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Article

Macro-entrepreneurship and sustainable development: the need for innovative solutions for promoting win–win interactions

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Abstract This article restates and enhances the methodology described by Yu et al. in this journal (3:291–309, 2000) by projecting its implications in light of recent interdisciplinary research, suggesting several new directions of inquiry. The difference between a static neoclassical approach and a dynamic multidimensional approach, stated in terms of macro-entrepreneurship setting the stage for macro-sustainability, is further highlighted. Existing case studies can be reinterpreted by this new approach.

Key words Sustainable development · Entrepreneurship · Methodology · Ecological economics · New institutional economics

Introduction

The approach to sustainable development based on regulation and control has been quite prevalent and much written about.[1] A decentralized approach, emphasizing the role of the state primarily in the setting up of infrastructure, has received relatively less attention. Sustainable development at its infancy in the early 1990s was considered by some as nothing more than mere rhetoric. Most economists trained in the neoclassical tradition largely rejected the concept at the time, because the prevailing thinking on sustainable development seemed drastically different from that of neoclassical economics. The latter emphasizes Pareto optimality in terms of a set of marginal conditions.

Yu et al. (2000) attempted to bridge the thinking of neoclassical economics and sustainable development by clarifying that the former deals generally with a *movement* along the marginal gain and cost curves, while the latter can be constructively interpreted as focusing on the *shifts* of the curves. The crucial

[1] The Brundtland definition of sustainable development, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs," has built-in mistrusts about the capital market. It may be more constructive to define sustainable development as developments that are compatible with, and which do not degrade, the potential value of public natural environment.

factor enabling the shifts of marginal curves in the neoclassical economic tradition is innovation. Thus, entrepreneurship enters the picture in some important ways that must be further explored and analyzed.

Recent works on sustainable development and entrepreneurship have begun to address to these issues (Cerin 2006; Lai and Lorne 2006; Dean and McMullen 2007). The development of "win–win strategies" in these studies constituted an important element of consideration, complementing well the earlier collection of essays on the subject in Lai and Lorne (2003). Applications of sustainable development concepts in this direction of inquiry in the area of real estate and construction have been most prominent and path-breaking,[2] (see, for example, Chau et al. 2003; Webster and Lai 2003; Chau et al. 2004; Lai 2005; and Lai et al. 2006; with the research agenda holistically categorized by Lai and Hung 2008).

The purpose of this article is to explore more deeply the role of entrepreneurship in the development of win–win strategies involving multiple stakeholders. As much as the strategies involve a *reflective* and *recursive* process between stakeholders, the crux of the matter is to develop win–win policy agenda. We will first propose some crucial concepts in entrepreneurship, which we refer to as *macro-entrepreneurship* (beyond that of micro considerations). Then by integrating the concept of macro-entrepreneurship with the criteria for sustainable development, we wish to also explore a concept of *macro-sustainability* by describing the theoretical foundation of attaining win–win interactions as a problem of changing mind-sets. The theoretical discussion may help clarify some of the case studies used in Cerin (2006), potentially suggesting methods to analyze other cases as well. The macro-type entrepreneurship is pointed out to be the "hidden" underlying driving force for promoting sustainability in the case studies that appear superficially to have only micro dimensions.

Meaning of macro-entrepreneurship

There is no shortage of definitions for the concept of entrepreneurship, but several can be particularly useful for appreciating the nonmarginal, curve-shifting approach adopted by Yu et al. (2000). At the outset, anyone working on sustain-

[2] The model of Yu et al. (2000) has been taught in MSc courses at University of Hong Kong for years. Indeed, through collaboration with various schools in Mainland China, the MSc Program (Real Estate/Construction Project Management) has been offered in major universities such as Beijing, Tsinghua, Tongi, Tianjin, and in 2008, Chongqing University. The scale of real estate development in China has been massive, rapid, and ubiquitous. In almost every city, students can find cases where the model is applicable. For example, in a study of a resort called South Hot Spring in Chongqing, systematic cause–effect relationships connecting the trisectors of economy, environment, and society can be identified. Then, by using conceptualization derived from the model, win–win strategies can be further formulated. The process of conceptualization is very important, because without going through it, the planning and the negotiation parameters would be very limited, and in some situations, deadlocked by methodological limitations. Pragmatic policy recommendations for development infrastructure in Hong Kong have also been made in recent consulting projects funded by the Bauhinia Foundation Research Center in Hong Kong.

able development must assume that a clear objective function is *not* given in order for the problem to make sense. A well-defined objective function with constraints constitutes a typical neoclassical economic problem in which a set of marginal conditions representing optimum economic efficiency is a matter of mathematical derivation. However, as will be articulated below, many of the entrepreneurial activities in the macro sense implicitly used by Yu et al. (2000) and in this article, are processes to define rather than to execute the maximization of an objective function. Neither a comparative static nor a traditional dynamic approach will be suitable for this purpose.[3] Instead, an entirely different frame of reference is needed. Some preliminary thoughts on this were expressed in Barkusky and Lorne (2006). This article takes this approach one step forward by introducing the concept of macro-entrepreneurship.

Macro-entrepreneurship, in a nutshell, is a collective term for innovative strategies to engage stakeholders of firms in alliance formations. New alliances create value in the same sense that micro-entrepreneurship creates value, but they involve more proactive human (stakeholder) considerations than micro-entrepreneurship, which often can be largely technologically or circumstantially driven. Even in situations where micro considerations involve other individuals, they often entail only impersonal market transactions (e.g., the hiring of short-term laborers to build a new bridge to access an island). Macro-entrepreneurship, by contrast, involves a mutual determination of "what is important" with the stakeholders. It takes on a more proactive stance toward stakeholder engagement. Below is an attempt to further characterize the meaning of macro-entrepreneurship from three distinctive paradigms, all suggesting the need to formulate the nature of the problem as one of specifying an indirect objective function that stakeholders can jointly maximize.

Economic perspective

There is an abundant literature reflecting the traditional treatment of entrepreneurship in economics. Characterization of entrepreneurial activities can be found in Schumpeter (1934), Hayek (1945), Kirzner (1973), Buchanan and Faith (1981), and Baumal (1993), which are well known. The literature emphasizes asymmetric information being the nature of the issue, with pure market mechanisms having problems of coordination. Entrepreneurship has been studied by a largely mathematical approach, with the Economic Nobel Prize of 2001 being notably awarded to works by Akerloff, Spence, and Stiglitz. Most of these works emphasized a type of micro-entrepreneurship.[4]

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[3] It is tempting to include a variable, t, for time in a conventional maximization problem for the purpose of addressing some of the issues that are time dependent and perhaps also capturing exogenous shocks due to innovation. The approach does not allow substantive discussion of the type of macro-entrepreneurship addressed by this article.

[4] The term "micro-case-studies" was used in Barkusky and Lorne (2006) in describing a group of companies that had voluntarily adopted corporate social responsibility in an oligopolistic industry environment (p. 167).

Aspects explored have also included the unique personalities of entrepreneurs, and how some great inventions of the past have been "accidentally" discovered. These aspects have been written about extensively, both descriptively and mathematically. Stochastic processes, expressed in terms of probability distribution, are the prevailing conceptual tools used in this type of formulation, and many successful entrepreneur stories were told, mostly in terms suggesting that a strategic decision was made when a random variable outcome was known only to the entrepreneur but not to others, or better known by the entrepreneur than by others. (e.g., an entrepreneur is often made to look like a genius when he buys things very cheaply and resells later at a high profit). The focus of this line of inquiry involves a mathematical formulation, articulating in terms of a random variable of outcome, known only to that entrepreneur but not to others, at least at the initial stage when the relevant ideas were first conceived.

A completely different approach, less well known, and indeed virtually unheard of, is the work of Steven Cheung, an economist who once chaired the Department of Economics at the University of Hong Kong. For many years, Cheung advocated a methodology of constrained maximization with a focus on an action-oriented empirical investigation of constraints for the purpose of generating refutable implications.[5] To Cheung, economic analysis is a study of constraints and perhaps the costs of altering them as well. The identification of constraints is, in itself, an entrepreneurial endeavor. This is because entrepreneurs need to take action and "walk the talk." Gaining accuracy in refutable predictions in the form of: "If A, then B,"[6] no matter how subjective, provides the basis for confidence for an entrepreneur taking action in a sea of unknowns. All entrepreneurs in the world struggle with the proposition of: "If A, then B". Cheung's methodology is distinctively entrepreneurial.[7]

Cheung's methodology of advocating economic analysis as an empirical investigation of constraints is equivalent to a search for an unknown constrained objective function. But the search for constraints relevant to this exercise is not so much a search for the laws of nature as required by an inventor working in a closed laboratory. The living world is the laboratory, according to Cheung; and the nature of constraints Cheung proposes to investigate are contractual costs, cultural habits, laws, and various human constraints, broadly called transaction costs. This methodology is particularly relevant for a macro type of entrepreneur-

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[5] Cheung is well known for his contribution to studies of transaction costs. Mentioned explicitly by Ronald Coase in his acceptance of the Nobel Prize in Economics of 1991, his methodology was more or less "an oral tradition" that was not formally written until 2001. See Cheung (2001, 2002a,b, 2005).

[6] "If A, then B" is the essence of positive economics, which is a methodology articulated well in Milton Friedman's 1953 classic piece entitled *The methodology of positive economics*.

[7] Cheung's methodology can be put into a broader perspective. Maximization problems with Lagrange multipliers have been the neoclassical foundation of economic analyses as described in leading economic textbooks such as Samuelson. As pointed out in Silberberg (1978), the problems can be generally treated as problems of maximizing constrained objective functions.

ship, because the engagement of stakeholders into relationships is often a human endeavor. The indirect objective function of macro-entrepreneurs may need to be jointly determined.[8]

Sociological perspective

The broad area ramifications of entrepreneurial activities in the form of constraints, as well as a search for an objective function, can be more abundantly inferred in sociology literature dealing with system evolvement and the process of conceptualization, value formation, etc. Anthony Giddens' work has been much cited for emphasizing a structural holistic approach, which is a recursive process requiring reflective monitoring (Giddens 1976, 1979, 1984). The structuration theory sees the role of an entrepreneur as being much bigger. Through a process of interpretation and observation, an entrepreneurial individual has the potential to change *what is to be observed.* This notion is very much in line with the broad objective of identifying constraints and the objective functions in the language of economists. To seek *what is valuable*, could indeed be the essence of entrepreneurial activities. Again, the methodology of the marginal principle has very little to say if this line of thinking is to be further pursued.

Sociologists do not usually adopt the methodology of marginalism, but they have long used the term micro vs macro in their studies. Giddens described the distinction while at the same time criticized it. He argued that a new dichotomy is needed for analyzing "day-to-day" social activity as opposed to "issues of large-scale social organization," (Giddens 1984, p. 139).[9] Similar to Cheung, Giddens did not see constraints of society to be literally treated as unbreakable technological constraints in the mathematical sense of the term: "I would suggest that the effort coherently to reconstitute macrosociology upon radically empirical microfoundations is the crucial step toward a more successful sociological science," (1984, p. 140).

In Giddens' structuration theory, the concept of co-presence takes on a very important role. He believes that the micro/macro approach to human behavior should be conceptualized in terms of "how interaction in contexts of co-presence is structurally implicated in systems of broad time–space distanciation—in other words, how such systems span large sectors of time–space," (1984, p. 26).

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[8] Economists have not written about this much, with some hybrid discussion of this in North (1990). Rosa (2006), borrowing the work of Richard Dawkins, provided more specific insights for the thought process of invention, particularly in this digital age that we live in. The concepts discussed by Rosa were much broader, having potential implications on how people in the new digital age can pragmatically search for their objective functions, see particularly Chapter 6, pp. 201–264. Independent of the work of Rosa, Barkusky and Lorne (2006) also attempted to bridge the work of Lancaster (1979) in this formulation.

[9] Microsociology is taken to be concerned with the activities of the "free agent," which can safely be left to theoretical standpoints such as those of symbolic interactionism or ethnomethodology to elucidate; while the province of macrosociology is presumed to be that of analyzing the structural constraints which set limits to free activity.

Giddens differs from economist Cheung's perception of constraints in that the former considers constraints to be more explicitly and jointly determined, that is as a problem of the connection of social with system integration, whereas the latter believes the process to be only implicit. An entrepreneur can only predict the outcome of a situation if he can identify the constraints that fellow human beings have imposed on him in the form of transaction costs. Whether the process is explicit or implicit, the outcome is the same. A new objective function (indirect with Lagrange multipliers) could be the outcome of a series of macro-entrepreneurship or macro-sociological interactions. The constitution of a society is thus the outcome.[10]

Business management perspective

Combining economics and sociology, the business management perspective of entrepreneurship has also much been written about. Shane and Venkataraman (2000) provided a good overview and a setting of the research agenda. Entrepreneurship is viewed as a "nexus of opportunity and agency, whereby opportunities are not singular phenomena, but are idiosyncratic to the individual" (Eckhardt and Shane 2003; Sarason et al. 2006). The approach specifically identified the entrepreneurial process as a structural transformation in the dimensions of signification, legitimation, and domination (Sarason et al. 2006 pp. 295–299). The crux of the matter has to do with an interaction between opportunities and human action, and, in that sense, is very similar to an Austrian approach of Ludwig von Mises in economics. Yet, it can also be integrated with the institutional approach of North, Coase, and others. As Dean and McMullen (2007) stated, "a complete theory of nature of entrepreneurial opportunities must include consideration of the barriers to widespread and rapid exploitation of opportunities that arise from exogenous shocks" (p. 57). The authors proposed to categorize different types of entrepreneurship. Among the many described, with informational entrepreneurship being the most crucial one, they can all be used for addressing the problem of sustainable development, particularly of the macro type discussed in this article.

At a practical level, a business managerial approach to macro-entrepreneurship is usually more pragmatic than that of economics or sociology. Rather than viewing the problem as an identification problem for a new objective function, businessmen deal with practical questions of how to develop alliances, and how to engage stakeholders of firms in some constructive and innovative ways. However, Bamford and Ernst (2002) summarized a survey of over 500 corporations across the world, and indicated that although many have over 30 alliances

[10] The implication of Giddens' work on urban planning and real estate issues cannot be understated. With almost a prophetic tone, long before people started using rhetoric on metropolitan sustainability, he wrote: "... the theory of urbanism is essential to it. For it is only with the advent of cities—and, in modern times, with the urbanism of the 'created environment'—that a significant development of system integration becomes possible," (p. 26).

(some with 100) with various stakeholders, "fewer than 1 in 4 have adequate performance metrics", (p. 29). Failures to recognize "deal structures, types of partners, or functional tasks" were widely observed. In the context of the need to search for an indirect objective function discussed in this section, the management problems so described bring to light the heart of the issue. What business communities really need today is a process to identify emerging values that result from forming alliances.

The process of alliance management is likely to be a process of "signification, legitimation, and domination." There is no uniform best way of doing this. Most firms do it in the form of trial and error. These are all entrepreneurial activities attempting to expand the boundaries of traditional firms, which have been traditionally viewed by economists as consisting only of activities of shareholders/managers/workers at the core. Macro-entrepreneurship from a business management perspective can extend the boundary of a firm. In doing so, a new (indirect) objective function is usually in the forming.

The three approaches to macro-entrepreneurship outlined above seem rather disjointed; but they could be linked in terms of a common methodological denominator. Brown et al. (2005, 2008) and Dillard et al. (2005) argued that the common metric used in sustainable development evaluation, Triple Bottom Line (TBL), is rather inadequate as a common denominator. If sustainable development is to be defined as an intersection of economics, society, and environment, the authors argued that traditional accounting practices cannot adequately capture that intersection because activities in society and environment often cannot be commodified and evaluated quantitatively by using accounting numbers.[11] They suggested looking out for another common denominator other than using the common currency of numbers. Perhaps, as is hoped in this article, the "accounting system" that serves as a common denominator is a methodology rather than a number, an amalgam of the three perspectives of seeking new objective functions could be a first step in this endeavor.

The philosophy of natural science has long been grounded upon a "process of observation and experimentation," always striving to identify the logic of cause and effect. This methodology is also in the traditional thinking paradigm of economics and sociology. Yet there could be an additional angle to this shared methodology. As explained in this section, the methodology can also be viewed as an attempt to seek new objective functions by economist Cheung and by the sociological approach of Giddens in terms of a constitution of society. The business approach emphasizes methodology to a lesser extent, but the approach could be subconsciously going in that direction also. In other words, all three paradigms strive to identify objective functions via actions rather than hypothesis as the underlying universal problem.[12] Indeed, that is what macro-entrepreneurship is all about.

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[11] Dillard et al. (2005, p. 81), "Only as the natural system components are commodified can they be incorporated into the neoclassical economic calculus."

[12] A refutable implication in the format of "If A, then B" can thus also be used as a template for actions, for example, "If I ask the girl out for a date, she'll become my wife."

Toward macro-sustainability

Micro-entrepreneurial efforts can fail or become unsustainable, and one does not need to search far to find examples. Likewise, macro-entrepreneurship can fail. Macro-entrepreneurship that survives will achieve macro-sustainability. We first review what sustainability can be construed to mean.

Sustainability at its early stage of concept development has a relatively strong environmental emphasis, responding perhaps to the alarming signals of some physical phenomenon (e.g., the extinction of fish in sea water). Environmental degradation has thus been viewed as a form of negative externality, the action responsible of which needs to be curbed. This traditional approach may achieve optimality in terms of a static concept of economic efficiency, whether by taxation, regulation, or more imaginatively with Coasian bargaining, but it cannot achieve sustainable development in the sense of making the environment and development truly compatible. To do so, an expanding multidimensional notion of sustainable development is needed, including not only societal considerations, but various methods of implementation.[13]

Lai and Lorne (2006) described the key feature of a dynamic notion of sustainable development by emphasizing a change in mind-set, turning a negative externality into a positive externality. A case of water and soil pollution from a copper mine at Britannia Beach in Canada was used to illustrate how a changing framework can achieve new results. The article pointed out that in spite of well-functioning property markets operating in the area, Coasian bargaining in the traditional sense of reaching quantity optimality was deadlocked for over 20 years. This type of brownfield redevelopment project cannot be moved to an actionable stage until some drastic change in mind-set aiming at what *could* happen rather than what *should* happen was effectuated.

The framework used in the formulation of the argument is from Yu et al. (2000), in graphical form as reproduced in Fig. 1. Because the original article provided the first formulation of the model, only key features of the model are summarized here.

The setting in Yu et al. (2000) was built upon a semihypothetical example of an electric generator located next to ocean water with fish. Industrial output of the electric generator was presumed to have an adverse effect on the quantity of fish in the ocean. In Fig. 1, the positive y-axis denotes the quantity of fish, F, which can be a function of the natural environment, expressed as e on the positive x-axis. The more polluted the environment becomes (i.e., lower e), the fewer fish it can sustain. However, because this relationship is stochastic, fish as a function of the environment is only a probability statement. Generally, the relationship between F and e in the NE segment of the phase diagram is upward sloping, but represented in the form of an area (a collection of curves) rather than a single curve. This was the formulation in the original article; but as will be further argued later in this section, the area can also be viewed as an outcome of expanding a multidimensional engagement process.

[13] For a series of work done in this direction, see Lai and Lorne (2003, 2004).

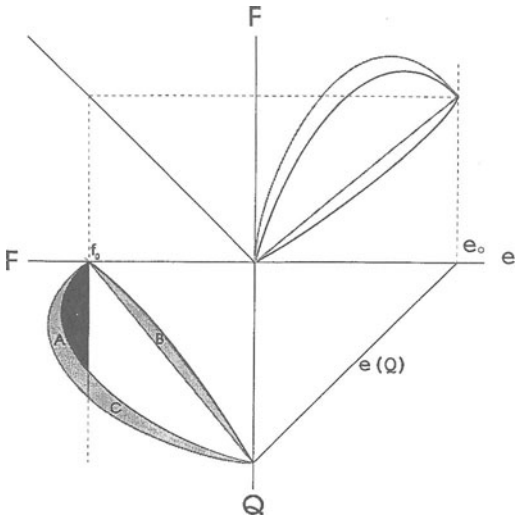


Fig. 1. "Win-win" Possibility Frontier for Negative Externalities. Source: Yu et al. (2000)

The negative *y*-axis denotes the industrial output of the electric generator, *Q*. Thus, the SE segment of the phase diagram denotes what causes the environment to deteriorate. A larger industrial output can degrade the environment, and, thus, their relationship is negative (i.e., higher output implies lower *e*). The ecosystem under analysis starts with a natural state of f_0 and e_0 in Fig. 1, in which the environment, *e*, is considered to be "natural," and thus, at the maximum. The natural state of the environment of f_0 is compatible with a natural state of the world at zero industrial output.

Macro-entrepreneurial efforts between the stakeholders in fish stocks and the environment can be discussed with more focus by assuming that there is no entrepreneurial/innovative effort on *Q*. Thus, for simplicity, the relationship between *Q* and *e* is assumed to be deterministic as *e*(*Q*). This means that the interaction between industrial output and the stakeholders of environment is assumed to be unidimensional, and purely determined by the existing technology in use.[14] The positive *y*-axis, the positive *x*-axis, and the negative *y*-axis represent the interests of society, environment, and the economy—the essence of achieving sustainable development.

The negative *x*-axis is also labeled as *F*. In other words, the linear line in the NW segment of the phase diagram is a one-on-one mapping of the positive *y*-axis to the negative *x*-axis. This formulation allows the type of entrepreneurial

[14] Generally, interaction between the owner of an electric power generator and environment stakeholders can be subjected to a stochastic process, similar to that between fishermen and environment stakeholders. For example, an electric plant can switch to a different type of generator with different recycling technology.

innovative efforts discussed in the NE quadrant to be mirrored into a SW quadrant, providing a win–win discussion between the owners of two outputs, Q and F directly; or broadly speaking, between the economy and the society.

The win–win discussion between the electric power generator and stakeholders in fish stocks is what contributes to the dark shaded area in the SW quadrant of Fig. 1. The example given in the original article was the electric power generator changing the water temperature, thereby making a particular species of fish prosper (rather than decrease). Whether this came as a surprise discovery or as the result of deliberate planning was not specified. However, one could easily imagine that it could have come about through some human ingenuity rather than an exogenous shock provided by nature.

The model of Yu et al. (2000) has other inspirational suggestions perhaps not sufficiently emphasized in the original article. Presumably, all outputs in the ecosystem are generated from some type of capital, whether man-made or natural. Fish, represented by either the positive y-axis or the negative x-axis, is output from natural capital. Industrial output, represented by the negative y-axis, is the output from man-made capital. Thus, the SW quadrant of the diagram can also be viewed as a consequence of a trade-off between man-made capital and natural capital. The dark shaded area in the SW quadrant illustrates how man-made capital can enhance natural capital in a win–win fashion *beyond the natural state*, rather than acting as substitutes for each other.

One of the main insights offered in Yu et al. (2000) is that what is generally perceived as a negative externality situation can turn into a positive externality situation as described by the dark shaded area in the SW quadrant. The article went on to show that the State can alter sustainable development infrastructure by tilting higher the balloon area in the NE quadrant. The corresponding shift in area in the SW quadrant can result in an increase in area **A** + **C** at the expense of area **B**. A weak concept of sustainable development can accept both **A** and **C**. A strong concept of sustainable development will only accept area **A**. The distinction between a strong and a weak concept of sustainability is also a major contribution in that article.

The discussion on the nature of macro-entrepreneurship in the previous section may suggest some additional interpretations for the area relationship between e and F, and thus F and Q, in the NE and SW quadrants respectively. In the 2000 model, the area relationship is generated by subjective or objective probabilities. Yu et al. did not elaborate on how these probabilities would come about. What can be articulated more here is the nature of this innovative process, vis-à-vis how new indirect objective functions are generated.

One constructive way to interpret an area rather than a two-dimensional locus is to think of the innovative process as one that involves the *addition* of coordinates. For example, assuming that the ecosystem we are addressing initially involves only the degraded environment for fish (i.e., a larger output leading to a smaller quantity of fish). Then an entrepreneur teaches people that there is also an esthetic value to the environment, which can be represented by a third coordinate perpendicular to the two-dimensional axes. In other words, an (F, e)

discussion can be diverted to a (F, e, x) three-dimensional discussion. The effect of adding coordinates as parameters of discussion can be interesting graphically. A joint acceptance of a particular value of x in the third dimensional coordinate can take the ecosystem to a different (F, e) point on the two-dimensional coordinate. When multidimensional outcomes are represented on a two-dimensional graph, it is represented as an area.

Indeed, an entrepreneurial process of the type described in the previous section has the intrinsic property of expanding the domain of an ecosystem. The constraint identification methodology described as an economic perspective aims to support an action-oriented prediction of an entrepreneur, and as such, the parameters under consideration will go beyond an existing framework. We can now provide a theoretical foundation for the term of "thinking outside the box." The co-evolvement of the sociological approach, similarly, does not aim to narrow an individual's perception of what is relevant, but to broaden it. Thus, conceptually, the macro-entrepreneurial process could be characterized by an expansion of the ecosystem from (F, e) to (F,e, $x1$, ... xn), in which n evolves from a "recursive reflective" process. The approach can be marginal, but marginal in terms of adding coordinates. Within the framework of Yu et al. (2000), sustainable development can be achieved when the ecosystem increases marginally to the nth dimension permitting the shaded area of win–win in Fig. 1.

Thus, what Yu et al. (2000) attempted to articulate is a model of the changing of mind-sets. In this respect, concepts and tools outside economics may also be insightful in characterizing the process. In Gregory Bateson's book entitled *Steps to an ecology of mind* (Bateson 1972),[15] the changing of a mind-set is described as a process of letting a subconscious part of the mind evolve to a stage of consciousness. He metaphorically spoke of consciousness as "arc circuitry" on the surface, like the tip of an iceberg on the surface of the water (Bateson 1972, pp. 144–147). In many ways, the identification of additional coordinates of a function is precisely that; having more circuitries emerging from the "surface."[16] Of relevance to the discussion here is that a circuitry in the manner described by Bateson could be represented by a line in a two-dimensional graph. Multiple circuitries thus constitute an area. The larger the amount of circuitries surfaced, the larger will be the area. The approach thought of by Bateson is compatible with that in Yu et al. (2000). Macro-sustainability may have to be construed in terms of the size of the win–win area in relation to the magnitude of economic efficiency in the neoclassical model.

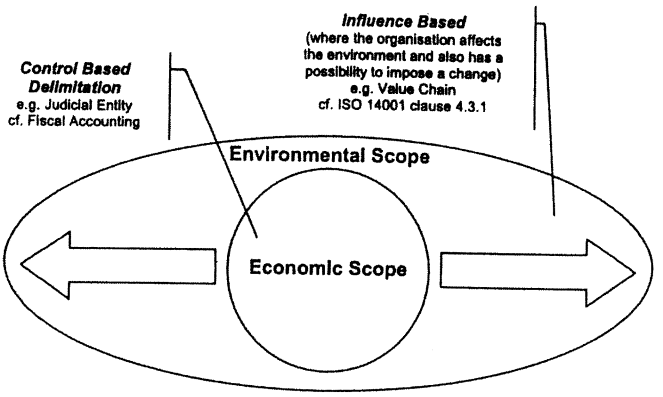
Innovation solutions as a changing of mind-sets

The area approach described in the previous section may not be easily accepted as the conventional wisdom in the sustainable development literature, but viewing

[15] Bateson was an ethnologist, a researcher in a hospital, and also a teacher.

[16] The process of innovation was captured most elegantly in terms of the following: "That is the sort of world we live in—a world of circuit structures—and love can survive only if wisdom (i.e., a sense or recognition of the fact of circuitry) has an effective voice" (p. 146).

real world cases through the angle suggested in this article could be a good start in this direction. Cases addressing sustainable development are abundant, but those using main stream economic tools are rare. An exception can be found in Cerin (2006). Cerin reviewed the Porter hypothesis using the viewing lens of Coase.[17] The study identified hidden reasons for successful sustainable development initiatives in industries beyond those mentioned in the Porter hypothesis. The explanation highlighted the importance of properly realigning decision responsibility in accordance with information asymmetries. Cerin's main proposition was that industries or firms that can set up proper incentive alignment are more likely to be the industries and firms that will be sustainable. Cerin, in essence, suggested that Porter could be right for the wrong reasons. There were features in Cerin's studies that resembled the call for macro-entrepreneurial-led sustainability in this article. Figure 2 (from Cerin 2006) is particularly useful for this purpose. The figure denotes an inner economic scope surrounded by a larger environmental scope on the outside. The traditional concept of firms stresses a "control-based delimitation" within the economic scope.[18] Cerin argued that



Source: Cerin, Pontus, 2006. "Bringing Economic Opportunity into Line with Environmental Influence: A Discussion of the Coase Theorem and the Porter and Van Der Linde Hypothesis." Ecological Economics 56, no.2:p,219

Fig. 2. Control Based versus Influence Based Initiatives

[17] The "Porter hypothesis" is the Porter and van der Linde hypothesis, which derived its name from articles published by the two authors in 1995 in the Harvard Business Review and the Journal of Economic Perspective. The authors claim that strict environmental legislation in some countries can serve as a catalyst for firms in those countries to acquire a competitive advantage.

[18] The control-based delimitation is precisely how a static neoclassical economic efficiency criterion would prescribe the nature of the problem—stressing a quantity dimension, whether it is by regulation or by negotiation.

sustainable development can be best implemented if decision makers can elevate themselves from a purely economic scope to an environmental one. But a control-based approach that delimits activities is unlikely to accomplish that. For expanding possibilities, if "influence-based initiatives" are adopted instead, the economic scope can be extended to the environmental arena. The influence-based initiatives may indeed require macro-entrepreneurial proposals of the type described in this article.

Cerin's article did not address the pragmatic methods of carrying out the influence-based initiatives. An example of that could have been discussed and certainly relevant to the discussion here is the Charette methodology, which is widely used by many sustainable development practitioners throughout the world (Charette methodology is described by Condon et al. 2002). Typically, stakeholders of a project are assembled in a physical location and visionary propositions are facilitated by skillful communicators who, in language borrowed from Bateson, attempt to reveal the subsurface "circuitries" in the minds of the stakeholders.

Certainly, there can be many faces of a phenomenon. To study what one might be able to learn from a phenomenon, some of the cases studied by Cerin (2006) are reviewed in the remaining part of this section. At the outset, we point out that virtually all successful sustainable development endeavors have changes and innovation embedded in the process, with an entrepreneur or a group of them proactively promoting win–win strategies in defining whatever ecosystem they deem important for habitation. The following situational episodes are worthy of additional contemplation.

Industry adoption of green products

This scenario deals with a general class of problems, but the specific example used for illustration in Cerin (2006) was the case of the Munken Panda Copy in Sweden, where chlorine-thrifty paper became widely used in spite of its higher price. Cerin (2006) pointed out that the successful adoption of an environmentally friendly product was not due to regulation, but to the "the actions of an active and persistent nongovernmental organization (NGO) in stating the great potential of public procurement," (p. 214). The proposition was insightful, but it may be useful to take the proposition one step further by probing the "actions" referred to in the quote; more precisely, what prompted a 40-municipality public procurement of the product of a small paper company in the first place. Whoever was heading the company at the time, an entrepreneurial effort must have been proactively made to change mind-sets, first at the municipal level, and later more broadly at the public level. It is doubtful that the successful outcome was purely the success of utilizing the economy of scale. Unless there is a changing of mind-set, the public has no reason to adopt a higher-priced product. The skill involved is a macro-entrepreneurship skill—the changing of mind-sets.

A tale of two countries

Cerin (2006) also pointed out an interesting puzzle of how a company doing business in two countries had taken vastly different environmental positions, embracing a piece of regulation in one while avoiding the same regulation in another. Volvo (Cerin 2006, pp. 215–216) reacted to the emission control regulation by actively adopting an emission control device and raising prices in the USA. However, in Europe, its strategy was reactionary; and indeed, exactly the opposite, opting for a delay. Cerin explained this puzzle by pointing out that Volvo's market share in the USA was relatively small. Thus, the cost of adoption of the environmental regulation was not perceived to be huge. By contrast, in Europe, Volvo's market share was high to begin with, so there was less additional room to draw upon the scale economy factor as in the public procurement example described in the Sweden case. Our explanation for the Volvo puzzle would be one based on the ease of practicing macro-entrepreneur skill. In the USA, Volvo was being promoted as a premium environment-friendly brand. The cost of engaging in a changing mind-set endeavor was part of the marketing campaign and was probably perceived to be manageable. By contrast in Europe, the broader market base of Volvo, emphasizing low costs and its practical appeal, was not positioned to engineer the same macro-entrepreneurial endeavor as in the USA.

Right guy for the wrong job

Cerin (2006) stressed the importance of incentive alignment, and suggested an interesting proposal for reducing the production of an environmentally "wrong" product—autopaint (pp. 219–220). He suggested that if the painting process of automobiles is outsourced to the paint companies, the total usage of paint would be reduced. The incentive alignment angle of this proposal is to assign the right guy for this "wrong" job if the right guy is expected to shirk on paint application. "The paint company is more likely to succeed with this ambition [of painting "efficiently"] than the car company because of its competence in the characteristics of its own paint and in how to use it. Thus, the costs for the environment impacts do now coincide with the core competence of the product designer." (Cerin 2006, p. 220).

Ingenious as the argument is, the outcome of the right guy for the wrong job will not come about if consumer preference subjectively wants heavy coats of paint. Outsourced or not, paint utilization would be identical if that is exactly what consumers want. The entrepreneurial efforts needed thus may go beyond just the realignment of incentives, again entailing a changing of the mind-set, involving perhaps the product designer of the paint company to engage consumers in a macro-entrepreneurial effort for a "green paint." It may, for example, be true that once the paint companies are involved, they will have a higher entrepreneurial incentive to educate consumers about "paint redundancy" and promote a strategy that is win–win for them and the consumer, or, perhaps stretching the limit of imagination, a radical change in consumer preference for

a "green auto *without* paint." An automobile without paint can benefit a paint company (even if the use of paint is zero), as long as the company is able to concoct and patent a new liquid product for paint replacement.

Conclusions

One can gain more understanding of the entrepreneurial process of sustainable development by integrating new angles of conceptualization. This article points out areas with theoretical and practical ramifications that can be further explored. Innovative solutions entail a changing of mind-sets for consumer preference as well as for production function, all involving *shifts* in marginal benefit and cost curves, rather than movements along them. The need to promote win–win interactions for macro-entrepreneurial sustainable development implies the following extensions:

1. A recognition that innovation can achieve sustainable values beyond preservation (e.g., making man-made capital complementary to natural capital in creating values).
2. A will to go from micro-entrepreneurship to macro-entrepreneurship—a plan for engaging stakeholders in building sustainable relationships and extending the boundaries of firms.
3. A need to provide a theoretical foundation to define an ecosystem in terms of indirect objective functions—an interdisciplinary approach for seeking the intersection of economics, environment, and society for the changing of mind-sets.

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