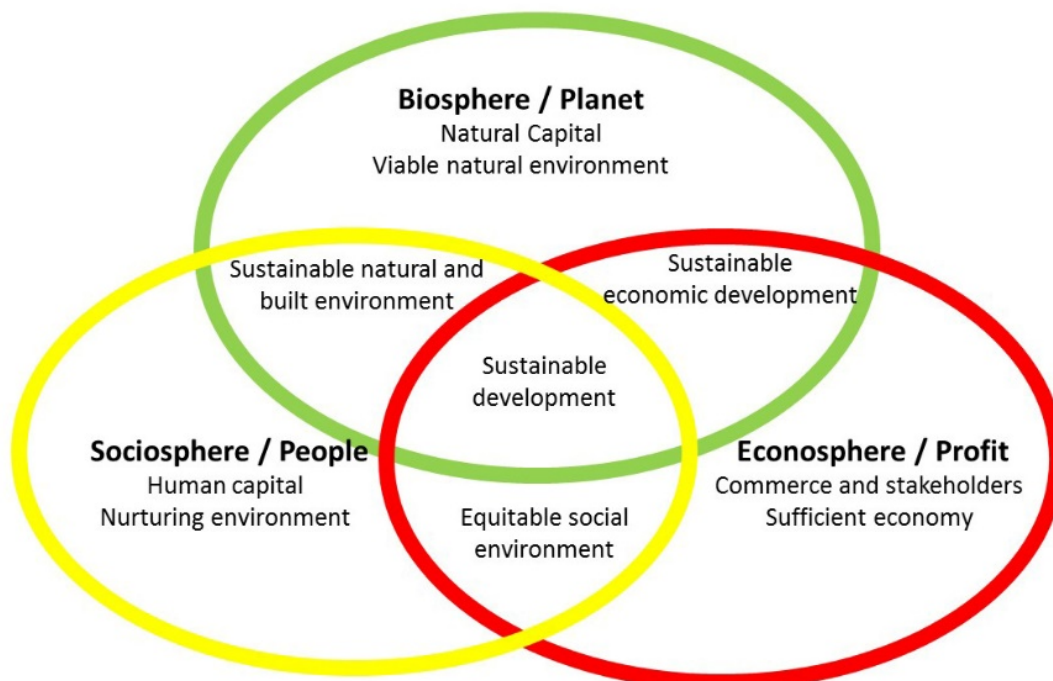
chain linkages; emissions tracking; sources of greenhouse gas and reduction targets; and using an internal carbon dollar value in investment decision making.

Figure 2 The five capitals model within the biosphere, sociosphere and econosphere



In this section, we have extended the legacy capital/finance frameworks of entrepreneurial venture funding into the realm of the biosphere. We see that there is more to entrepreneurial capital seeking than money, and more to entrepreneurial performance measures that stakeholder value. As we move forward, entrepreneurs must take into consideration their use of and impact on all forms of capital with the goal of adding value to the biosphere, and not wantonly exploiting it.

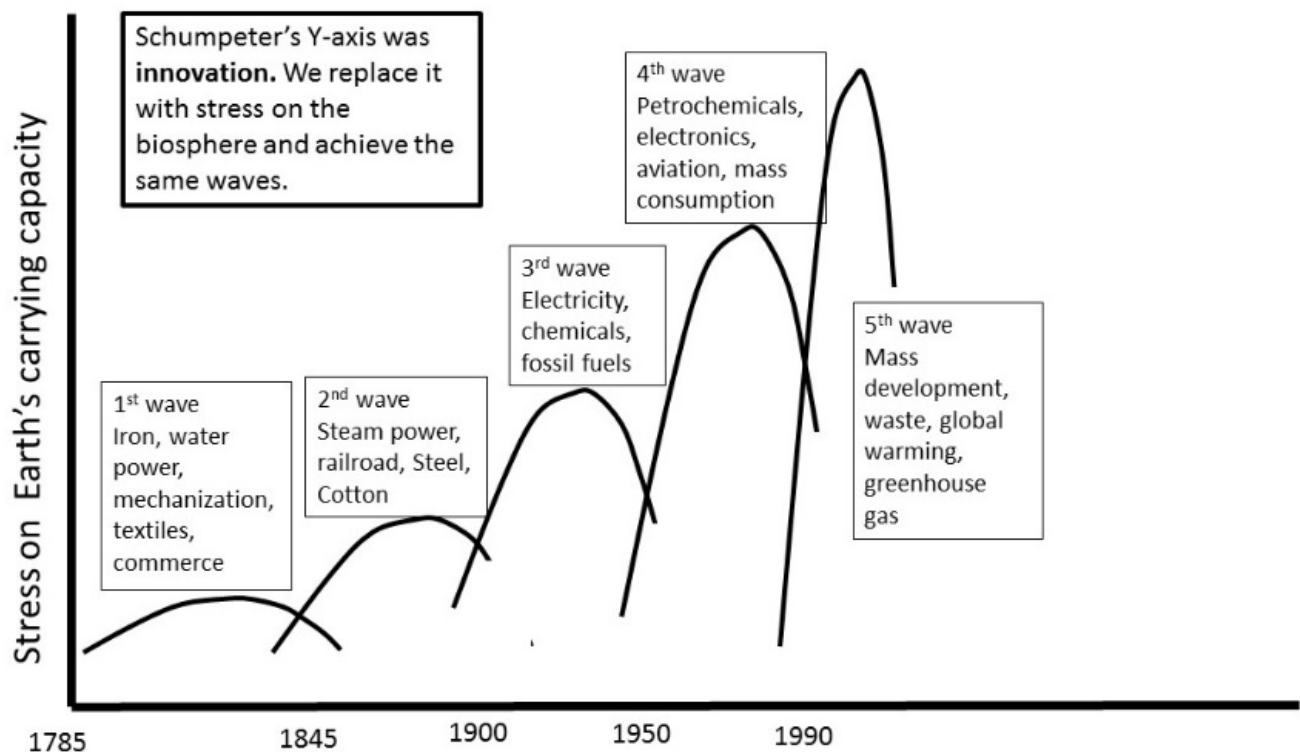
Figure 3 Triple bottom line financial capital framework



Here we examine growth frameworks that relate to biosphere entrepreneurship. The classical economic growth paradigm (Rostow, 2000; Solow, 1956) seeks to optimize resources within an equilibrium environment. Give that the classical paradigm does not well account for wanton consumption of natural resources, nor the impact of technology, we should review with framework within the context of entrepreneurship.

In our research tradition, Schumpeter challenged the classical growth paradigm by introducing the disruptive entrepreneur. As Schumpeter saw it, a normal, healthy economy was not one in equilibrium, but one that was constantly being “disrupted” by technological innovation. Drawing upon Kondratieff (1922), Schumpeter (1939) described “long waves”, or business cycles driven by clusters of industries/technologies that introduced new sets of innovations in Figure 4. The entrepreneur's role was to accelerate this process of creative destruction of the ever-shortening cycles, allowing the economy to renew itself and bound onwards and upwards again (“Catch the wave,” 1999; Schumpeter, 1950, pp. 80–86). Not immune to evolutionary theory, Schumpeter said “the same process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of creative destruction is the essential fact about capitalism” (pg. 83).

Figure 4 Kondratieff / Schumpeterian long waves related to Stress on Earth's carrying capacity

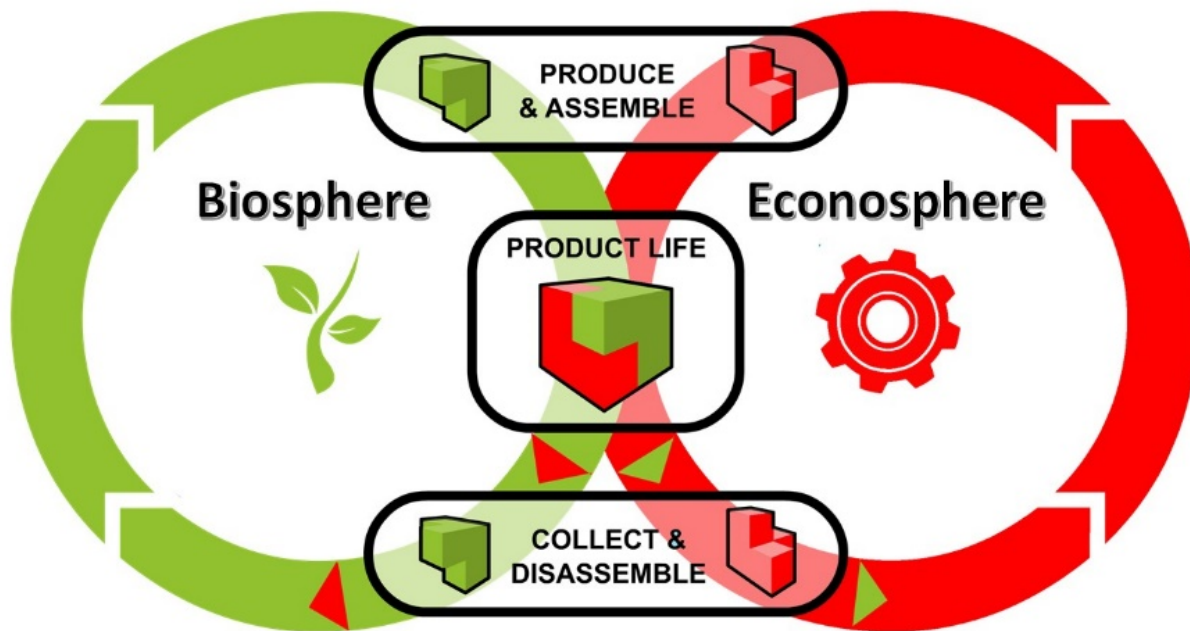


To relate this to biosphere entrepreneurship, let us make one small change to Schumpeter's (Kondratieff's) theory of long cycles of industrial innovation. We simply re-label the Y-axis. Schumpeter called it "Innovation"; here we change it to "Stress on Earth's carry capacity", and make no other changes. We see that each industrial cycle increases the burden of stresses on Earth's carrying capacity and results in a 'peak curve' followed by demise and destruction. This corresponds to Hubbert's peak resource theory which predicts the depletion of various natural resources (Black, 2014; Gray, 2015; Hubbert, 1982). A peak curve applies to any resource that can be harvested faster than it can be replaced. Hubbert used it initially to measure the end of finite resources such as coal, oil, natural gas and uranium, but the theory is now used with other resources such as the biosphere (Bostan et al., 2012; Franchetti & Apul, 2012; Holmgren, 2012).

Indeed, to recover resources and return to an equilibrium growth, some researchers have proposed the exact opposite to the classical framework. It is called the "de-growth" framework. The de-growth framework confronts traditional ideas of incessant growth, consumerism and capitalism (Andersson & Eriksson, 2010; Assadourian, 2012; Buch-Hansen, 2014; Kallis, 2011; Klitgaard & Krall, 2012; Victor, 2012). De-growth is defined as an equitable downscaling of production and consumption that increases human well-being and enhances ecological conditions (Schneider, Kallis, & Martinez-Alier, 2010, p. 512). Entrepreneurs may find opportunities in decoupling resource consumption from economic growth. De-growth opportunity seekers might spot the need for resource and pollution caps and sanctuaries, infrastructure moratoria, eco-taxes, work-sharing and reduced working hours. We can also imagine opportunities in eco-villages and co-housing, cooperative production and consumption, various systems of sharing, and community-issued currencies. De-growth need not mean a decrease in wellbeing, or indeed of individual profit.

Our growth paradigm has focused on manufacturing products that could be later discarded into their graves—either landfills (in the worst case) or incinerators (in the best case). This has a deleterious impact on the environment in terms of pollution and is expensive since new materials have to be manufactured from scratch every time. McDonough & Braungart (2002) challenged entrepreneurs to envision a world without waste, a world without poisons and a world in which all materials are continuously recycled/upcycled from the economy in and out of the biosphere. The key to sustainability is making the economy work for the environment instead of against it. In the "cradle-to-cradle" framework, green 'nutrients' feed into the production process (see Figure 5). They can be continuously useful (recyclable) over repeated production without losing their integrity or quality. Some will ultimately be 'down-cycled' into lesser products, and will finally become waste. Others will be up-cycled into higher value-added products. Through design and manufacturing techniques, entrepreneurs could build products that can be fully re-grown for the biosphere (natural capital) or re-gained for the econosphere (manufactured capital).

Figure 5 Cradle-to-cradle entrepreneurship



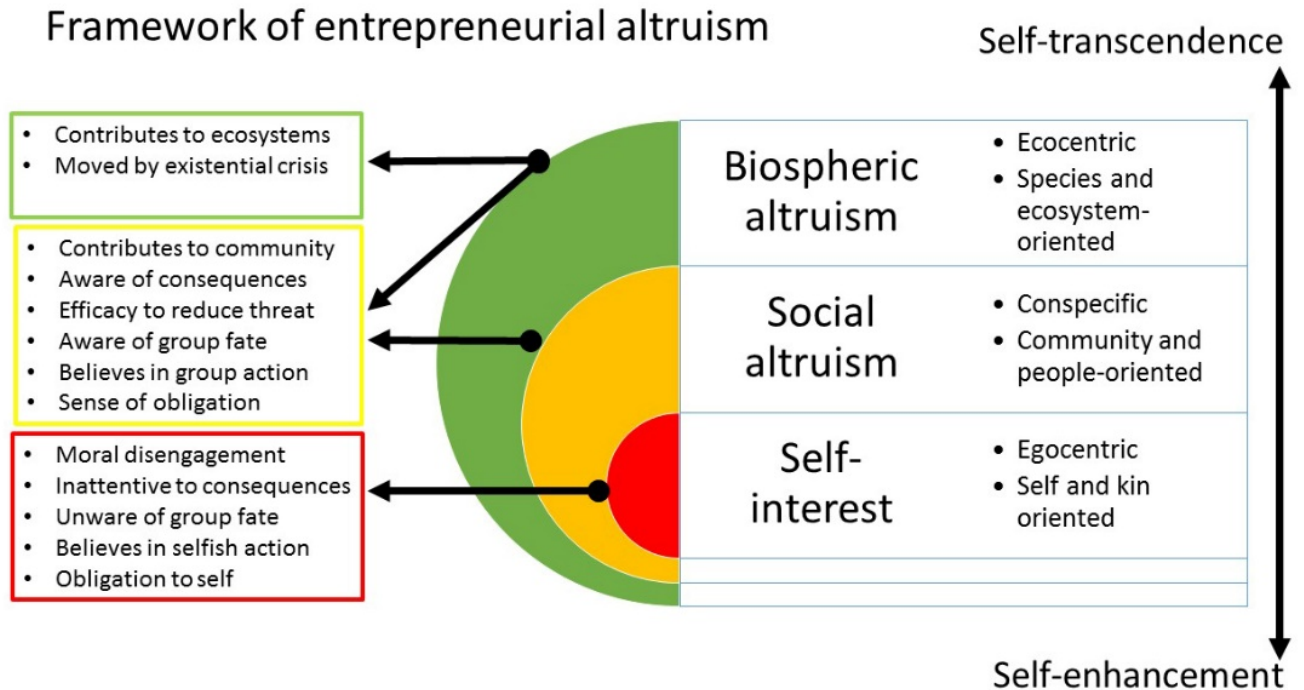
Socio-cultural frameworks

Many biosphere-consequential behaviors are strongly influence by external factors (Gardner & Stern, 1996; P. C. Stern, 1999). Within entrepreneurship research, this framework is usually called the *environmental framework* (Alvarez & Urbano, 2012; Dubini, 1987; Edelman & Yli-Renko, 2010; Hayton, George, & Zahra, 2002; Nguyen, Frederick, & Nguyen, 2014; York & Venkataraman, 2010). But for reasons of clarity vis-à-vis the present topic, we will call it the *socio-cultural framework*, as many have done (Begley & Tan, 2001; Koe & Majid, 2014; Shivani, Mukherjee, & Sharan, 2006; Thornton, Ribeiro-Soriano, & Urbano, 2011; Toledano & Ribeiro-Soriano, 2011)

The socio-cultural framework traditionally looks at the many factors, conditions and influences (positive and negative) external to the entrepreneur that affect the emergence of a new venture. This refers to phenomena such as social and cultural beliefs, altruism, behavior, lifestyles, religion, family, education and social conditioning (Van de Ven, 1993). Prominent examples of this framework include Hofstede's (1984) cultural dimensions model, and Trompenaars and Hampton-Turner's (1998) human-nature dimensions. The questions thus arises whether there are socio-cultural factors that influence the emergence of biosphere entrepreneurs. While work is being done on the impact of those non-economic factors on *social* entrepreneurs (Koe, Sa'ari, Majid, & Ismail, 2012; I. A. Majid & Koe, 2012; Shivani et al., 2006; Thornton et al., 2011), little has been written on the impact of socio-cultural factors on *biosphere* entrepreneurs.

We should take each of these dimensions and map them against biosphere entrepreneurship. Due to spatial reasons, we must leave that to others. However, given some empirical evidence of the relationship (Nordlund & Garvill, 2003; Schultz & Zelezny, 1999, 1998), let it suffice to examine the framework of entrepreneurial altruism and its relationship to the biosphere (see Figure 6).

Figure 6 Framework of the socio-cultural aspect of biospheric altruism



History reveals that there are those entrepreneurs who took advantage of the instrumental value of Earth's resources rather than cherishing and replenishing their intrinsic value. The first seeks economic expediency and exploits the environment with impunity. We call this the *egocentric* approach. The second type seeks intrinsic value, namely to "preserve the integrity, stability, and beauty of the biotic community" (Leopold, 1970, p. 18). We will call this the *ecocentric* approach. Drawing upon climate change sociology and particularly Values-Beliefs-Norms (VBN) theory (Dietz, Fitzgerald, A, & Shwom, R, 2005; P. Stern, 2000; P. C. Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Zehr, 2015), let us examine a framework of biospheric altruism and contrast it with ego- and eco-centric altruism.

At base, we have the self-maximizing egocentric entrepreneurs seeking benefit for self and kin, who are inattentive or ignorant of the consequences on society or the biosphere, who may suffer, as Bandura suggests (Bandura, 1986, 2001; Bandura, Barbaranelli, Caprara, & Pastorelli, 1996) from a "moral disengagement" that harms the biosphere. Do these entrepreneurs structure their actions so they appear less harmful, shift accountability to others, or shift blame to the victims? Or is it, as Shepherd et al. (2013, p. 1252) posit, that low self-efficacy and high perceived resource-scarcity entrepreneurs use moral

disengagement to adjust their values to view harm to the planet as more attractive? In any case, we categorize them as egocentric.

At another level we have social altruism, where an entrepreneur reduces his own fitness while increasing another's fitness in the expectation that the other will act similarly at a later time (Trivers, 1971). Human cooperation and benevolence can be understood as "resulting from networks of indirect reciprocity" (Alexander, 1987, pp. 3–20). Here we have the social entrepreneurs who move beyond self-interest to create value for their conspecifics and the broader community. At this level, entrepreneurs are moved to add value to the community, and they are aware of the consequences and believe they have the resources to reduce the threat.

Then there is biospheric altruism, where entrepreneurs go beyond individual self-interest and even community benefit to add value to species and ecosystems (Dietz et al., 2005; P. C. Stern & Dietz, 1994). These entrepreneurs launch ventures that contribute to the planet and to ecosystem services. Biosphere entrepreneurs are motivated through this type of altruism to support human well-being and ecological resilience by adding value to the biosphere.

In this section we have used altruism to map the relationship of socio-cultural factors to biosphere entrepreneurship. The main difference is where the "value-add" goes. Does it go into one's pocket or into the social community, as business and social entrepreneurs might do? Or is there a third category of biosphere entrepreneurs included by socio-cultural factors who prefer to add value to natural capital. Other researchers should find a fecund area in mapping other socio-cultural factors as well.

Entrepreneurial opportunity frameworks

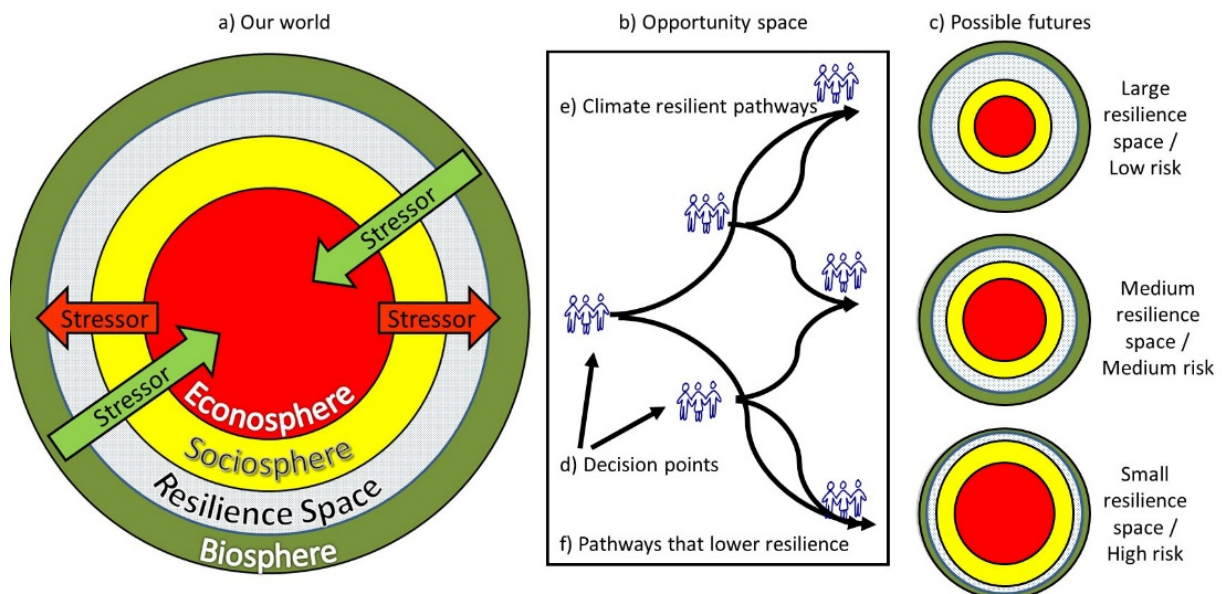
Identifying and shaping opportunity is central to the domain of entrepreneurship (Venkataraman, 1997). Opportunity, at its simplest, is a gap in the market where the potential exists to create value. There are four famous frameworks on how and why entrepreneurs identify opportunities. Cantillon (1680s-1734) first elaborated the *competition opportunity framework* of entrepreneurship (Cantillon, 2001; Hébert & Link, 2009). These entrepreneurs essentially discover discrepancies in the market, buy low and sell high, and drive the supply and demand equation to a new point of equilibrium. Next, best described by Schumpeter (1936), we have the *innovation opportunity framework*. The difference with Cantillon is that the entrepreneur creates new demand by introducing new goods and services that disrupt existing markets. Kirzner's (1973) *alertness opportunity framework* combines the previous two opportunity models but places a higher emphasis on the entrepreneur's superior levels of knowledge about the market, industry, technology or networks. The *social opportunity framework* shows that, more than making markets more efficient, this framework aims to fulfill needs not satisfied and unlikely to be satisfied by the market (Bornstein & Davis, 2010; Frederick et al., 2016, pp. 199–201; Goldsmith, Georges, & Burke,

2010; Phills, Deiglmeier, & Miller, 2008; Yunus, Moingeon, & Lehmann-Ortega, 2010). Each of these four opportunity frameworks above has its relation to biosphere entrepreneurs.

Many quip that entrepreneurs never waste a good crisis because they recognize opportunities where others see chaos or confusion (Dagnino & Mariani, 2007; Dimov, 2011; Gielnik, Zacher, & Frese, 2012; M. Schindehutte & Morris, 2009; Tang, Kacmar, & Busenitz, 2012). This could be no truer than in the present age when entrepreneurs face the existential threat of climate change and global warming. Cantillon's competition entrepreneurs are seen in such arenas as emissions trading, biodiversity offsets, payments for ecosystems services (PES) and reducing emissions from deforestation and forest degradation (REDD) schemes. Next, Schumpeter's disruption entrepreneurs see opportunities in biobanking, bioprospecting, carbon sequestration technologies, geo-engineering, species banking, and virtual water trade. Kirzner's alertness entrepreneurs are bountiful in climate change-induced problems of population (aging, youth, overpopulation), water (pollution, sanitation), food (protein/water consumption ratio, drought resistant strains), fossil fuels (clean energy, emissions control), and biodiversity (aquaculture, genetic diversity, ecosystem brokering, ecotourism). Finally, social opportunity entrepreneurs have launched new forms of community planning, fair trade, habitat conservation, labor standards, and microfinance.

By reconciling and merging these frameworks, we arrived at the *biosphere opportunity space framework* (Adapted from Field et al., 2014, p. 29) (see Figure 7). Biosphere opportunity spaces are arenas in which entrepreneurs identify opportunities to create value for a more resilient planet. Opportunity spaces are pressure points created by both the physical and social worlds and reveal the gaps, market failures, unmet needs of the Planet.

Figure 7 Biosphere opportunity space framework



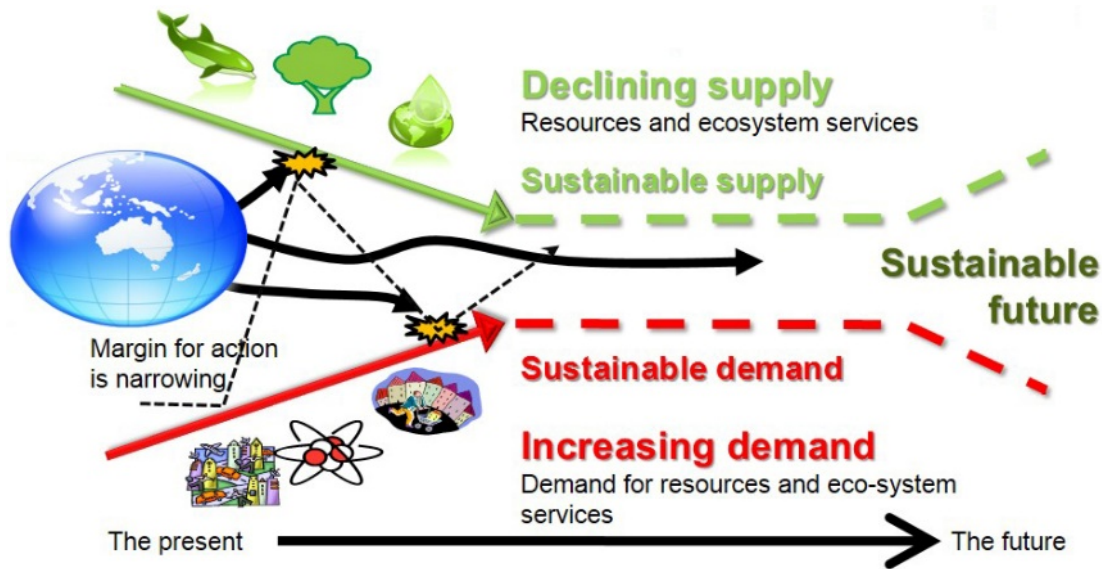
To narrate this framework, our world (a) is threatened from the outside by biophysical stressors (green arrows), such as climate change and degradation of ecosystems; and from the inside by social and economic stressors (red arrows), such as unrestrained economic growth, exploitation with impunity, population increase, poverty and inequality. These stressors expand and contract the resilience space (white hatched), which is Earth's capacity to become strong, healthy, and to recover. Entrepreneurs operate within the Opportunity Space (b), where they face multiple decision points (d) and pathways that lead to different possible futures (c), each with differing sizes of resilience space (hatched). Entrepreneurs take advantage of these pathways and exploit routes to market in which they act (or fail to act), or in which they manage (or fail to manage) risks related to the planet's resilience. Some pathways (e) can lead to a world with lower risk and higher resilience (top right) while others (f) lead to higher risk and lower resilience (bottom right).

That brings us to a second entrepreneurial opportunity framework, a process called 'The Natural Step' (Alexius & Furusten, 2013; Bradbury & Clair, 1999; Herbertson & Tipler, 2006; Holmberg, 2006; Holmberg, Robert, & Eriksson, 1996; Martin & Schouten, 2014; B. Nattrass & Altomare, 1999; Brian Nattrass & Altomare, 2013). Imagine looking at a giant funnel on its side. The upper wall (green) is declining supply which we hope will reach a sustainable equilibrium of available resources and the ability of the ecosystem to continue to provide them. The lower wall (red) is increasing demand which we hope will reach a sustainable equilibrium between demand and the ecosystem's ability to create them. The things we need to survive food, clean air and water, productive topsoil and others are in decline while the demand for them is increasing, which leads to a narrowing margin for action and opportunity (see Figure 8). Meanwhile, as the funnel narrows there are fewer options and less room to maneuver, with actions bumping against the wall (yellow blotches). How do entrepreneurs find a path through this ever narrowing funnel?

To summarize, we have reviewed dominant opportunity frameworks in the entrepreneurship literature and tried to reconcile them showing how entrepreneurial action can increase or lower opportunity spaces as well reduce risk. The basic learning is that there is narrowing scope for action as the biophysical and socio-economic stressors reduce Earth's resilience and our collective capacity to help the planet recover.

During the historical transition from entrepreneurship based on extraction of resources with impunity to value-adding to the biosphere, entrepreneurs must address the complexity and the dynamics of ecosystems and climate in relation to social and economic activity. In the face of technological change, the uncertainty of consumer expectations, and the unpredictability of new regulations, entrepreneurs must learn not to violate conditions that systematically undermine Earth's capacity to meet present and future needs of humanity (Norton, 2012, p. 167).

Figure 8 Narrowing margin for entrepreneurial opportunity



Toward a theory of biosphere entrepreneurship

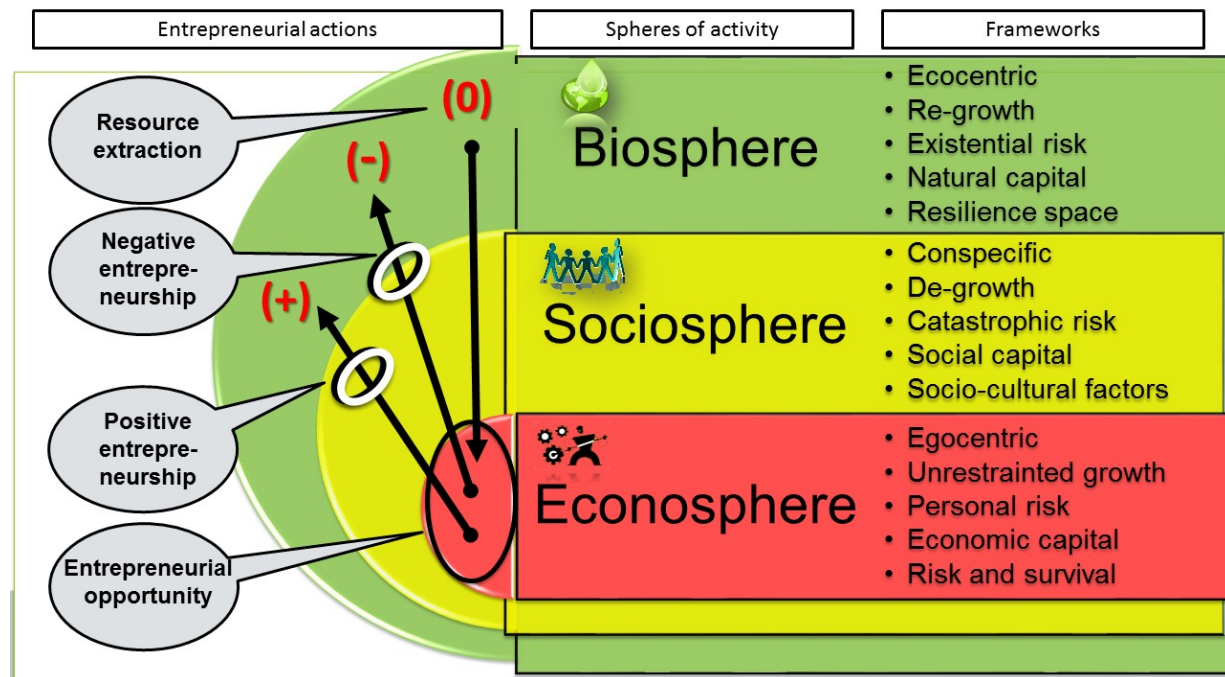
Taking frameworks developed above, we now advance a synthesis. In the era of industrial entrepreneurship, from the nineteenth century through to the new millennium, entrepreneurs were not obliged to consider the environment in their planning and design. They focused on extraction of resources with little regard to their replenishment, on global distribution without regard to distance, on destruction without regard to environmental consequences. The history of entrepreneurship shows that entrepreneurs were not typically oriented towards the prevention of negative effects, to the reversal of degradation, or to net improvement in the physical universe. In the age of industrial entrepreneurs, waste was not a design consideration. The result was that some entrepreneurs (think Henry Ford and Thomas Edison) had a negative impact on the environment.

Now, in the age of sustainable entrepreneurship, we need to consider the biosphere as a locus for entrepreneurial activity, understand the biospheric factors that influence opportunity, consider the waste embodied in products, and develop techniques to add value to rather than extract from the biosphere. We need to move beyond simplistic zero-sum input-output analysis without regard to the consequences and to apply new concepts that take into account the “living dimension” of the products and services that we produce.

The biosphere is inextricably linked to the sociosphere and the econosphere. But problem is that, if what goes in must equal what goes out, entrepreneurs will not try to increase positive outputs to create surplus benefits. This leads us to a tentative reconciled model of biosphere entrepreneurship (see Figure 9).

All entrepreneurs operate within the econosphere but are greatly affected for the sociosphere and the biosphere. Beginning on the right, there are various frameworks of observed phenomena that influence entrepreneurship action. To begin, there are three types of entrepreneur influenced by socio-cultural factors: The commercial/business entrepreneur takes personal risks and profits personally. We call this egocentrism not at all in a negative sense. These are the self-maximizing entrepreneurs who have created value for themselves and their shareholders. At the next level we have the social entrepreneur who aim to contribute value to their conspecifics through community and social action. And now we have biosphere entrepreneurs who seek not only to increase their private purse and add value to the community; they see to increase resilience and capital in the complete system, in fact, to over-compensate for past and accelerating consumption, losses of biodiversity and threats to humanity.

Figure 9 Integrated frameworks for biosphere entrepreneurship



Turning to the left-hand side, from a material point of view, we can see objects (O) passing from the waste-free biosphere through the sociosphere into the realm of entrepreneurial opportunity within econosphere through the process of resource extraction and production. Next, after entrepreneurs are done with these resources, they pass them out of the econosphere as waste. Their value usually becomes negative (-), in other words, damaging to the environment and resulting in a net biosphere deficit. Throughout the history of entrepreneurship there has been an uneven, negative exchange to the biosphere resulting in a net deficit to the planet. This is ultimately unsustainable or what we call “negative entrepreneurship”.

However, this could be different. Positive entrepreneurship (+) can generate positive impacts through value adding and eliminating designed waste, duplication, disposability, planned obsolescence and

wasteful end purposes. Positive entrepreneurs can create net positive-impact loop systems and innovations that create levers for biophysical improvements and social transformation. Entrepreneurs can trigger “impact loops” of two types: They can amplify degradation or restoration in the biosphere. It seems to create net positive impacts, not less negative or even neutral ones, to expand the biosphere beyond pre-settlement conditions. The target of positive entrepreneurship is to reverse the degradation of the ecological footprint (Birkland, 2008; Cohen & Winn, 2007; Dean & McMullen, 2007; Kury, 2012; Shepherd & Patzelt, 2011).

One example of positive entrepreneurship will suffice here. Recycling usually means separating materials for disposal, but here we make the distinction between *down-cycling* and *up-cycling*. Down-cycling transforms waste materials and goods into lower uses. While it may address post-consumer waste, this is a small fraction of the waste entailed in extraction and processing. The obvious example is the recycling of plastics, which turns them into lower grade plastics without regard to the huge energy losses that were incurred in their production.

With up-cycling, waste materials are advanced into new, higher-value products. This is the practice of taking something that is disposable and repurposing it into a product of higher quality. An example would be reconstructing old mattresses, repairing and reusing carpet squares, turning wooden pallets into designer furniture and converting waste into art, edible chopsticks and compostable shoes, fashion & homewares made from PET bottles and fire hoses, and camping gear that is taken back and repaired when it is worn out (Birkeland, 2014; Desha, Timothy Beatley, & Birkeland, 2016; Korsgaard, Anderson, Gaddefors, & Kariy, 2016; McDonough & Braungart, 2002; Wang, 2011; Wilson, 2016).

In this section we have advanced a combination of frameworks. We distinguished industrial versus sustainable entrepreneurship in historical terms. We now must think of the biosphere as a locus for entrepreneurial activity and take into account the “living dimension” of what we produce. We then examine the material flows of biosphere resources into the zone of entrepreneurial opportunity, and observed that some of those resources are negative devalued. Positive entrepreneurs need to trigger impact loops that restore the biosphere and increase its resilience.

Conclusions

What have we accomplished here? On the one hand, we have reviewed and extended extant frameworks that have been substantiated by informed observers in the fields of entrepreneurship and sustainability using pictorial images. These included entrepreneurial risk frameworks as well as frameworks that deal with finance and capital, growth, society and culture, and opportunity. We have answered the research questions in the affirmative: There is something here. We have established that there is a third kind of entrepreneurship beyond business and social entrepreneurship. We have been able to sort observations

into categories, extend some existing frameworks, and envision a model that ties threads together. We have been able to satisfy Kuratko et al. (2015, p. 3) by opening up a new approach to entrepreneurship theory by expanding the context into the biosphere and deepening theory.

Drawing upon these concepts and structures, the author depicts a candidate theoretical model of biosphere entrepreneurship showing how Earth, people and the entrepreneurial economy are connected. The theoretical model thus presented shows the flow of energy and materials taken from and returned to the biosphere. For the most part, throughout the history of entrepreneurship this is an uneven exchange. Unsustainable (or negative) entrepreneurs have extracted and plundered resources, thus depleting Earth's natural capital and decreasing its resilience. Normally entrepreneurs return these resources to the biosphere as waste in devalued form. Sustainable (or positive) entrepreneurship means returning resources in value-added form.

In the end, we see now to produce a cohort of positive entrepreneurship who can generate positive impacts through value adding and eliminating designed waste, duplication, disposability, planned obsolescence and wasteful end purposes. In so doing, they can create net positive-impact loop systems and innovations that create levers for biophysical improvements and social transformation.

Implications

The scope of this paper is huge and there are many implications to my research. Below, I discuss the implications on entrepreneurship education. But there are so many other areas of interest. I believe my framework analysis and candidate theory are fecund enough that researchers could begin asking about the implications of biosphere entrepreneurship in other areas. For example, a study of implications for government policy prescriptions would be exceedingly interesting. In government policy, attention could be directed to policy that could change entrepreneurs' mindset toward the biosphere. This discussion might start with the notion that the biosphere is a public good, one that might suffer from free-ridership leading to less than optimal number of entrepreneurs taking biosphere entrepreneurship seriously unless the incentive structure changes. Another area is the impact of ownership structure on level of biospheric altruism. For example, entrepreneurs with bigger stakes and control in their companies might be more supportive of biosphere entrepreneurship compared to companies owned by third-party (pension) funds, who would theoretically care less about the biosphere and more about stakeholder value. Another area of interest might be the political implications for political parties. In terms of macro-economics, everything in our economy may benefit / damage someone or something if we trace it from beginning to end. How do we calculate benefit created only to look further down the road and see it convert into harm or disenfranchise someone?

Implications for entrepreneurship education

That said, I'd like to comment in extensor on the implications of biosphere entrepreneurship on how we education your entrepreneurs. Sadly, resource depletion and overpopulation are both products of the enterprising spirit. Climate change is *the* issue of the millennial generation. As the world's greatest cities risk disappearing under water during their lifetimes, as the hottest summers in recorded history occur before their eyes, and they see that species alive during their parents' lives are disappearing, the call to save the world has become compelling. Climate change will have a significant impact on our students' incomes and wealth during their peak earning years. Already, Generation Z, those born 1995–2009, who never knew the pre-internet world, is entering universities. They will be followed by Generation Alpha, those born after 2010, who will fare even worse (Bailey, 2016; Demos, n.d.).

Every aspect of a good entrepreneurship course--from strategy and marketing, to business planning and intrapreneurship, and from mind-set to ethics—should deal in some way with the existential threats facing our young entrepreneurs. There is much more to say about “climate change entrepreneurship” and this author's textbook covers climate change in every chapter (Frederick et al., 2016). Let's review some of what teachers should be imparting to our young entrepreneurs.

- **Basics:** Students need to know that economic growth and entrepreneurial activity are inextricably linked to global warming. Safety on Earth is slipping away. The only option is innovation and enterprise to get it right. Entrepreneurs who understand the new climate reality—and are willing to invest in preparedness and risk management—are best equipped to seize opportunities. As Rajendra Pachauri, Nobel Prize winner and chair of the Intergovernmental Panel on Climate Change (IPCC), has said, “entrepreneurs who respond to the challenge will reap commercial success—while businesses which fail to do so face oblivion” (Wright, 2009).
- **Climate change economics:** Students need to understand the relationship of entrepreneurship to climate change economics. Market failures motivate environmentally degrading behavior. Entrepreneurs can cause negative externalities, where costs to the environment spill over onto the consumer and the public, leading to the ‘tragedy of the commons’. They need to know how to hedge against physical climate risk, mitigate regulatory costs or improve/repair corporate reputations through green business. They need to know how to manage climate risk in the supply chain, invest in low-carbon activities, and innovate new technology that sells while improving the planet. They need to understand climate-related revenue drivers (pass-throughs to customers; carbon credits; low-carbon substitute products; impact of weather patterns on revenue), as well as cost drivers (regulatory; emissions tax; price increase in materials; energy costs; insurance premiums).
- **Some entrepreneurs engage in environmental crime.** Most morally questionable entrepreneurs are environmental crime enterprises. These syndicates carry out illegal fishing, illegal trade in wildlife and timber, smuggling of ozone depleting substances, illegal disposal of asbestos, shipment of animal

parts for health remedies, illegal trade in charcoal, or trade in hazardous waste—all to benefit the criminal entrepreneur and his syndicate. They can relate environmental crimes that have occurred near them, including strip mining, damming of rivers that drive out people, atomic energy failures, industrial pollution, etc.

- **Innovation in the era of climate change:** There are already a myriad of wind and solar technologies that are cost-effective. Ultimately, the green revolution is going to be carried by engineers and entrepreneurs who can break down the barriers to the market and commercialize existing technologies. We need innovators to team up with entrepreneurs to produce and market all sorts of breakthroughs by creating and responding to demand. Only entrepreneurs can take this much innovation to the marketplace. Only entrepreneurs can generate and allocate enough capital fast enough to commercialize them. The candidates for top sustainable 21st century innovations include: genetic engineering; artificial trees; species preservation; geo-engineering; carbon sequestration; free non-fossil fuel power systems; gene sequencing; hydrogen-powered cars; methane-fueled rockets; waste management; weather prediction. In its product planning a business should include methods of manufacturing and distribution which ensure a minimal environmental impact. And consider creating products with significantly longer life spans. By creating products, which can be upgraded, retro-fitted or are simply indestructible, we can communicate to consumers the inherent environmental and cost benefits of purchasing a product which will last a generation.
- Design thinking for the environment
- **Family business in the age of environmental sustainability:** Environmental sustainability is relevant to family-controlled businesses. This is because family businesses are oriented towards preserving wealth and ensuring success for future generations. Climate change and global warming are affecting the fortunes and longevity of family businesses. A crop failure may mean bankruptcy. A new pollution regulation can put a family business into debt or make it uncompetitive. On the reverse side, some families can take advantage of this by positioning themselves in eco-tourism. Long-term stewardship is generally a core value at family firms.
- **Social intrapreneurship:** Social intrapreneurs demonstrate that business and social values can be aligned. This is nowhere as true as in the field of environmental sustainability by delivering solutions or products that both add value to the company's bottom line as well as to society and the planet. Social intrapreneurs see businesses as part of the Earth ecosystem and needing to add value to society and the environment as well as to the bottom line.
- **Green entrepreneurial marketing:** Recyclability, re-usability, biodegradation, and positive health effects are definitely in. Marketing can decouple material consumption from consumer value and can facilitate both innovation and choice for sustainable consumption. It can help consumers to find, choose and use sustainable products and services, by providing information, ensuring availability and affordability, and setting the appropriate tone through marketing communications. Green marketing

has become an important marketing strategy for entrepreneurial companies that aim to help improve the environment and position themselves as responsible organisations, all while attempting to drive sales. Global consumption patterns are unsustainable and efficiency gains and technological advances alone will not be sufficient to bring global consumption to a sustainable level. Changes will also be required to consumer lifestyles, including the ways in which consumers choose and use products and services.

- **Entrepreneurial strategy and sustainable development:** Entrepreneurial strategy involves the art of managing assets that one does not own. Now there is an increasing realization that the Earth's resources also fall into this category. New millennial entrepreneurs have to confront the challenges of how to put a strategy in place that at the same time grows the company as well as protects those resources that we do not own. New strategy tools are important for young entrepreneurs to learn. The Sustainability Helix helps us understand how business can become more sustainable. Strategic backcasting is a methodology for planning under uncertain circumstances. BioDefinition guides decisions about creating or investing in a biodiversity business. BioSwot analyses strengths, weaknesses, opportunities and threats in the linkages between the business and the biodiversity. BioGovernance puts in place structures to preserve the biodiversity integrity of the business and to secure achievement of biodiversity performance. Product stewardship focuses on minimizing not only pollution from manufacturing but also all environmental impacts associated with the full life cycle of a product.
- **Legal framework regulating climate change:** Companies with international operations are today increasingly subject to various emissions regulations and standards in key markets. The Convention on Climate Change and the Kyoto Protocol embodied the core principles of a multilateral response to climate change. Given the increasing awareness of climate change and the role of business in bringing it about, entrepreneurs can expect the policy and regulatory environment to adapt and produce such policies as the introduction of carbon pricing schemes, providing support for research and development in zero carbon technologies and processes, imposing mandatory energy efficiency standards, and raising investment in network infrastructure such as public transport systems and smart electricity grids. A coordinated approach to policy measures will be critical in order to improve the productivity of energy and natural resource use, reduce 'policy risk' to create a conducive environment for private investment in clean infrastructure and encourage innovation in low/zero-carbon and environmental industries.
- **Sustainability performance measures for entrepreneurs:** Climate change has suddenly exploded onto the agenda of financial disclosure statements around the globe. Companies are now talking about climate change both positively (touting their own progress on emissions reductions) and negatively (disclosing the ways in which climate change can hurt the bottom line). Entrepreneurs can now find a variety of planning, strategy and performance tools to use in launching and evaluating new

sustainable ventures. Many companies are required to disclose sustainability performance measures on their progress toward sustainable development. These tools include: Life cycle assessment (LCA); Factor X; ISO 14 000; Environmental impact assessment (EIA); ;Material flow analysis (MFA); Triple bottom line performance measures; Carbon footprints; and Food or product miles

- **The need for a sustainable business plan:** As entrepreneurs we are collectively reaching the tipping point where we have to change our business models to respond to sustainability issues. We can and must advance sustainable development initiatives taking into account the importance of mitigating and adapting to climate change. We now need to plan for every final impact of their business with sections on greenhouse gases, energy use, clean power and other emissions-reducing strategies.

Epilogue

At the top of this piece I quoted Ray Anderson, “What’s the business case for ending life on earth?” Since the Stern Reports, perhaps that should be turned on its head: “What is the business case for saving life on earth?” For too long entrepreneurs have been part of the problem – not part of the solution. Ray Anderson’ daughter, Harriet Langford, collected some of his quotes (Saporta, 2014) that might spark a brilliant discussion Here are a few of them:

- *Status quo is a powerful opiate.*
- *Doing well by doing good.*
- *Doing business by respecting earth.*
- *Live mindfully of the need of all species and of each other.*
- *We only pass through this world once; we can either leave it a better or worse place.*
- *I am a recovering plunderer.*
- *I read Paul Hawken’s “Ecology of Commerce” and wept.*

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