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ÁREA TEMÁTICA: ECOSSISTEMA E MEIO AMBIENTE

SYSTEMIC REASONING AND SUSTAINABLE DEVELOPMENT¹

Autores

Sandro Luis Schlindwein
UFSC – CCA – Programa de Pós-Graduação em Agroecossistemas
Departamento de Engenharia Rural
Caixa Postal 476
88040-900 Florianópolis (SC)
e-mail: sschlind@mbox1.ufsc.br
Tel.: 48-3331-5434

Ray Ison
Professor of Systems, Director of the Open Systems Research Group
The Open University, Walton Hall
MK7 6AA – Milton Keynes – United Kingdom
e-mail: r.l.ison@open.ac.uk

RESUMO

A partir do relatório da Comissão Brundtland e da Conferência UNCED no Rio de Janeiro em 1992, houve um aumento do reconhecimento da necessidade de colocar em prática em sistemas de interesse humano medidas para promover uma modalidade de desenvolvimento conhecido como sustentável. Desenvolvimento sustentável incorporou a noção de sustentabilidade, e foi transformado no paradigma dominante de desenvolvimento. Contudo, e apesar da concordância geral de que um novo (diferente?) padrão de desenvolvimento é necessário, há menor concordância de como melhor abordá-lo, tanto nos seus aspectos teóricos como práticos. Devido ao entendimento generalizado de que desenvolvimento sustentável resulta da consideração conjunta das dimensões econômica, ecológica e social do desenvolvimento (atualmente outras dimensões também têm sido consideradas), pensamento sistêmico tem sido indicado como uma abordagem apropriada a ser adotada para integrar estas dimensões. Mas pensamento sistêmico surgiu a partir de diferentes tradições de pensamento com a consequência que diferentes epistemologias, teorias e práticas têm sido rotuladas de sistêmicas, e tem sido compreendido e aplicado mais freqüentemente como uma forma de descrever o mundo (complexo), ao invés de indagá-lo e modificá-lo. Muitas vezes a simples identificação de um sistema tem sido considerado suficiente para se dizer que uma abordagem sistêmica está sendo empregada. Por isso, quando se adota esta forma de pensamento para tratar de desenvolvimento sustentável (e de sustentabilidade) os resultados podem ser notoriamente diferentes. Esta é a razão pela qual neste paper deveremos discutir a natureza da sistemicidade do pensamento sistêmico que está sendo adotado para tratar de desenvolvimento sustentável. Os resultados de nossa pesquisa nos permite dizer que apesar das diferentes tentativas que foram feitas para tratar de desenvolvimento sustentável de uma perspectiva sistêmica, uma narrativa coerente de desenvolvimento sustentável baseada em pensamento sistêmico ainda não existe. Há uma clara necessidade para mais pesquisa para desenvolver metodologias que poderiam ser adotadas na formulação de políticas públicas para tratar de desenvolvimento sustentável, em particular aquelas que permitiriam a interessados a aprender a se tornar sistêmicos, tornando possível a conversão dos aspectos teóricos do desenvolvimento sustentável em ação prática propositada.

Palavras-chave: pensamento sistêmico, sistemicidade, sustentabilidade.

¹ Short version of a more extensive paper under preparation

ABSTRACT

Following the Brundtland Commission report and after the UNCED-Conference in Rio de Janeiro in 1992, there was increased recognition of the necessity to put into practice in human systems of interest measures to promote a kind of development known as sustainable. Sustainable development incorporated the notion of sustainability, and has been transformed since then in the dominant development paradigm. Because it is commonly understood that sustainable development results from the joint consideration of the economic, the ecological and the social dimensions of development (currently other dimensions have been taken into consideration as well), systems thinking has been indicated as a suitable approach to be adopted to integrate these dimensions. But systems thinking arose from different traditions of understanding, with the consequence that different epistemologies, theories and practices have been labeled as systemic. Therefore, when applying this way of thinking to address sustainable development (and sustainability) the outcomes can be remarkably different. This is the reason why in this paper we shall discuss the nature of the systemicity behind the systemic reasoning being adopted to address sustainable development. The results of our research allow us to say that despite the different attempts being made to address sustainable development from a systems perspective, a coherent narrative of sustainable development based on systems thinking is still lacking. There is a clear need for more research to develop systems-based methodologies and frameworks which could be adopted in policy making to address sustainable development, in particular ones allowing stakeholders to learn to become systemic and, hopefully, making possible the conversion of the theoretical aspects of sustainable development into purposeful practical action.

Keywords: systems thinking, systemicity, sustainability

INTRODUCTION

In the last thirty years the growing awareness of large scale environmental degradation and all its related issues (poverty, human migration, food and water shortages, etc) and unintended consequences triggered worldwide discussions on sustainability and sustainable development (S&SD)². As suggested by FARREL & HART (1998), one of the understandings on which the discourse of sustainability was developed considers that to promote its emergence in human activity systems economic, social and ecological objectives should be equally considered. Based on this understanding, it has been generally considered that sustainability has different dimensions – the economic, the ecological and the social – to which, more recently, others have been included, such as the ethical dimension (PAULA & CAVALCANTI, 2000). It followed from this assumption that to address sustainability properly (or because the principles of sustainable development call for it, according to KELLY, 1998) the adoption of an approach capable of integrating all these dimensions would be necessary. Therefore CHAN & HUANG (2004) claimed that achieving a healthy, sustainable community requires a long-term, integrated and systems approach to address economic, environmental and social issues.

But the purposeful integration of different dimensions in a framework designed to promote the emergence of sustainability in human activity systems has proven to be difficult. This is particularly true in the development of indicators of sustainability, which are being currently proposed to measure progress towards its achievement. WIRÉN-LEHR (2001) suggests that the lack of ‘systemic indicators’ which integrate “all” (three) dimensions of sustainability, is one of the majors constraints avoiding the conversion of the theoretical aspects of sustainability and sustainable development into purposeful practical action. Therefore, it cannot surprise that several authors have claimed to adopt systems thinking to address and measure S&SD.

² Along this paper S&SD will be used as interchangeable terms

If we accept that sustainability is a complex issue whose understanding and purposeful practical action demands an alternative epistemological approach, what does it mean to adopt systems thinking to address it? In other words, in which aspects and to what extent can a systems-based explanation of sustainability be different from an explanation based on a traditional, objectivist epistemology? In this paper an attempt is being made to identify different traditions of understanding of those claiming to adopt a systems thinking approach to address S&SD.

2 ADOPTING SYSTEMS THINKING TO ADDRESS S&SD

Understandings of S&SD are often based on the assumption that they rely on three founding domains, namely the environment, the economy and the society, as if these were in fact separate and distinct domains (or dimensions). Accepting this understanding TRZYNA (1995) claims that sustainable development “*forces us [sic] to look at many dimensions of a situation, at the total picture over the long term, forcing us to get beyond our usual compartmented thinking and consider the interrelationships between ecology, economy and society*”. Therefore, he claims that one of the challenges of sustainable development is that “it requires cutting across many professions and disciplines”. As he asks “*how can we break down the barriers between professions, disciplines, institutions, and sectors*”, he is undoubtedly claiming for the adoption of a boundaries cutting approach – like systems thinking – to address sustainable development. And as have been said earlier in this paper, the adoption of systems thinking is recommended always when we are engaging with unbounded, poorly defined problems of the ‘real world’, when we want to make sense of a situation of complexity, as is the case when we are engaging with issues related to S&SD. For HJORTH & BAGHERI (2006) traditional fragmented and mechanistic science is unable to cope with issues about sustainability, as these are often related to complex, self-organizing systems.

Although repeated frequently, the claim that a systems approach is necessary to address S&SD has not avoided the appearance of discourses with contradictory arguments. Recently GALLOPIN (2003) also attempted to make a systemic analysis of S&SD. For him “*the systems approach can offer a perspective more useful than other analytical approaches, because the systems view is a way of thinking in terms of connectedness, relationships, and context*”. However, this author proposes “*to distill [sic] some of the most basic and general characteristics of the complex concept of sustainability by adopting a systems approach*”. But distillation is a separation process, a process designed to separate parts from a whole, a process designed to destroy what holds parts together, at the end of which the identity of the whole gets completely lost. What he is saying is therefore totally contradictory and misleading. Systems thinking is a synthetic, rather than analytical process; it even does not make sense to ‘distil’ since the systems approach is concerned with the whole ‘integrity’ and identity of the phenomena of concern. This example reveals the strength of deeply held internal mental models of how to address a complex issue, namely by breaking it down according to the classical, analytical approach, which is exactly supposed to be overcome by adopting a systems thinking approach. As SENGE (1999) said: “*the inertia of deeply entrenched mental models can overwhelm even the best systemic insights*” and intents.

Unfortunately this is very often the case ('most scientists are stuck in reductionist thinking'), and might also explain why it is so difficult to overcome the hurdle of going from theory to practice in systems thinking terms.

3 IDENTIFYING MAJOR TRADITIONS OF THE APPLICATION OF SYSTEMS THINKING TO ADDRESS SUSTAINABILITY

Among the literature sources and the authors we reviewed during this research we could identify different "modes" of making explicit use of systems ideas to address sustainability and sustainable development. These modes – provisionally denominated as A, B and C – will be briefly characterized here.

In **Mode A** we included those attempts which employed "systemic reasoning" (an articulated use of systems ideas) to discuss the problematique of S&SD, claiming that systems thinking could be employed to identify the relevant issues and to develop a 'total' perspective. This mode of adoption of systems thinking to address sustainability can be found among others in CLAYTON & RADCLIFFE (1996), ESPEJO & STEWART (1998) and SCHÜTZ (1999, 2000). The accomplishment of the central, organizing idea of Mode A is dependent upon the development of a 'systems competence'. For SCHÜTZ (1999) "*to organize society systemically, people must have both the capacity to understand the necessity and the capability to practice a constructively balanced approach between various marginal interests. (...) This implied capability to understand the superiority of the systemic viewpoint without giving up individual interests may be called 'systemic competence'*".

Mode B is characterized by all those attempts which adopt, explicitly or not, a systems based modeling approach to address sustainability as in HANSEN & JONES (1996); KELLY (1998); RONCHI et al., (2002); BELCHER et al. (2004), and HJORTH & BAGHERI (2006), or modeling frameworks which attempt to consider feedback, as for example in PARRIS (2002). According to KELLY (1998), who specifically adopted in her work a systems dynamics modeling approach, "*the systems approach supports the identification of relationships among the indicators [of development], learning about the behaviour of the system*". It can be said that the general objective of the attempts included in this mode has been to develop a framework which allows for simulation studies with the purpose of assessing and improving sustainability of the human activity systems under consideration.

In **Mode C** the adoption of systems thinking has been suggested for the purpose of gathering information and measuring progress towards sustainability, as in development projects, and this mode refers to the employment of systems methodologies, like soft systems methodology (SSM), for monitoring and measuring progress towards sustainability (as in BELL & MORSE, 2003). The difference to the conventional approach of developing indicators of sustainability is that this approach is supposed to be a framework for the participative development of an indicator, where "SSM is incorporated as a device for facilitating stakeholder participation" (BELL & MORSE, 2003). Within certain limits, also the work of CHAN & HUANG (2004), who used a systems based sensitivity model to foster community development for sustainability, can be included in this Mode.

As it is apparent from this brief description of the main characteristics of the three proposed Modes of adopting systems thinking to address S&SD, a sharp separation among them is not possible, as not always is possible to include a certain attempt of addressing S&SD using systems ideas sharply into one of these three suggested modes. The overlapping is particularly common in the Modes B and C, and although they are based on different systems traditions, they share some common objectives, as both intend to provide some measure of progress towards sustainability in human activity systems.

4 FINAL REMARKS

In the last thirty years after the first alerts of an increasing global environmental degradation and the institutionalization of notions like sustainability and sustainable development which followed, many approaches and strategies have been suggested to better address these issues. At the same time the popularity of systems thinking has increased, probably due the failure of other approaches to deal with a complex world. Therefore, as the issues related to S&SD typically characterize complex situations, involving stakeholders with conflicting interests, different worldviews and perspectives, and distinct levels of concern, quite soon and often the claim has been made that these issues could be better addressed employing systems thinking.

However, it is easier said than done. Despite the existence of different attempts to address sustainability from a systems perspective, as the different modes suggested here characterize, a coherent narrative of sustainability based on systems thinking is still lacking. Mental models based on classical analytical thinking are still working and influencing the way of thinking and acting, even when in a particular situation an explicit claim for the adoption of systems thinking is being made. Although it is possible to find attempts of using systems ideas which are to some extent formalized and structured, the overall working approach is still partial and fragmented.

It might be concluded furthermore, that the main modes through which systems thinking has been adopted to address sustainability have failed (to a greater extent) to promote what BAWDEN et al. (2000) have denominated as a “shift in systemicity”, or in other words, a shift in the perspective ‘from the world out there’ to ‘ways of thinking about issues concerned with the world out there’. On the other hand, there is an opportunity to open possibilities to be further explored in the attempt to adopt systems thinking to address S&SD. ISON et al. (1997) claimed that although systems methodologies are helping to reshape the way in which natural resource research and development is conducted (which includes S&SD), they are under-utilized and under-researched. Therefore, there is a clear need for more research for the development of systems methodologies and frameworks which can be adopted in policy making to address sustainability and sustainable development, allowing stakeholders to learn to be systemic.

LITERATURE

- BAWDEN,R.; PACKHAM,R.; MACADAM,R.; MCKENZIE,B. Back to future: reflections from Hawkesbury. In: CERF,M.; GIBBON,D.; HUBERT,B.; ISON,R.; JIGGINS,J.; PAINE,M.; PROOST,J.; RÖLING,N. (ed.). *Cow up a tree. Knowing and learning for change in agriculture. Case studies from industrialized countries.* Paris: INRA, 2000. p. 397-409.
- BELCHER,K.W.; BOEHM,MM.; FULTON,M.E. Agroecosystem sustainability: a systems simulation model approach. *Agricultural Systems*, 79: 225-241, 2004.
- BELL,S.; MORSE,S. *Measuring sustainability. Learning from doing.* London: Earthscan, 2003. 189p.
- CHAN,S.L.; HUANG,S.L. A systems approach for the development of a sustainable community – the application of the sensitivity model (SM). *Journal of Environmental Management*, 72: 133-147, 2004.
- CLAYTON,A.M.H.; RADCLIFFE,N.J. *Sustainability. A systems approach.* London: Earthscan, 1996. 258p.
- ESPEJO,R.; STEWART,N.D. Systemic reflections on environmental sustainability. *Systems Research and Behavioral Science*, 15: 483-496, 1998.
- FARREL,A.; HART,M. What sustainability really mean? *Environment*, 40: 1998.
- GALLOPIN,G. *A systems approach to sustainability and sustainable development.* Santiago: United Nations – Sustainable Development and Human Settlements Division, 2003. 38p.
- HANSEN,J.W.; JONES,J.W. A systems framework for characterizing farm sustainability. *Agricultural Systems*, 51: 185-201, 1996.
- HJORTH,P.; BAGHERI,A. Navigating towards sustainable development: a systems dynamics approach. *Futures*, 38: 74-92, 2006.
- ISON,R.; MAITENY,P.T.; CARR,S. Systems methodologies for sustainable natural resources research and development. *Agricultural Systems*, 55(2): 257-272, 1997.
- KELLY,K.L. A systems approach to identifying decisive information for sustainable development. *European Journal of Operational Research*, 109: 452-464, 1998.
- PARRIS,K. A framework for analysis of sustainable agriculture: an OECD approach applied to soil and water management. In: WOODHEAD,A.; JENKINS,A.; PACKHAM,R. (ed.). *Proceedings of the OECD CRP Workshop on “An interdisciplinary dialogue: agriculture and ecosystems management”.* NSW Agriculture, Australia, p. 10-33, 2002.
- PAULA,G.O; CAVALCANTI,R.N. Ethics: essence for sustainability. *Journal of Cleaner Production*, 8: 109-117, 2000.
- RONCHI,E.; FEDERICO,A.; MUSMECI,F. A system oriented integrated indicator for sustainable development in Italy. *Ecological Indicators*, 2: 197-210, 2002.
- SCHÜTZ,J. The value of systemic reasoning (commentary). *Ecological Economics*, 31: 23-29, 1999.
- SCHÜTZ,J. Sustainability, systems and meaning. *Environmental Values*, 9: 373-382, 2000.
- SENGE,P.M. *The fifth discipline. The art and practice of the learning organization.* London: Random House, 1999. 424p.
- TRZYNA,T.C. Introduction. In: TRZYNA,T.C. (ed.). *A sustainable world. Defining and measuring sustainable development.* London: Earthscan, 1995. p. 15-24.

WIRÉN-LEHR,S. Sustainability in agriculture – an evaluation of principal goal-oriented concepts to close the gap between theory and practice. *Agriculture, Ecosystems and Environment*, 84(2): 115-129, 2001.