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Understanding and communicating sustainability: global versus regional perspectives

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Abstract While there is no single definition of sustainability, most would agree that it implies that a system is to be maintained at a certain level, held within certain limits. Sustainability denies run-away growth, but it also precludes any substantial set backs or cuts. This sustainability path is hard to reconcile with the renewal cycle that can be observed in most living systems developing according to their natural intrinsic mechanisms. Besides, since different human dominated systems are in significantly different states and stages of development, sustaining those states assumes maintaining social disparities in perpetuity. This creates a challenge in communicating the ideas of sustainability in different regions. Systems are parts of hierarchies where systems of higher levels are made of subsystems from lower levels. Renewal in components is an important factor of adaptation and evolution. But then sustainability of a system borrows from sustainability of a supra-system and rests upon lack of sustainability in subsystems. Therefore by sustaining certain systems beyond their renewal cycle, we decrease the sustainability of larger, higher level systems. The only way to resolve this contradiction is to agree that the biosphere as a whole with humans as one of its components is the only system which sustainability we are to seek.

Keywords Renewal cycle · Hierarchy · Release · Adaptation · Initial conditions

1 Introduction

The World Commission on Environment and Development (WCED, 1987) has introduced the idea of sustainability some 19 years ago, but there is still no single

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agreed definition for it. There is ecological sustainability, economic sustainability, strong sustainability, weak sustainability (Pearce & Atkinson, 1993), etc. People tend to define sustainability in the ways that suit their particular applications, goals, priorities, vested interests, and often use the term with no explicit evidence and recognition of the exact meaning being implied. Just like biodiversity (Ghilarov, 1996) sustainability became more of a political issue than a scientifically supported concept.

To a certain extent this may be because once scientific analysis is applied to the sustainability concept it turns out to be either redundant, or ambiguous. In this paper, I attempt to focus on some of the problems and controversies of the goal of sustainability that emerge once it is treated within the framework of systems analysis. It seems to be especially hard to reconcile the concept of sustainability with such systemic properties as hierarchy and cycling.

The renewal cycle has been recognized in many dynamic systems and the cyclic pattern in life histories of complex systems has been often considered as an adaptive mechanism that serves the needs of evolution. Hegel's dialectic viewed development of systems as a cyclic process of change where negation of a system was a prerequisite of synthesis. Cycles have been observed in numerous systems of very different nature. This cyclic nature of development is contrary to the goal of sustainability, which is aimed at preservation, maintenance of a certain state or function. Sustainability in this case is a human intervention that is imposed on a system as part of human activity and is totally controlled and managed by humans in order to preserve the system in a state that is desired.

If renewal is an adaptation mechanism, that provides flexibility and potential for change, then sustainability of a system borrows from sustainability of a supra-system and rests on lack of sustainability in subsystems (Voinov, 1998). Therefore increased sustainability of a certain hierarchical level may impede sustainability of larger systems that potentially are even more important in the historical perspective.

2 Sustainability versus renewal

Most sustainability definitions originate from the relationship between humans and the resources they use. Wimberly (1993, p. 1) states that ''to be sustainable is to provide for food, fiber, and other natural and social resources needed for the survival of a group—such as a national or international society, an economic sector, or residential category—and to provide in a manner that maintains the essential resources for present and future generations''. This is very much along the lines of the original definition of the Bruntland Commission that was defining sustainable development as the one that meets the needs of the present without compromising the ability of future generations to their own needs (WCED, 1987).

Norton (1992, p. 25) argues that ''sustainability is a relationship between dynamic human economic systems and larger, dynamic, but normally slower changing ecological systems, such that human life can continue indefinitely, human individuals can flourish, and human cultures can develop—but also a relationship in which the effects of human activities remain within bounds so as not to destroy the health and integrity of self-organizing systems that provide the environmental context for these activities''. Costanza (1992, p. 240) leans on the systems properties, stressing that ''sustainability... implies the system's ability to maintain its structure (organization)

and function (vigor) over time in the face of external stress (resilience)''. Solow (1991) says that the system is sustainable as long as the total capital of the system is equal or greater in every next generation. Costanza and Daly (1992) argue that sustainability only occurs when there is no decline in natural capital.

More recently there has been considerable debate about the so-called weak and strong sustainability. Neumayer (1999, p. 9) defines sustainable development as one that ''does not decrease the capacity to provide non-declining per capita utility for infinity''. Those items that form the capacity to provide utility are called capital, which is then defined as a stock that provides the flow of services. For weak sustainability it is then necessary to preserve the value of the total aggregate stock of capital. This obviously implies that components of capital and utility function are substitutable. ''Strong sustainability instead calls for preserving the natural capital stock itself as well'' (p. 11).

Whatever may be the flavor of the different definitions, whether it is strong or weak sustainability, there is one common component in all of them. All of them talk about maintenance, sustenance, continuity of a certain resource, system, condition, relationship, in all cases there is the goal of keeping something at a certain level, of avoiding decline. This is also how the Google definition tool (Google, 2005a) defines sustainability: a state or process that can be maintained indefinitely, to keep in existence, to maintain or prolong, to use resources in a manner that satisfies current needs while allowing them to persist in the long term. Similarly the tool (Google, 2005b) defines sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs, or basically as development under the sustainability constraints.

However, this kind of behavior does not seem to be characteristic of neither natural ecological nor man-made economic or social systems. Instead of maintaining a certain state or condition, living systems tend to go through a life cycle. Gumilev (1978, 1990) observed this for ethnic systems. Holling (1986, 1992) generalized this cyclic behavior for ecological and socioeconomic systems. Zotin and Zotina (1993) have documented the thermodynamics of very much similar cycles in the cellular level. In all cases, the renewal cycle assumes that a system goes through a series of stages, starting from growth, followed by conservation (inertia and homeostasis in Gumilev's terms), then release (obscurity) and finally renewal.

Within the framework of the renewal cycle, sustainability may be interpreted as the goal of breaking the cycle, of extending a certain stage in the system life pattern (Fig. 1A). While in the renewal cycle growth and conservation are followed by breakdown, release and recombination, in a sustainable system, the conservation stage is to be extended indefinitely.

For a country in the developed Western world this goal can be appealing. It is a relatively simple sell for the public, which will very likely favor the preservation of the status quo, of the high living standards, and would welcome the safeguards from sharp drops and perturbations. We may even try to negotiate some ''trade offs'' that may be needed to achieve sustainability. Still we are describing a vision of a more or less ''business as usual'' economic system that is only slightly mended, where the Western life style is ''non-negotiable''.

If we move to the developing world, the idea of sustainability takes a somewhat different shape (Fig. 1B). Now we are dealing with economies that are far away from the conservation phase, that are just starting to grow, or trying hard to start growing. Yet again the sustainability concept is equated with the no-growth paradigm, the

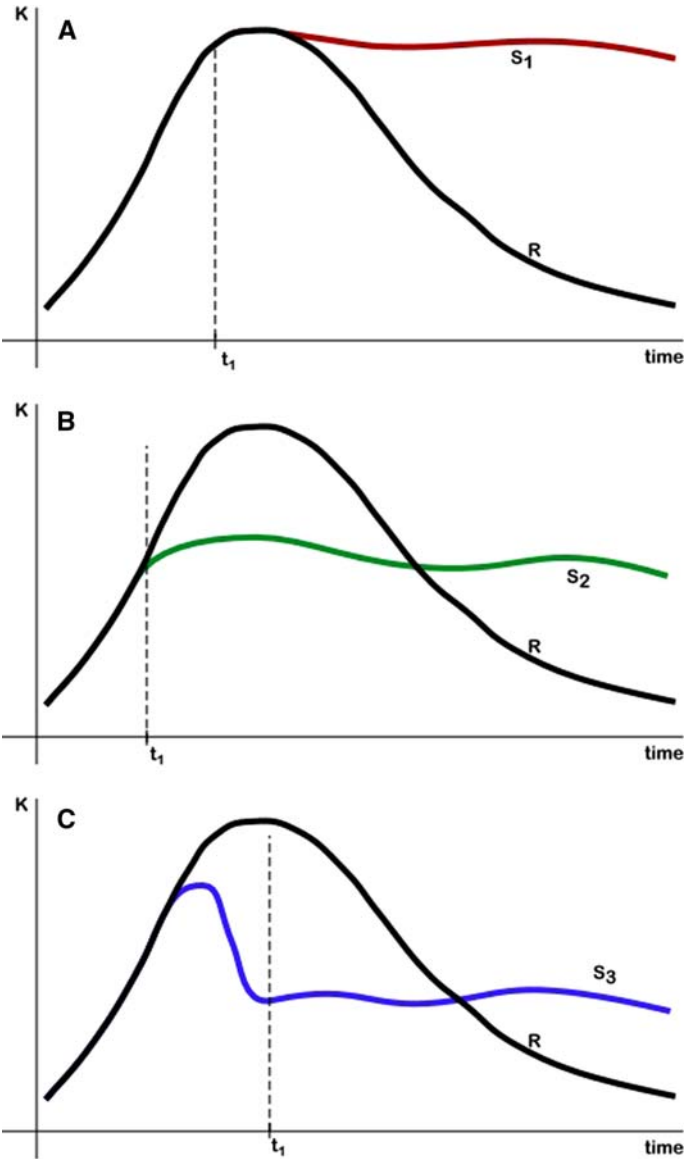

Fig. 1 A qualitative schematic for the sustainability path in different economic systems. *K* is a measure of capital in the system, or rather the per capita utility that this capital can provide. t_1 is the reference time, when we embark on the sustainability path. (A) Economically developed countries. (B) Third World developing countries. (C) Transitional economies

assumption is still that people will be better off if they stop growth and try sustainable development instead. We refer to indigenous economics, cultural values and try to advocate alternative low consumption lifestyles. This becomes a much harder sell especially in the context of globalization, the advent of Hollywood, Wal-Mart and Game Boy. The sight of a satellite dish on top of a bamboo hut amidst poverty and malnutrition is a symbol of globalization in the third world.

For transitional economies such as in Eastern Europe or Former Soviet Union, the path to sustainability may be described by Fig. 1C. Here we are just past a period of collapse, and it is almost impossible to argue that zero growth economy is what is needed. In fact, there is an intrinsic rejection of the sustainability concept, which is in part demonstrated by how the term is translated, say, into Russian. Sustainable development in Russian is called stable development, which has a clear connotation of stable economic growth. This view is nicely illustrated by the graph taken from a Mongolian publication (Fig. 2).

According to Holling (2000), ''sustainability is the capacity to create, test, and maintain adaptive capability.'' This definition is quite revolutionary since it says nothing about ''no decline'', it offers more flexibility, allows certain things to get worse, as long as this is needed for adaptation. It is easier to use in the diverse regional context, since it makes no prescriptions about maintenance of natural capital, and therefore does not necessarily imply a slowdown of economic growth. As long as the system can adapt it is sustainable. In this case the system can go through change, can follow the renewal cycle for a longer period of time, but not all the way. The release phase should be still excluded, since we do want to maintain the system that is to be able to adapt. We cannot let it die.

Still we see that sustainability assumes extension of existence of a certain system. Renewal assumes the release phase, when the system components are disintegrated and set free to recombine. Therefore the goal of sustainability of a system contradicts with renewal. The phase of release is the end, the collapse of a system per se. It does not necessarily mean extinction of all components or species that make the system. But it implies that the systemic function that they perform is modified, at least temporarily. The released components may recombine to perform again as a similar system but the system itself will be different.

Bankruptcy of a company when employees are laid off, and assets are sold (release) is the end of the company. It comes when the business as a socioeconomic system is no longer sustainable, and can no longer extend the conservation stage. The components (human and material resources) may recombine in the form of another company (renewal), but that will be a different system. Ethnic systems as documented by Gumilev (1978) also die, when their passion, vigor declines and they loose the drive to persist. Eventually people recombine as new ethnoi, but those will

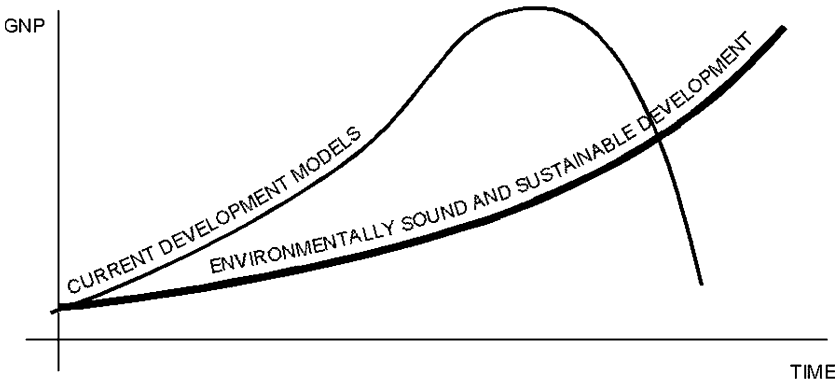

Fig. 2 The view on sustainable development dominating in transitional economies. From Ykhanbai (2000)

be different from the original one. Forest fires release organic material and nutrients thus ending a system. Forests may grow afterwards in the same place, but those will be different forests: they may have a different spatial and species organization.

3 Hierarchical systems

Renewal allows for readjustment and adaptation. However it is the next hierarchical level that benefits from this adaptation. Renewal in components helps a system to persist. Therefore, for a hierarchical system to extend its existence, to be sustainable, its subsystems need to go through renewal cycles. In this way, death of subsystems contributes to sustainability of the supra-system, providing material and space for reorganization and adaptation. Costanza and Patten (1995, p. 196) looking at sustainability in terms of component longevity or existence time, recognize that ''evolution cannot occur unless there is limited longevity of the component parts so that new alternatives can be selected''.

Companies appear, grow, prosper and die, however the overall economic system persists, and reorganization of each particular company usually contributes to persistence of the larger economic system. Forest fires burn down portions of ecosystems, providing nutrients and habitat for increased diversity of species that contribute to the development of the forest ecosystem as a whole. The local forest patch may no longer exist, but the enhanced variability, allows for adjustment to change in external or internal conditions.

Systems are not static, but evolve as a combination of dynamically occurring renewals in their components. A system cannot be singled out as a closed domain delimited by certain borders. It evolves in space and in time, throwing out tentacles and constantly changing through the renewal in its subsystems. A system constantly ''sacrifices'' its components to endure its own persistence, sustainability. More sustainable will be a system made of components that are readily dissipated and reorganized, rather than the one made of durable and persistent blocks, that have no potential for such change in their organization. Evolution needs material for adaptation.

In economic systems we may observe the renewal in subsystems when branches or departments are closed down or reorganized for the benefit of the company as a whole. Almost any recession in economy that needs restructuring or adjustment of businesses is accompanied by bankruptcies and layoffs, which is an indicator of subsystems going through renewal. By itself a layoff may be treated as a renewal in the individual level. The system benefits from renewal in its components. In this way the overall economic system adjusts and manages to sustain itself further, extending its conservation phase (sustainability). One could argue that the collapse of the Soviet Union was a result of lack of renewal mechanisms in the planned economic system. Inefficient enterprises were kept afloat by huge subsidies keeping human and material resources unavailable for recombination, and decreasing the overall adaptive capacity of the socioeconomic system.

In social systems, the alternating parties or groups in power can be viewed in a similar way. Again a political party gradually grows gaining more members (capital) and support. It may eventually win elections and thus reach the acme of its development. Then there is usually a breakdown followed by release, another party or

group takes the lead. A party goes through a renewal cycle, at the same time providing sustainability to the overall political system, that remains in place. If the political system has no provisions for renewal in parties, if there is no mechanism created to release capital, and one party or group tends to maintain its own sustainability indefinitely, the whole political system may go out of order resulting in social conflict, riots, revolution. Russian history provides at least two such examples already in this century. In contrast, Western multipartite systems seem to be much more durable in this context.

Ecological systems display very much similar behavior, when components are renewed for the benefit of the whole system. In ecology there has been much attention paid to the concept of stability, which may be considered analogous to sustainability, if considered narrowly within an ecosystem. According to Botkin and Sobel (1975) stability is equivalent to system persistence that allows change through time within defined bounds. This is fairly close to what sustainability would imply. Focusing on ecosystems we certainly loose an important component of sustainability, that is the human induced goal seeking activities within the uncertainties, and particular value sets and goal functions (Costanza & Voinov, 1995). Ecosystems per se provide numerous and well-documented examples of hierarchical structures in relevance to their stable or non-stable behavior. O'Neill, DeAngelis, Waide, & Allen (1986) analyze the hierarchical structures of ecosystems and conclude that hierarchies contribute to system stability.

Forest fires, infestations, predators controlling prey populations—all act as mechanisms of release and renewal. Moreover there are numerous examples of systems deteriorating, if they do not undergo renewal in a timely fashion. Fires in the Florida Everglades are fairly frequent and they burn out huge areas (Gunderson, 1994). In several seasons the vegetation is usually restored to its initial biomass and species composition. However if a fire is delayed by some reason and abnormally high biomasses are accumulated, there is an increasing chance that once a fire eventually breaks out, its intensity will be much higher. As a result not only the vegetation, but the soil substrate as well will be destroyed, exposing bedrock, thus totally changing the function of the system. This is a negative effect not only for the particular landscape unit (subsystem), but for the whole regional ecosystem (suprasystem) as well.

Holling (1986) reviewed 23 examples of managed ecosystems that fell into four major classes— forest insects, forest fire, savanna grazing and aquatic harvesting. He concluded that any attempt to manage ecological variables in attempt to maintain a certain state, to control variability of a target resulted in a slow change of the ecosystem, that eventually led to even more dramatic and irreversible perturbations. When a normally fluctuating ecological variable was bounded and artificially sustained, ecosystems became more spatially homogeneous over the landscape scale. This led to less resilient systems that were more likely to degrade under disturbances that could be previously absorbed. ''The very success in managing the target variable for sustained production of food or fiber apparently leads inevitably to an ultimate pathology of less resilient and more vulnerable ecosystems'' (Holling, 1996, p. 8). Note that the collapse in these cases is usually observed at the next hierarchical scale, over landscapes.

4 Is there sustainability without renewal?

There seems to be an internal contradiction in the sustainability concept. Sustainability of a system borrows from sustainability of a supra-system and rests on lack of sustainability in subsystems. This might be hard to perceive, because at first glance it seems that a system made of sustainable, lasting components should be sustainable as well. But in systems theory it has been long recognized that ''the whole is more than the sum of parts'' (Bertalanfy, 1968, p. 55), that a system function is not provided only by the functions of its components and therefore, in fact, system sustainability is not a product of sustainable parts, and vice versa. This is especially true for living, dynamically evolving systems. ''You cannot sum up the behavior of the whole from the isolated parts, and you have to take into account the relations between the various subordinated systems and the systems which are superordinated to them in order to understand the behavior of parts'' (Bertalanfy, 1950, p. 148).

Novikoff (1945) and Fiebleman (1954) and others have been developing the idea of *integrative levels* observing that ''laws of a lower level are inadequate to describe the higher level. The laws unique to the higher level can be discovered by approaches appropriate to the particular level; to do otherwise is invalid scientifically and, in some cases, dangerous socially''(Novikoff, 1945, p. 214). Bertalanfy bring us very close to the idea of renewal: ''It is the basic characteristic of every organic system that it maintains itself in a state of perpetual change of its components... Every organic system appears stationary if considered from a certain point of view. But what seems to be a persistent entity on a certain level, is maintained, in fact, by a perpetual change, building up and breaking down of systems of the next lower order: of chemical compounds in the cell, of cells in the multicellular organism, of individuals in ecological systems'' (Bertalanfy, 1950, p. 155).

This interrelation of sustainabilities in various hierarchical scales is important for many applications. Much concern, for example, is expressed about how to make economic activities sustainable in face of the deteriorating environment. It is observed that in some cases economic growth turns out to be beneficial for the environment (Arrow & Bolin, 1995).

However it is hardly noted that the inverted U-shaped curve for environmental degradation as function of economic growth, advocated by protagonists of economic growth, pertains only to regional systems, where such trends, even when observed, cannot be extended to the global level. In the global level, the economic growth is clearly resulting in decay of natural capital and growing environmental degradation. The regional successes in the more economically developed countries, that seem to provide examples of quasi-sustainable systems, should rather cause increasing concern, than content. The achieved sustainability is a result of either decreased sustainability of other regional subsystems, or decreased sustainability of the global system as a whole, or both.

This analysis could be improved if there were a measure of sustainability that could be used to track the state of the system and compare it at various stages. However, as long as sustainability is not clearly defined and allows various interpretations and understanding, there can hardly be an unambiguous way to measure it. Sustainability is usually discussed in the qualitative level rather than quantitative. There is a considerable effort to develop indicators of sustainability (Moldan, 1995),

but the indicators are numerous, in many cases they are also qualitative and hardly help in defining a universal measure to evaluate and compare sustainability of systems. Nevertheless qualitative analysis is still possible and useful, especially when operating in the conceptual level. Besides, basing on other studies we can still try to quantify some qualitative measures to track the dynamics of system sustainability.

Describing the renewal cycle, Holling (1986) proposes to look at capital accumulated by the system and notes the cyclic pattern that this variable follows. Starting at low levels, the system gradually accumulates capital, reaching a maximum at the end of the conservation stage, after which the release of capital begins. The cycle starts again after the renewal stage. Gumilev (1978) describes the dynamics of passion, which he views as a driving force for the development of an ethnos in his theory. Similarly, passion grows at first, reaches the acme and then gradually declines as the system turns to homeostasis and then obscurity. Peak of passion in Gumilev's terms or vigor in terms of Costanza (1992), as a measure of system activity, metabolism, productivity, tends to precede the peak in capital. Generalizing these measures we may try to measure sustainability in two dimensions.

Capital will present the stock of material accumulated in the system. Depending upon the type of the system this could be biomass, population numbers, financial capital, etc. Vigor will be the potential for growth, growth rate, or net activity of a system unit. This parameter is yet harder to define and measure. For cells Zotin and Zotina (1993) were measuring the thermodynamic potential. It is not clear how to measure Gumilev's passion, but some indirect estimates, like the amount of volunteer work performed in the society, could probably be useful. We may chart these two variables (Fig. 3) and find numerous examples of systems, which dynamics approximately follow the patterns shown. Smith and Voinov (1996), for example, observe this pattern for capital in forestry and vigor in fishery systems. In these terms the sustainability concept can be then introduced by extending the period of the higher values of both vigor and capital beyond those that would be reached within a renewal cycle (broken line in Fig. 3).

There is a staggering resemblance of the sustainability concept presented in this form and the variations in the thermodynamic potential measured by Zotin and Zotina (1993, p. 42) for some abnormally developing cells. In both cases systems tend to be sustainable in terms of going through the stages of birth and development and then maintaining higher levels of vigor in the conservation phase instead of declining. Noteworthy, the cells that displayed this type of life cycling in the observations of Zotin and Zotina were the cancerous cells. It is well known, what is the effect of their ''sustainability'' on the well being of the supra-system, which is the whole living organism in this case.

One way to resolve this contradiction between sustainability of a socioeconomic ecological system and its components is to agree that there is only one system, which sustainability we are to seek, and that is the top level system, the biosphere as a whole in our case. The global scale in this context seems to be the maximal that humans can influence at the present level of their development. It is also the scale that affects the humanity as a whole, the system that is shared by all people, and should therefore be of a major concern to all. Note that this argument by no means implies that global sustainability is best achieved by entirely eliminating the human component. By definition, sustainability is all about livelihood for humans as part of the ecosystem. We do not talk about sustainability of ecosystems in the absence of humans.

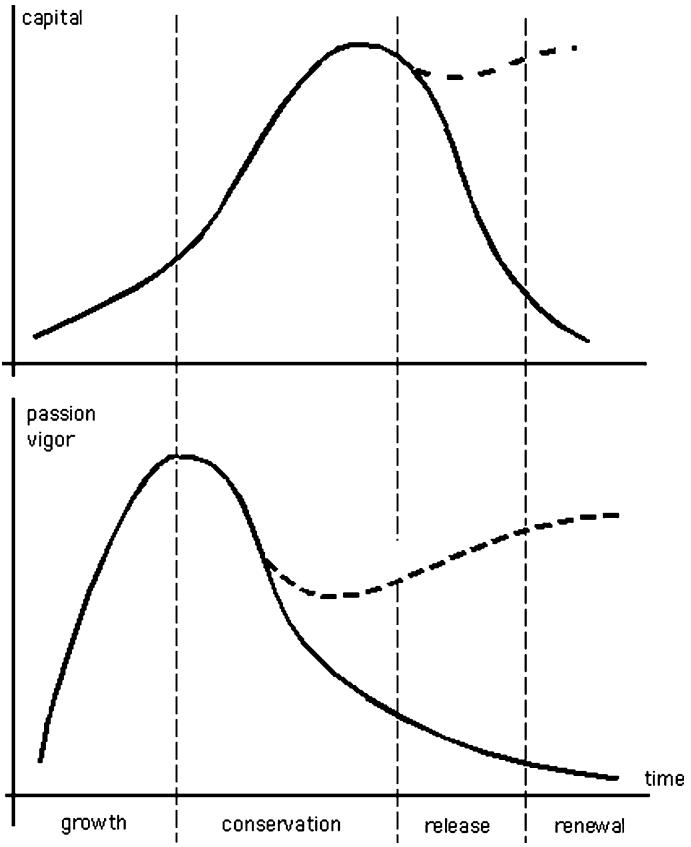

Fig. 3 Dynamics of vigor and stored capital in different phases of the natural renewal cycle (modified from Gumilev and Holling). The sustainable development trajectory (shown in broken line) tends to maintain the level of vigor and stored capital

One of the principles in Fiebleman's theory of integrative levels is that ''For an organism at any given level, its mechanism lies at the level below and its purpose at the level above'' (Fiebleman, 1954, p. 61). Does this mean that preservation of the biosphere becomes the purpose of humanity? Perhaps it does, if we agree that before we transcend to other higher purposes of humanity we need to make sure that humans survive as a species, which is possible only if the biosphere is maintained within certain livable conditions.

But then again we should realize that sustainability in lower hierarchical levels, in subsystems of the global system, may work against sustainability of the whole, the biosphere. Achieving sustainability at some regional level, we may decrease sustainability of the biosphere as a whole by reducing the potential for change and adaptation. The more sustainable the regional systems are, the less the potential for maneuver, for evolution through renewal, the less the chances for a sustainable global system.

Unfortunately, the global level is still most difficult to analyze, predict, interpret, and control. Among decision and policy makers of today there is not much

understanding of this interaction between local and global sustainability. The local or regional levels seem to dominate the sustainability stage, being easier to perceive and to ''sell'' to the public, the electorate. There are numerous citizen groups that are developing plans of sustainable development for their regions and communities. People tend to become much more easily involved in the wellbeing of their neighborhood, than in the future of more remote and abstract systems, like the planet Earth and the whole humanity.

Examples are numerous. Plans for sustainable development are drawn for counties (Jaklitsch et al., 1996), watersheds (e.g. the Rio Grande/Rio Bravo basin or the Chesapeake Bay), or countries. In Russia, the notion of sustainability has reached the highest echelons of power and became an issue of a 1994 presidential decree on ''Stable development''. Again according to that decree all regions were supposed to come up by the end of 1994 with a *regional* plan of *stable* development for their particular *region*. Naturally it was assumed that such ''stable'' regional development would necessarily add up to the sustainability in the national level as well.

Similar examples of a local approach to sustainability can be found worldwide. The Fourth International Conference on Urban Regeneration and Sustainability in 2006 was called ''The Sustainable City'' (City, 2005). Once again the call for papers refers to the first Sustainable City Conference held in Rio in 2000 and defines the concept of sustainability as applied to a city as ''the ability of the urban area and its region to continue to function at levels of quality of life desired by the community, without restricting the options available to the present and future generations and without causing adverse impacts inside and outside the urban boundary.'' The persisting assumption is that the systems per se stay in place, are maintained, and sustained. These local efforts may be certainly beneficial in the sense that they generate public involvement and awareness, but they are hardly feasible, taking into account the interconnectedness and, eventually, mutual dependence of all the subsystems and their dependence upon the higher hierarchical levels. The limited scope of these efforts is not duly exposed, while the analogy with the cancerous cells is too close to be neglected. By extending the longevity of subsystems beyond their natural life spans, the systems of higher levels are deprived from potential to adapt, they become brittle and are more likely to fall apart. The failure of higher-level systems is very likely to result in major perturbations, if not death, for the subsystems as well.

Moreover appeals for local sustainability are most likely to be deceptive. All local systems still share the same planet, the same climate, the same air and water cycles. They are also part of the larger, increasingly globalized economy and mass media. Isolating certain subsystems and sustaining them and only them in separation from the other local systems and the global system as a whole, is futile, and hardly feasible.

5 Conclusions

There is no evidence that a sustainable system is necessarily composed of sustainable parts. Fostering sustainability at local and regional scales may be detrimental to global sustainability. The function of the biosphere is more than a sum of functions of continents, countries and regions; local and regional goals and priorities may

contradict to the global ones and therefore we cannot envision the sustainable global design as a hierarchy of sustainable subsystems. There are external and internal factors that change and that the global system has to have potential to adapt to. This may require change or even destruction in components. Sustainability or increased longevity of components may be limiting for the adaptation and sustainability of the whole.

Actually there are not many regional systems for which sustainability can really be the issue. Systems in the developing countries or in Former Soviet Union are more interested in change and transition rather than maintenance. They are either in the release or renewal stages, which no one would want to sustain, or they have just entered the growth stage, when it is still hard to start thinking in terms of stable state economy (Daly, 1977) and sustainability. Economic transition assumes wide shifts in social and political institutions. These shifts, adjustments become possible as a result of discontent and rejection of the status quo by the majority of the population, while sustainability is based on social content and agreement.

Sustainability is certainly enticing for the developed economic systems, which have reached the conservation phase. This stage would be nice to endure for as long as possible, even beyond the normal lifespan that would be given within the renewal cycle. In this case there is a clear goal for maintenance and sustainable development seems to be desirable and realistic. Unfortunately there is little awareness that sustainability is most likely achieved by borrowing energy, resources (capital) and adaptive potential from outside of the system, and by decreasing the sustainability of the global system. Sustainability of a subsystem is achieved only at the expense of the supra-system or other subsystems.

The institutions and organizations that are to maintain life support systems on this planet need to emphasize the global priorities and first of all test policies and strategies against the sustainability in the biosphere level, rather than the regional or local interests of stakeholders, representing particular localities, communities, districts or countries. While in most cases the local, place-based efforts result in some negotiated agreement as to the desired qualities of a different and improved place to live and work in, which assumes certain changes in the characteristics of the system, the subsystems, they stop short of allowing for the destruction of the local system itself. While designing a sustainable Burlington, we are happy to consider a different Burlington, but we do not allow for the release, for a ''no-Burlington'', for a totally different system that may replace the city of Burlington.

However, this is exactly what the renewal cycle would assume: release, creative destruction, making resources available for recombination through adaptive restructuring. This is probably what some of the developed regions are ripe for. We certainly do not imply that this renewal should be now forcibly instigated. We only suggest that sustaining these systems may be destructive for the higher level of the global system, that the goal of sustainability may not be appropriate for these systems, that in some cases it would be more appropriate to ''let them go'' instead of artificially maintaining them indefinitely long at the expense of the global system.

One may argue that in some cases the sustainability and wellbeing of parts is essential for the sustainability of the whole. If, for instance, we consider a human body, then clearly its health is largely delivered by healthy parts and organs. For the whole organism to persist we need a healthy well working heart, liver, kidneys, arms, legs, etc. By sustaining the parts we bring sustainability to the whole. Then, perhaps, there are also subsystems of the biosphere that are to be sustained, and perhaps

there are regions or localities that we should sustain. What are these subsystems, which sustainability is crucial? I would argue that there may be two types of subsystems: *functional* and *replicative* ones. Each different functional subsystem is responsible for a certain function of the whole: like organs in a human body, like different species in an ecosystem, like indigenous unique cultures and traditions in the cultural heritage, or like element cycles in the biogeochemistry of the biosphere. Sustainability of functional subsystems is crucial for the sustainability of the whole system. However, as noticed above, sustainability is an anthropocentric concept. Therefore it makes little sense to talk about sustainability of such functional subsystems of the biosphere as species, biotopes, or biogeochemical cycles.

On the other hand, replicative subsystems are simply copies of the same, they do not provide any new and unique features and functions to the whole, they are merely instantiations of the same function: like cells in an organ, like companies in an economy, like cities in a country, or like individuals in a species. These should go through renewal to allow for adaptation and evolution. These do not need to be sustained. Unfortunately most of the regional and local systems that we try to sustain belong to the replicative category: they do not provide any unique functional features to the whole global system, they are simply replicas of certain element subsystems.

Interestingly, in the report ''Our Common Future'' (WCED, 1987), the document that has paved the way for the term sustainable development and which actually generated so much attention to the issues of sustainability, we can hardly find any discussion of types of sustainability other than the global one. The whole purpose of the report was focused primarily on designing scenarios of global sustainable development, recognizing that the local level is no solution to the global problems, and even while most of the action is available in the local level it is the global level that should be of major concern and be the ultimate goal. The original essence of the concept seems to be in the unified vision of the development of this planet as a whole, and it would be a pity for this integrating mission of sustainability to be eventually torn apart and grounded in local declaratively ''self-sufficient'' and ''self-centered'' efforts.

Twelve years later, another respectable body of scientists, the National Research Council, conducted its analysis of the trends and futures of sustainable development and concluded that ''The primary goals of a transition toward sustainability over the next two generations should be to meet the needs of a much larger stabilizing human population, to sustain the life support systems of the planet, and to substantially reduce hunger and poverty'' (National Research Council, 1999, p. 31). It is noteworthy that once again the main focus is made on the planet as whole.

Designing sustainability, in a way, is an interference with the natural course of events, it changes the ability of systems to renew, and therefore can have serious impacts on systems in other levels of organizations. As Fiebleman (1954) puts it: ''A disturbance introduced into an organization at any one level reverberates at all the levels it covers'' (p. 61). We should be careful in selecting the systems that we wish to sustain. To sustain the global system we would need to sustain the functional subsystems. Just like in case of our body, we do not care about the health of our heart or kidneys just for the sake of these organs. We care about them because they are essential for the health of the whole organism. The purpose of the heart is not just to pump blood; it is to pump blood for the sake of the survival of the whole organism. Similarly the purpose of sustaining the functional subsystems is in the global level,

and we are concerned about their sustainability as long as this is important for the supra-system. However sustaining most of the replicative subsystems, such as cities, farms, firms, counties, regions, or countries, which do not have the purpose of sustaining the whole global system that serves the humanity as a whole, is counterproductive and may even be detrimental.

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