

# Revisiting Sustainability Boundaries from a Systems Perspective

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## EXTENDED ABSTRACT

The developments of the notions of sustainability and systems thinking have similar triggers and are complementary in their purpose. Both have evolved in response to an inability of reductionist approaches to achieve desired outcomes when dealing with messy and complex issues. Both concepts call for holistic approaches to research, development, monitoring and evaluation. Indeed, systems approaches have to be integral to sustainability investigations if the sustainability concept is to have coherent meaning. The challenge is how to establish, in applied studies of sustainability, the appropriate boundaries of the system. This challenge arises because of the multiplicity of stakeholder perspectives, together with the multiplicity of spatial and temporal scales that might be considered. Different strands of systems thinking inform the process in different ways. Within hard systems thinking, boundary issues tend to be assumed within a delimiting framework that ignores the social dimension. Hard systems thinking is therefore generally supportive of quantitative modelling undertaken by 'experts'.

Within soft systems thinking, definition of the elements, interactions and boundaries of the system are recognised as essentially being an artefact of the modeller to try and make sense of a

chaotic world. Hence, there is explicit recognition that the system is socially constructed and that system improvement may be viewed differently according to the perspective of different stakeholders. Soft systems thinking recognises the fallibility of the 'expert' and supports discussion in search of consensus.

Critical systems thinking goes considerably further in attempting to make explicit the power relationships that drive specific interventions and assist the inclusion of the boundary issues of those whose perspectives are ignored in a sustainability plan. At an operational level the principle of subsidiarity, whereby decisions are made as close as possible to those who are affected, can be considered one guiding principle. However, considerable challenges remain as to how those who are affected can be empowered in terms of achieving the capability to shape and implement sustainability plans. Further development of linkages between critical systems thinking, capability theory of development as well as sustainable livelihood frameworks appears as one way that this might occur. Participatory simulation approaches can also help in co-learning and development of capability among stakeholders.

ways of resolving boundary issues in planning, modelling and implementation of sustainability.

## 1 INTRODUCTION

The concepts of sustainability and systems thinking are complementary concepts. The issue of boundary is a crucial link between systems thinking and sustainable development although rarely explored in the literature.

This paper explores how the boundary concept is treated in both sustainability and systems thinking and articulates the boundary issue. It also suggests

### 1.1 Sustainability and Systems Thinking

According to Churchman (1982) the purpose of systems thinking is securing improvement for the whole system. A secure improvement is a development of the whole system that persists over time (Ulrich 1994: 36). This conception of systems thinking is closely related to the notion of sustainable development (Maru & Woodford 2001).

Because of the interconnectedness of elements, achieving improvement in a system implies a never-ending process to consider everything relevant to the system. However, the details of these interconnected elements are complex and changing given the dynamic behaviour of human and natural systems and their capacity for spontaneous self-organisation (Flood 1999: 2). This systemic view of considering the totality of relevant factors of the whole system is theoretically necessary, but practically impossible. Thus, systems thinking is an ideal for holistic appreciation (Ulrich 1993: 586). Most importantly it is a reminder for us to aim for comprehensive understanding of a system, though in practice we can never achieve it (Ulrich 1994: 35).

In practice we delimit a system based on our assumptions about manageable scale and some relevant factors. However, this need to delimit inevitably leads to a less than comprehensive appreciation of the system. Assumptions and perspectives that shape the definition of issues (problems), selection of scale(s), relevant variables, processes and relationships in the system are the means by which we form the boundary.

## 1.2 Boundary and Systems Strands

Despite gaining relatively little attention from systems analysts and development practitioners, boundaries pervade both sustainability and systems thinking and practice. In the latter, boundary setting is one of the key differences between systems strands.

There are three major strands of systems thinking: hard, soft and critical. Within hard systems thinking the boundary is either ignored, or considered understood, or its boundary is given in terms of time and space. Within soft systems thinking the boundary is considered problematic and “messy”, requiring discussion for consensus. Within critical systems thinking the boundary is considered as crucial and problematic, requiring critique and debate by all concerned (Checkland & Scholes 1990; Ulrich 1983, 1991; Flood 1991; Midgley 1997).

Conventionally the boundary of a system or sustainability investigation and plan are set in terms of temporal and spatial scales. What is often neglected is what Ulrich (1994) calls “boundary by pragmatic dimension” or what we refer to as the social dimension or scale. This is defined as the practical meaning and impact of the issues, elements and relationships of a system considered in a sustainability investigation or plan to affect

different concerned groups including those that are not directly involved in the plan.

## 1.3 Boundary and Sustainability

We can now define sustainable development as a secure multi-scalar improvement of a socio-ecological system. Conceptually the temporal scale in sustainable development is captured in terms of intergenerational equity of resources and livelihood opportunities. With regard to sustainable resource management, the spatial scale often includes down- and up-streams effects. Intragenerational equity has both temporal and spatial scales. Intragenerational equity is often expressed in the assessment of the distribution of primary goods or basic needs and income.

The boundary of sustainability investigations reflects our judgments of what is relevant and what is not, what should be in the system and what is outside of the system. Many people within the boundary of the whole system are left out in planning processes due to lack of communicative competency, including lack of language skills, low level of education and remoteness from planning centres (Ulrich 1994; Stafford Smith et al 2003).

In planning for sustainability, we need to make every attempt for comprehensive involvement of people with different perspectives on issues, elements and relationships within the system. This should then be followed by explicating the systems boundary. Systems with explicit boundaries tell us what is included and what is excluded and under what assumptions. Boundaries that are explicit can provide an opportunity for concerned groups to dispute or discuss the assumptions and judgments about sustainability. This discussion may also allow common ground for co-learning about the sustainability of the system from different perspectives of the concerned groups (Senge 1992).

The remainder of this paper investigates two major questions related to this social scale (dimension). The answers to these questions can help explicitly establish the practical meaning of a sustainability plan to those concerned. The first question is “what minimum competency is required of those affected by any plan for sustainable improvement to be actively involved in setting the boundary?” This question is addressed in section 2, where capability refers to basic communicative competence in asking the boundary questions outlined in Table 1. The second question is “what is the portfolio of abilities required in all concerned in order to

capably maintain a sustainable improvement?" This question is addressed in section 3, which introduces a framework for an expanded analysis of capability of communities for sustainable livelihood-resource outcomes.

## 2 COMPETENCY FOR CRITIQUING SUSTAINABILITY BOUNDARIES

Sustainability as a systems concept has a boundary that is set by value judgments. Those actually or potentially affected by a plan for socio-ecological sustainability are no less experts at judging the boundary, which may or may not include their concerns, than the planners. They need to ask questions in order to investigate the boundary of the sustainability plan. Drawing from historical analysis of systems studies, Ulrich developed generic questions that would help those especially affected by a plan, but excluded from it, to conduct a boundary investigation (see Table 1). The questions are organised into four key issues of boundary critique (Ulrich 1983, 1993: 596).

**Table1.** Boundary critique questions for basic communicative competence in sustainability (Source: Ulrich 1993)

<b>Is/are questions</b>
<b>The value basis of the sustainability plan and implementation:</b>
What are the sources of motivation that provide the necessary sense of direction and purposefulness?
What purposes are served?
Whose purposes are they?
What is the decisive measure of success?
<b>The power basis of the sustainability plan and implementation:</b>
What are the sources of control built into the design, i.e., who controls the necessary means and resources?
Where does the decision authority reside?
What is beyond the decision power of those authorities?
<b>The knowledge basis of the sustainability plan and implementation:</b>
What are the sources of expertise that contribute the information, practical experience and know-how of planning and implementation skills?
What is the role played by expertise?
<b>The legitimisation basis of the sustainability plan and implementation:</b>
What are the sources of legitimacy of those affected but not involved?
Is there any sense of self-reflection and responsibility built into the planning and implementation?

Who argues the case of those who cannot speak for themselves, and those not born, and who argues for nature?

The same questions also have to be asked as should/ought. The gap between these sets of is/are and should/ought is the basis for negotiation to either reach a compromise or take a political or judicial action.

## 3 CAPABILITY FOR SUSTAINABLE SOCIO-ECOLOGICAL SYSTEM

Once the boundaries of a plan for sustainable socio-ecological system are negotiated among all concerned, what capabilities are required to carry this plan and to sustain its outcomes? A useful start can be a capability framework developed by Sen in response to issues of assessment of equity and wellbeing (Sen 1992, 1993). Over the last ten years this framework has been critiqued and further developed by Sen (1999) and other development scholars, (e.g. Alkire 2002; Alkire & Black 1997; Cohen 1993; Nussbaum 1993, 2000; Robeyns 2005). An extensive treatment of Sen's capability framework is beyond the scope of this paper. A discussion paper is in progress on systems-based modification of the framework for an analysis and modelling of sustainable livelihoods in Australia. Here it is sufficient to refer to Sen's simplified notion of capability as the extent of rights and capacities to achieve wellbeing. It refers to a bundle of abilities to have or to do:

"... such elementary things as being adequately nourished, being in good health, avoiding escapable morbidity and premature mortality, etc., to more complex achievements such as being happy, having self respect, taking part in the life of the community, and so on" (Sen 1992: 55).

We adapt the concept of capability in its broadest sense to refer to basic communicative competence introduced in section 3, and to the sufficiency of rights, responsibilities and resources of those concerned in the system to maintain and enhance the outcomes of a sustainability plan.

In many developing countries, several interventions with good project outcomes have been abandoned due to a lack of necessary capability among host communities to sustain achievements (Maxwell & Smith 1992). Developing capability among host communities is a prerequisite for the principle of subsidiarity, which for effectiveness and sustainability of outcomes that matters ought to be handled by the smallest (the lowest) competent authority.

In many practices of relief and development in developing countries, the principle of subsidiarity has been misused because central development authorities in these countries decentralise responsibilities to communities while holding back on corresponding rights and resources (Swift 1995). Alston (2000) echoed a similar observation in Australia, in relation to local community governments.

An illustrative hypothetical example is where a national government initiates an intervention in response to a study that established major crises in sustainability of livelihoods and resources of remote communities. Host communities can raise questions listed in Table 1 related to boundary critique, seeking the explanations and details of the planned intervention. Raising these questions to critique the boundary of the planned intervention in a dialogue complemented by capability analysis can also assist the community to determine its level of involvement in the plan and its commitment to sustain any positive outcomes of the planned intervention.

When a community in question is entirely dependent on other agents for sustainable planning and maintaining its livelihood-natural resource system interventions are short term fixes. A long term perspective is to facilitate a transition from dependent to capable communities.

#### 4 BOUNDARIES IN THE SIMULATION OF A SUSTAINABLE SOCIO-ECOLOGICAL SYSTEM

Often the focus of systems modelling has been the key variables (elements) and their relationships. Explicating the boundary of a system is even more important in modelling and simulation exercises than in a general sustainability plans, where in the former we are forced to tightly define the objective of the modelling – i.e. the problem or issue it is intended to solve or resolve. We also make selections of key variables and relationships for a simplified representation of the reality. A boundary of a system starts to take shape right at the start of problem definition. It continues to be an issue throughout the modelling process even after a solution is found to the problem. A solution to a problem may still be a problem to other people that needs a solution, thus requiring the boundary of the system to be redefined (Flood 1998).

Participatory sustainability modelling and simulation is exploratory in nature, promoting dialogue among participants and helping them to understand each others' issues and perspectives in relation to the sustainability of their livelihood-

natural resource system. Participatory simulation also promotes anticipatory learning, which is both adaptive and generative. It is adaptive because it assists to modify mental models in response to sustainability requirements. Anticipatory learning is generative in the sense that it provides a basis for changing the mental model of livelihood system and devises innovative ways of resolving its sustainability issues.

The following processes and tools may help in explicating a system's boundary for modelling and simulation:

Consider the social dimension in the definition of the problem (issues) and the selection process of what is relevant.

Use graphic tools such as boundary diagram (shown in Figure 1) to convey the choices made about the boundary of the system (Meadows & Robinson 1985; Ford 1999)

Develop models with or without the views and issues of different groups of stakeholders

Explore scenarios with conflicting views on major issues, compromises made in these issues or when consensus is reached about these issues of sustainability

Facilitate dialogue on the scenarios and summarise learning by the different groups

Use feedback from different groups to inform planning and maintaining the sustainability of the livelihood-resource system

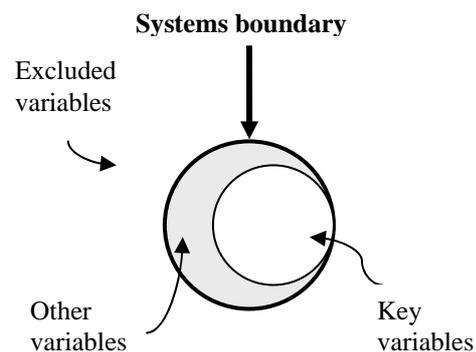


Figure 1. Bull's-Eye based system boundary diagram

#### 5 CONCLUSION

Sustainability is a secure multi-scalar improvement of a linked socio-ecological system. The social nature of boundary setting is often neglected in plans for and implementation of

sustainability of such systems. This could lead to the exclusion of communities from sustainability planning and subsequent dependence of the communities on external agents for implementation of the plans. This paper suggests solutions for basic communicative competence for planning and for extended analysis of capability for involvement in the implementation of sustainability plans. Modelling and simulation, informed by the critical importance of sustainability boundaries, can be used to facilitate the development of capability among community members

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