Macrosustainability and its Development

Foreword

I began my political involvement with sustainability at the age of eleven, when I participated in the very first Earth Day. Inspired by anti-war slogans, I made a sign saying "Ecology Now" and went around the neighborhood with other children picking up trash.

Now I approach the task before us as an imperative to plan for the ecologically sustainable development of economic activity. To offer a path toward such a plan, it is first necessary to have a concise analysis of, and solution for, the current problem in doing so, which has not yet, to my knowledge, emerged in the necessary form.

So I offer this brief work first, to advance such an argument; second, to provide a theoretical framework; and third, to provide a proposal for a tool for the practical, systemic implementation of sustainability.

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Introduction

There is a tremendous amount of excellent work being done in various measures and indices of the components of an ecologically sustainable path for economic development. Energy use assessment and related data gathering is the current strong suit, with software applications geared to an increasing array of needs, including those of municipalities.

Both public and private operations are becoming more efficient, not only in energy use but also in materials design, use, re-use, and recycling.

It is not a stretch to say that there are advances in creating solutions for every problem in sustainability we know about, often a multiplicity of possible solutions. Not all solutions are at the same level of refinement, but the entire scope of the problems of our current unsustainable development path has solutions, and most of these are being implemented, some quite widely.

So why isn't the world becoming more sustainable?

None of the solutions to the identified problems address the larger underlying problem. They are incapable of doing so, on a deep, structural level. The underlying problem is that we live in a world with a dominant development path that is global, amazingly efficient in certain ways, and absolutely interdependent. It is, of course, also poisoning the planet and extinguishing many of its species. It is extremely strong, but increasingly brittle.

We need, on the other hand, a world that is efficient, yes; one that is interdependent on a global scale, yes; but one that is also both ecologically, systemically productive and resilient in the face of ecological change—that is, sustainable in practice.

So the problem is not that we lack solutions to all the individual problems that have been identified relative to the current dominant development path. The problem is that it is the astonishing, if perilously brittle, integrity of the current system, as a whole, that is keeping those solutions from taking hold. An ecologically sustainable development path is mutually exclusive with the current path, not just in its parts, but as a whole, as Amory Lovins pointed out in the 1970s. The current dominant development path, as a whole, is extraordinarily strong, and poisonous to its core, both ecologically and socially. Further, it is temptingly easy to blame big government or big business and simply be satisfied with getting one more building audited. This is the danger of continuing the current development of the theory and practice of sustainability only at a "micro" level, and not addressing parts of the problem outside of the context of the vital whole.

This dynamic seems similar to that which occurred when Ronald Reagan took office and cut funding for progressive efforts in this direction. Many otherwise progressive organizations opted to "focus on their core mission" and not the overarching problem—not the relationships they had with other issues that would have spoken to the central, systemic problem. What was needed then, and what is needed now to avoid the further Balkanization of sustainability efforts, is an articulation of, and work toward, systemic change: a recognition not only that no work for sustainability is an island, but that all such work is integral to the whole, and needs its place, its function and form, developed in concert with other efforts.

So the bad news is that we all have been working on sustainability, through necessity, within that strong but increasingly brittle framework—the dominant global economic system, which is structurally inherently ecologically unsustainable due to its use of energy and materials.

The good news is it is becoming obvious to all but the most entrenched ideologues that systemic change is necessary for the survival of a healthy global civilization. The mass media are no help, and becoming increasingly schizophrenic, with pieces extolling the development of domestic petroleum production juxtaposed with the story of the United States Department of Agriculture having to re-draw its climate zone maps due to climate change caused in part by that very energy source. Neither story, of course, mentions the other topic.

The solutions for all the problems we have identified need to be integrated into a comprehensive system—one as global and interdependent and efficient as the current one, but ecologically sound

and resilient. This is the choice to make to move toward an interrelated global society.

The alternative is decay into a plutocratic, neo-feudal economy with the wealth involved being access to non-renewable energy production and its subsystems, including the current dominant form of agriculture.

The good news is that systemic change needn't mean a complete wrenching away of all that is familiar. All the "micro" work has built the necessary bridges to the future.

Of course, not all of the micro solutions are equally well-developed: sustainable transportation, for example, whether for people or cargo, seems to be stuck in a rut that ignores public transportation entirely, with, for instance, virtually no one, to my knowledge, proposing locally-built, photovoltaically powered trolley systems.

An even more dramatic opportunity, though, is that systemic change means a wholesale re-conception of our global human ecology as an integrated whole, with all the social change—acknowledging the potentially resulting turmoil—that implies.

Macrosustainability

A "macro-sustainability" approach applies the two primary parameters of ecological analysis to the three major levels of economic activity, at global, regional, and most importantly for practice, local levels. Below is a tool, still conceptual but needing no major breakthroughs to implement, to help assess communities and regions, which is still to be developed and refined, but which should prove both academically and practically productive. Also below are some thoughts about the ultimate level of analysis, with an indication of how very close we are to having this be a real and useful tool.

The primary parameters of ecological analysis are energy flow and materials cycling. Energy flows through ecological systems, sometimes coming in as solar radiation and being stored by eating and breathing in a complex material such as adenosine tri-phosphate, but always eventually leaving the system as heat. Ecologists know a great deal about phosphorus and nitrogen cycles, for example, and they, along with the global business community, also know that peak phosphorus extraction from the earth, in terms of uptake by the dominant development path, is not far off.

A brief primer: the three major levels of economic analysis are termed primary, secondary, and tertiary. The primary economy is labor applied to natural resources—getting the water we drink, gathering or growing the food we eat, piling the stones together to make a wall or house. Traditionally, it is farming, forests, fishing, and mining. Energy is required for all activity, and all activity requires materials, even in a simple, close cycle of food production to feed those who labor and their dependents.

The secondary economy is manufacturing—adding value, again through labor, to the primary economy. We bang the rocks together, we make metal, we build lathes. We make it easier to engage in primary production. This is one of the most serious problems facing us—a manufacturing sector entirely dependent on non-renewable energy. Solar furnaces can and have been built, but even these of course

require energy as well—so far, non-renewable energy.

The tertiary economy is the service economy, including retail and financial services. In our current global economy, as most of us know by now, the United States is known largely for its financial services, or at least it was until quite recently, when people got nervous and started investing in gold instead, substantially speeding up its chemically-intensive manufacture.

The fundamental analysis in sustainability must include the two ecological parameters of energy flow and materials cycling, and on anything other than an isolated homestead basis, the three levels of economic activity.

Modeling and Development

What tool can help this modeling? Imagine the popular computer game SimCity, but with your own community's or region's data, mapped with a geographic information system, and using not an off-the-shelf, white-bread economic model, but a suite of economic models based on energy flow and materials cycling encompassing all three economic levels.

Schoolchildren would play this as a video game in school, high-schoolers also gathering foodshed and agricultural data, green communities plugging in data gathered for energy efficiency initiatives.

Soon we could generate an assessment of where we stood, and not long after, professional municipal and regional planners would be able to generate scenarios for different policy decisions. This could not be, and should not be, seen as a one-time effort; this is a tool that should be refined indefinitely, with academics calling for data to refine their models and communities expressing their needs for increasingly specific and complex scenarios. So this involves geographers, planners, economists, and educators at all levels, as well as individuals, their communities, and their regions.

This community sustainability development tool, that integrates hardware, software, data collection, modeling, and educational aspects, focuses on integrating the fields of regional planning, economics, and education (community education, K-12, and higher education), and to a lesser degree, computer science. The results—scenarios—would then be used to inform municipal and regional policy, for instance, assessing import substitution options.

Inherent within this program is the integration of substantial stakeholder input to inform the development of the tool. Developing the tool includes a continuous improvement process that will refine and direct the tool as the community desires. The results of using the tool will improve citizen education and involvement in community decision-making, especially over time as the educational aspects bear fruit.

The tool would generate scenarios for future community

development based on local data and a suite of public policy (e.g., regional planning) and economic models. In its most developed form, it could be both a live, interactive screen presentation for professional use, and a video game for educational purposes.

Users would input data into a geographic information system (GIS) program, exporting the results to actual regional plans and policies (resulting in, for example, a build-out scenario), and then to various economic models to calculate economic consequences.

Data would include figures from Federal, State, and Agricultural Census reports; available community GIS data layers (including current land use and zoning); and economic layers such as real estate, energy, water and other natural resources, and food security (the primary economy); infrastructure and industry (by Standard Industrial Code and size) (representing the secondary economy), and services (the tertiary economy).

Various economic models, demonstrating various economic philosophies and theories, but including at least a strict free-market model and an ecological economics model, would allow for communities to choose policy options both between and among models depending on their values. The scenarios generated are intended to be tracked and real-world results assessed relative to the models used. This aspect will be especially useful to theoreticians of economics, who have historically operated from a paucity of real-world experimental results (see "Modeling," below).

Hardware

The community should have access to dedicated hardware capable of running a GIS system, economic modeling software, importing and maintaining data records, and producing educational materials. It should be able to display the results of all aspects of the program in various formats (including printed and video display). This includes a graphic printer for GIS data and a video card capable of running video displays.

Software

Regional economic modeling already exists, albeit in strictly conventional form. One challenge to the academic community is to provide a suite of models that use different assumptions, some of which may be based on community values as determined by research. At least one model should be that of the dominant economic paradigm; at least one other should be one designed to take into account community ecology, that is, an ecological economic model. This model would be especially useful in considering community energy generation potential and other natural resources.

Software should also include easy export from the GIS database into the economic models. This should be straightforward, not requiring fundamentally new knowledge. Conversely, the economic models should incorporate regional planning data, which could be more problematic for that profession. Finally, the system should be able to provide educational modules for each of the aspects of the program, for different educational levels, including community and adult education.

Data collection

To be most effective, community-specific data should be gathered. This would normally be the task of either economists or regional planners, but the extreme granularity of the data needed for effective modeling (e.g., specific energy use patterns) raise questions both of efficiency and, importantly, privacy. One aspect of continuous improvement in this system will be matching the data available to be collected with the models to be used.

That said, the community itself might be the best source for data, provided the community is willing and the data are verifiable. This includes the educational system, which could collect household data within an educational framework (i.e., bags of trash and bins of recycling generated per month).

Finally, data collection can focus on what the community desires. If it is unwilling to provide certain data, the models must take that into account. If, on the other hand, the community is open to providing all sorts of data, the models can incorporated finely detailed information, resulting in greater accuracy.

Modeling

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Most conventional economic work in higher education involves economic modeling. Rarely, however, are models derived from real-world conditions—rather, they demonstrate the results of environments based on certain assumptions. With the rising awareness of ecological factors in economies, however—most notably energy and materials costs and prices—there is a need for models that more closely fit the broader environment people inhabit.

In this plan, work with models would proceed along two lines. First, modelers would start from real-world conditions, looking at energy flows and materials cycling, especially as they related to the satisfaction of communities' basic needs, including food, water, housing, heat, and transportation. Models would include all levels of the economy—primary (natural resources), secondary (manufacturing or otherwise adding value), and tertiary (services). As above, this aspect includes a substantial amount of data collection, which in order to be most precise should involve community members as much as possible.

Second, modelers would apply various theoretical frameworks to the communities to generate scenarios for future development. This project would allow various models to be tested against each other, and, most importantly, to be refined based on real-world responses to policy changes. This process of refinement is seen as a major factor in on-going, continuous improvement in the project.

Education

In order for the full potential of the project to be realized, and in accordance with the values of a democratic system of government, community members would have to be well-informed in the project. This is true both to motivate participation in data collection, but also to participate in policy formation. (In New England towns with the Open Town Meeting form of government, every citizen has a vote in the local legislative body on the municipal budget, planning and zoning issues, etc., which, incidentally, should make civic education a greater imperative than it is.)

One of the primary purposes of this project is to provide scenario development for making policy, especially in the allocation of a municipality's scarce resources. This can be done best with a well-informed citizenry. Education can start early by learning about local conditions, a common educational strategy and one most effective where there are limited resources allocated to education. Curriculum specialists will be needed in order to make the progression of learning most effective.

As children grow older, however, they could engage with a video-game version of the tool, first learning about their region, and as they progress, making a game of choosing various development options, much like SimCity, though with real, local data. As their understanding increases, the choices made can reflect more accurately the current choices faced by their municipality or region.

Computer science

Some expertise will be needed to bridge the GIS, modeling, and video scenario (game) aspects. However, since this will not be breaking new ground, but is more a programming problem, this aspect is not innovative and should not pose operational difficulties.

A Pattern Language for Sustainability

For this program to work most effectively, work needs to be done to identify the "atoms" of analysis at the most local level, suitable for all climates and conditions. Christopher Alexander's "A Pattern Language" does this for architecture; we now need a pattern language for sustainability.

Such a language would help identify the most efficient use of local materials to satisfy local basic needs, as well as suggest trading patterns for more developed economic activity. It would be these units that models would require to work best, and the dynamic of developing models and practical tools is one which could continue for a very long time, especially as climate change re-shapes our regional ecologies.

The task before is a complete analysis of what we have; models that show a path toward sustainable use of what we have; the social and educational work of community planning, so that people participate in, and so embrace, the necessary changes; and the implementation of such plans across this region, this nation, and the world.

Again, the variety of such data already existing is rich, as much of the micro work has been done.

What is not needed is more energy put into mitigating the disastrous effects of the current dominant system and its decline. It is failing fast, and the world is hungry for viable alternatives. The imperative of a continual and substantial reduction in fossil fuel use will restrict the energy available for making the transition to sustainability, but the only other path leads to the complete breakdown of social institutions and whatever degree of development our economy has without any thoughtful transition to positive alternatives.

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