Sustainability and Self-Organisation: Sustainability in the Perspective of Complexity and Systems Science and Ethical Considerations

Wolfgang Hofkirchner

In the perspective of complexity and systems science, sustainability can be considered a system property of social systems and a system's goal as well, which implies ethical aspects. A first section deals with the problem of how to relate the factual (the system property) and the normative (the goal of a social system), which marks the position taken here as „emergent ethics". Emergent ethics allows for including a critical stance when it comes to assessing developments of social systems. The next section gives an account of sustainability in terms of complex systems thinking. The fulfilment of functions on the part of social systems involves the creation of values on the part of the social actors that are elements of the social systems. The concluding section deals with requirements of sustainabilisation in the context of globalisation and informationalisation. Global challenges are defined as frictions in the functioning of complex systems. Only the implementation of a Global Sustainable Information Society will reduce the frictions such that a breakdown of the evolution of social systems can be avoided.

1 Emergent ethics

If system theory suggested to derive prescriptions from descriptions of sustainability, one would be inclined to label that suggestion a naturalistic fallacy. Naturalistic fallacies are well-known as wrong inferences in the meta-ethical debate: "ought" cannot follow from "is".

The naturalistic fallacy is only one kind of inferences that do not hold (Table 1).

Table 1. Ways of thinking in ethics.

It is based on a reductionist way of thinking. It reduces "ought" to "is", thus levelling down a norm or an evaluation that is related to a fact to a proposition that only describes facts without making prescriptions or evaluating the facts (which is an implicit prescription). Reductionism, in general, reduces phenomena of higher complexity to those of less complexity. Insofar norms or evaluations are not only, directly or indirectly, prescriptive but relate to facts they are more complex than descriptions of facts that lack the prescriptive moment.

Another fallacy is wishful thinking. It is an idealistic fallacy that pretends that "is" follows from "ought" and projects the higher complexity given in prescriptions onto descriptions that are less complex. That is, projection presumes the existence of something in an area where it cannot be found.

A third fallacy might be called the "postmodern" fallacy. As it is a feature of postmodernity to accept only that great narrative that says there are no great narratives any more, postmodern thinking deconstructs consistency provided so far; things fall apart and so do "is" and "ought". From that follows there is no dependency of one on the other at all and every norm or value is as justified as any other. That is an expression of a way of thinking that disjoins things that are connected.

Now, there is another possibility for conceptualisation. It is possible to look upon "is" as necessary, but not sufficient condition of "ought". In that way "is" can be integrated with "ought". They are not made completely identical nor completely different. They are conceived of as being related by a certain connection that opens room to move. "Ought" can emerge as contingent on a given basis. Thus reductionist, projectivistic and disjunctivistic ways of thinking are negated. Values, guidelines for actions, morals are emerging in a historical context; they are originating from and dependent on history.

This is very like modern views of laws of nature. Laws of nature that govern natural processes are not predeterminants that are given from outside nature or are unchangeable. It is hypothesised that laws of nature are time-dependent (Smolin 1997) and that the so-called fundamental constants of physics have, in fact, changed over cosmological time scales (Barrow 2002). Natural laws might "depend (at least to some extent) on what happens in the universe" (Davies 2010, 73): "the laws of physics are inherent in and emergent with the universe, not transcendent of it" (Davies 2010, 83). Physical laws seem to emerge along with matter and energy. So seem morals to develop with the circumstances in which they are embedded. System goals are construed on the basis of the actual interaction of the elements of that system. The former depend on the latter, but cannot be reduced to them. The former are a surplus that supervenes the latter. Thus this position is called "emergent ethics". Taking this position enables to talk about ethical issues without being trapped in a naturalistic fallacy or any of the other fallacies discussed above.

Emergent ethics makes complex systems thinking even compatible with critical thinking that supports criticism of current trends of societal development measured against possibilities of improving the human condition. Even ideas of Ernst Bloch (1985) fit complexity considerations. He rescued the idea of utopia from abstract utopianism that does not take into account concrete conditions as necessary starting point for the realisation of the vision. The unrealistic attitude made visions of a good society sink into oblivion when confronted with practicism that realises everything that can be realised.

Emergent ethics states that for the improvement of a social system one has to take into consideration that which is not only possible but also desirable and, in turn, not only what is desirable but also possible (Figure 1).

Figure 1. Utopia after Bloch in system theoretical terms.

This approach includes not only an account of the potential that is given with the actual but also an evaluation of the potential which sorts out the desired. Thus it embraces an ascendence from the potential given now to the actual to be established in the future as well as an ascendence from the less good now to the better-then, which altogether yields the Not-Yet in the sense of Ernst Bloch.

Let's suppose a multistage scheme in which different phases and different levels can be distinguished such that each phase is marked by a leap in quality that introduces another level. Then the potential is a space of possibilities rooted in the conditions of the actual in a certain phase on a certain level. The future actual is a realisation of a certain possibility out of the space of possibilities which adds a level to the existing ones. However, this is not the whole story. A value has to be assigned to the potential to discriminate whether or not it is better than the actual *hic et nunc*. Only in the case of improvement shall the potential be realised. This is an ascendence from the less good to the better. The Not-yet is then the future better. It is anchored in the present potential. Thus it is said to flash up now. The flash-ups foreshadow the better future.

2 Sustainability as property of social systems

Evolutionary Systems Theory – the denotation coined by Ervin Laszlo (1987), Vilmos Csanyi (1989) and Susantha Goonatilake (1991) – is a theory about evolving systems and a theory of systemic evolution. It no longer deals merely with mechanisms, strategies and controls for achieving or maintaining homeostasis and the development of species; it also concerns the birth, growth and decline, i.e. development, of systems, from the formation of the earliest known particle, through the arrival of terrestrial life forms, to the shaping of specific social systems on the human level – it concerns the rise and fall of real-world systems whatsoever (Ebeling and Feistel 1994, Goerner 1994, Mainzer 1994), including the cosmos itself (Layzer 1990, Smolin 1997).

It revolves about the notion of "self-organisation". This term depicts a process or event in which matter displays its capability of spontaneously building up order and maintaining it. While the physical basis for self-organisation was resesarched by a team around Ilya Prigogine already in the end of the 40ies of the last century (emergence of macroscopic structures in dissipative systems that have moved far away from thermo-dynamical or chemical equilibrium (Nicolis and Prigogine 1989), since the sixties of the last century the notion of self-organisation has been applied in various disciplines and empirical evidence has been found *en masse*. After Prigogine Hermann Haken generalised the physics of self-organisation to his so-called Synergetics with applications in social and economic science too (order out of chaos, principle of slaving, (Haken 1978, 1983). Manfred Eigen (Eigen and Schuster 1979) described the emergence of living matter in a hypercycle of autocatalytic reactions. Humberto Maturana and Francisco Varela (Varela et al. 1974) have put forward their idea of living systems as autopoietic ones, which can reproduce and maintain themselves. Niklas Luhmann (1984) tried to apply autopoiesis to society by suggesting that social systems are self-reproducing ones. The examples mentioned are only the tip of the iceberg. Today the concept of self-organisation has diffused into nearly all scientific disciplines. Considering self-organisation enabled, on the one hand, system theory to depart from a state where it only could deliberate on how systems are maintained and to include system changes too and it opened, on the other hand, the possibility for the Theory of Evolution to overcome the restrictions of simple mechanistic interpretations of the Darwinian model. By that sciences envisage a theory of open, non-linear, complex, dynamic, self-organising systems approaching which is the result of the merger of systems theory and evolutionary theory – in short, an Evolutionary Systems Theory.

The core of this theory is a model of evolutionary stages according to which systems evolve hierarchical levels in subsequent phases. Dependent on the granularity one focuses on, different stages can be differentiated. It is most common to distinguish sciences according to dealing with matter, with life, and with humans. Such a distinction can be translated into, and substantiated by, Evolutionary Systems Theory. Pure material systems are self-organised systems that characterise the physico-chemical phase of evolution and establish a physico-chemical level. They build up and mainatian order by dissipating entropy (Prigogine 1980). Pure living systems are advanced material systems that build up and maintain order by making their elements produce new elements in order to reproduce the system. That stage of self-organisation might be called autopoieses after Varela et al. (1974). Autopoiesis is characteristic of every biotic system. Compared to nonbiotic systems, they developed a new level, the biotic one, that rests on top of the physico-chemical one, when they ushered in the biotic phase of evolution. Human systems are a sophistication of living systems. They build up and maintain order by "re-creating" themselves. Erich Jantsch (1987) was the one to introduce that term. Human systems create themselves insofar they change their environment and they create themselves anew in a never ending process. Another level, the social one, appeared in the social phase of evolution.

If "stability" marks the property of any self-organising system to follow a path of development that can protect its order against damage, be it from the outside or the inside, one can distinguish between different kinds of stability according to the kind of systems in question (Figure 2):

- "robustness" could signify stability in pure material systems; there is a threshold beneath which disturbances can be tolerated, while disturbances of greater impact can destroy the order of the system;
- "resilience" – a term introduced in ecology denoting ecosystem succession cycles (Holling 1973) – can be generalised so as to designate stability in pure living systems that are able to react more flexibly than pure material systems, to bounce back after disturbances, to recover, to repair themselves;
- "sustainability" might then denominate stability in human systems; according to the specifics of re-creativeness, it covers the capability of taking care of, and providing for, the necessary conditions of the continuation of the social systems' re-creation cycles.

Figure 2. Kinds of stability in evolutionary systems.

Sustainability is concerned when the so-called natural environment by itself is able to provide with conditions that are necessary for the next production cycle of the social system or when the social system is able to support the so-called natural environment by so-called reproductive work in order to provide these conditions. Thus in the beginning the term "sustainability" was used to refer to the ecological context mainly. But it becomes clear that its use is not restricted to the ecological use. There are more functions to be met, if a social system is to be maintained, and more values to be taken into account.

Society can be regarded as social system that is built up by social subsystems according to a specification hierarchy, which means that each subsystem defines a function that is more general than the function defined by the next-lower subsystem (figure 3).

- Culture is about rules in society, including the regularities of political life. It is the field of discourse in which the actors can express themselves as long as they happen to gain influence by sharing the power to define what is (a) good. The power of definition legitimises actors to act in a specific way.
- Politics is about power, namely, power of decision. The disposal of means of power means the ability to influence decision-making processes about circumstances of life in general including economic affairs. It represents

regularities of how actors pursue interests. By resorting to power, actors are authorised to determine themselves.
- Economy is about self-preservation of the actors through access to resources. Economy is that sphere of society where the actors carry out economic actions in order to meet their demands. The social relationships that emerge here and channel the self-preservation of the actors are property relations – property being the disposition of resources. According to the power of disposition resources are allocated to the actors, that is, goods are distributed to them.

Figure 3. The architecture of society in the narrow sense.

Altogether, the cultural, political and economic systems make up the social system of society in the narrow sense. Social actions are carried out that make sense. Tangible and intangible goods are produced and consumed. Every social being is called to co-design the collective in which the supply of the goods is provided.

The social system of society in the broad sense includes two more subsystems (Figure 4).
- Ecosystems comprise the flows of matter and energy in support of the physical life of the actors. Contrary to all other forms of life on our planet, humans are able to consciously design their metabolism and to produce their *umwelt* whenever nature itself is not capable of reproducing itself for the sake of humans.
- Technological systems are that part of ecosystems that enhance and augment the actors that take the role of productive forces in that they produce something when they aim at something. The technosphere is the sphere in which the actors of society carry out their instrumental activities. Instrumental activities are the use of technologies as well as the invention of new technologies.

Figure 4. The architecture of society in the broad sense.

Sustainability means that at each level of the listed subsystems, from culture to technology, there is an inherent value that needs to be observed in order to avoid suffering damage of the subsystem in question which would, consequently, be detrimental to the whole edifice of subsystems (Figure 5).
- As to culture, the ideal of equality can be fulfilled, if all cultural actors share the same power of definition. Equality is opposed to lack of influence.
- As to politics, the more political actors have a determining influence on decisions, the more they are deemed free. Thus freedom is an inherent value of the political sphere. Freedom is opposed to powerlessness.
- As to economy, the regulative idea for the allocation is solidarity. Solidarity is opposed to expropriation.
- As to society in the narrow sense, the more actors have access to the supply, the more the society is well-balanced, fair, just. Thus, inclusiveness is the value we can identify at that level. Inclusiveness is opposed to exclusiveness (the latter is tantamaount with alienation from other humans).
- As to ecology, survivability denotes the required delicate balance between the human nature and the humanised nature. It can be reached, if the value of respect for nature scores high. Alliance with nature is opposed to degradation of nature (which equals alienation from nature).

- As to technology, the overall aim to which the technological augmentation of productive forces is to contribute is to secure a peaceful development of civilisation. It is productiveness (that can be broken down into usefulness, usability, efficiency, reliability, security, safety and other values) as opposed to destructiveness (which yields alienation from technology).

Figure 5. Values emerging on social subsystem levels.

3 Reducing frictions by means of a Global Sustainable Information Society

In the age of global challenges sustainabilisation is the task of today. Global challenges have a dark side and a, so to say, bright side: the dark side is the imminent danger of the breakdown of interdependent societies with the perspective of extermination of civilised human life because of external effects not any longer being external, while the bright side marks a possible entrance to a new stage of evolution of humanity, to the self-organisation of a humane world society. Sustainabilisation is the process of putting society in a position to avoid anthropogenic breakdown and safeguard a stable path of development by keeping global challenges below the threshold of endangering the maintenance of society.

Global challenges are due to social disparities among humans (between humans and society, that is, culture, polity, economy), between humans and environment and between humans and technology. In 1995, the author of these lines put forth the idea that these disparities can be seen as expressions of a deficiency on part of the humans in capability, i.e. an incapability, to control and regulate the systems in question by information. The problems can be looked upon as problems in controlling and regulating society, the environment and technology in such a way that the maintenance of the systems and its functions critical for the survival of humanity can be ensured (Hofkirchner 1995). Five years later the same author stated that the problems be interpreted as "frictions in the functioning of the information generation of those systems that make up world society", as the author wrote in a paper some ten years ago (Hofkirchner 2000).

Francis Heylighen points to the homology between physical and social friction. He says, referring to Carlos Gershenson (a PhD dissertation from 2007, published 2010): "Initially, interactions tend to be primordially competitive, in that a resource consumed by one agent is no longer available for another one. In that respect, interactions are characterized by *social friction* […], since the actions of one agent towards its goals tend to hinder other agents in reaching their goals, thus reducing the productivity of all agents' actions. Note that the two common meanings of the word 'friction' – (physical) resistance, and (social) conflict – describe the same process of unintended obstruction of one process or system by another, resulting in the waste of resources. […] Like physical friction, social friction creates a selective pressure for reducing it, by shifting the agents' rules of action towards interactions that minimally obstruct other agents. Interactions, however, do not only produce friction, resulting in a loss of resources, they can also produce *synergy*, resulting in a gain of resources. Actions are defined to be synergetic if they produce more benefit when performed together than when performed separately" (2007, 9-10).

Those systems affected by frictions in the course of global challenges are social (cultural, political, economic), ecosocial and techno(eco)social systems including biotic and physico-chemical structures processes. Humans are constantly engaged with those systems and they can do nothing but intervene in those systems. This intervention might be in accord with the self-organisation capacities of the systems or might be dissonant and tending to disable their self-organisation capacities. In the first case frictions will be decreased or, at least, not increased, while in the second case not, eventually running the risk of damaging the system.

Sustainability can be achieved by the reduction of frictions.

Informationalisation is the process that reduces frictions. It is the process of raising the problem-solving capacity of world society to a level of collective intelligence that allows for successfully tackling the problems that arise from society's own development.

Informationalisation can be supported by informatisation which is the diffusion of information technology. Information technologies, knowledge-based technologies, technologies for co-operation at all can support self-organisation processes and thus ease the frictions occurring in systems they are applied to. As it is, in the final analysis, social frictions that tend to multiply and propagate throughout the subsystems of the societal suprasystem and become manifest in frictions of all kinds – social, biotic, physical –, frictions in the subsystems can be reduced by reducing the social frictions on the level of the suprasystem (Figure 6).

- In cultural systems, frictions can be reduced, if the spread of disinfotainment via mediated mass manipulation can be outbalanced by re-linking humans to the planetary context, by establishing a noosphere in which reason is dominant, and by making everyday life scientific in the service of a good society.
- In political systems, frictions can be reduced by empowering the people against surveillance and infowars; an agora of noopolitik, a democratic forum smoothened by e-governance means can be established.
- In economic systems, frictions can be reduced, if world knowledge is respected as a commons; the processes of proprietarisation of information via commercialisation and commodification can be halted in order to mine knowledge for all and establish a cosmopedia.
- In the society in the narrow sense, frictions can be reduced by turning people into informed world netizens; the divide in information rich and information poor can be overcome by making civil society capable of using the network to include all of them.
- In ecosocial systems, a control revolution can reduce frictions by optimising material and energy flows instead of optimising the degradation of the environment which results in greening the technology.
- In techno(eco)social systems, frictions can be reduced by reducing the vulnerability of the industrial civilisation by smart technologies instead of increasing high-risk technologies.

Figure 6. Values emerging on social subsystem levels, given the global challenges and information technologies.

Sustainability can be reached, if globalisation is accompanied by informationalisation such that the required developments are globalised. A Global Sustainable Information

Society is a society using ICTs for steering a sustainable course on a global scale. Informatisiation is instrumental to informationalisation that provides that kind of knowledge that is needed to fight the risks of a self-inflicted breakdown, which can be accomplished only in a concerted action at the planetary level.

Conclusion

Sustainability can be defined as a property of complex systems in the human realm. Values are inherent in setting the goals for different social subsystems. In the age of global challenges, a process of sustainabilisation has to be set in motion by the dynamics of self-organisation, if the continuation of civilised human life on earth shall be a valid value. Information technologies can help put social systems on a sustainable path. Thus the vision of a Global Sustainable Information Society rooted in laws of systems development has a normative intent. The bifurcation point reached in the evolution of social systems might otherwise cause exterminism.

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