Chapter 5

Addressing the Social Dimension: An Application of Systems Thinking

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As professionals addressing environmental education and communications, we occasionally tackle discrete problems. However, more often we confront the needs of an entire company, community, country, or ecosystem.

When GreenCOM is called in to "fix" a situation, we often find that the real need is broader than communication and education. We find that the whole human dimension to a project, program, or policy is missing. People have been left out of the process. Those regulated have not been told what regulations they are subject to. Peoples' use of resources may have been restricted without involving them in that decision. By the time we arrive, policies have been conceived and in some cases implemented; infrastructure has been built; the resource has been depleted without considering the needs or opinions of the stakeholders. We are asked to "sell" a completed—and often inappropriate—program with our education and communication project.

For these situations, some of us are experimenting with tools from the field of cybernetics, or "general theory of systems," which deal with the entire spectrum of complex systems. We have formulated a set of principles designed to help us quickly assess a new system and effectively apply what we know from other complex systems.

The concepts presented in this chapter have proven useful in describing, modeling, model testing, and then reaching policy conclusions and forming communications strategies.

BACKGROUND OF GENERAL THEORY OF SYSTEMS

Over the past few decades a number of scientific fields have made efforts to understand very complex systems: the universe in physics, cell function in biology, atmospheric reactions involved in climate change in chemistry. As researchers began to describe and understand these complex systems, they realized that they might understand their systems better if they compared them with other—seemingly unrelated—systems. They discovered some general principles of complex systems that can help us more quickly understand a new system.

Because this set of principles is derived from a multitude of disciplines, it may seem hard to apply at first. This chapter tries to make the principles more concrete by applying them to a GreenCOM case study in environmental communications from El Salvador. We hope it will help stimulate you to apply this effective new tool for examining complex systems with complex problems, including those in environment and development.

Over the past 25 years much of the material in this chapter has been presented in other media by the authors; we hope that this shortened version will be helpful to those in environmental education and communications. GreenCOM hopes to develop this tool further to make it more helpful to practitioners.

APPLYING SYSTEMS THINKING IN EL SALVADOR

In the 1990s, El Salvador surfaced from years of civil war with practically no social infrastructure. The education system and the natural and built environments of El Salvador were in ruins. As USAID reentered the country it addressed many severe problems. Wisely, USAID understood that environmental education would help the population rebuild its natural resources including forests and fresh water that were the basis of the country's economy.

USAID's global Environmental Education and Communication Project, known as GreenCOM, began a five-year, multi-million dollar effort in this decimated country. We used the general theory of systems—including the 10 principles described below—as a guide to help determine how to begin work.

10 PRINCIPLES OF A GENERAL THEORY OF SYSTEMS

1. **A concrete living system is made up of objects that as a population constitute the mass of the system.**

The first step is to clarify the components of the system. Systems are composed of objects. A living system is made up of objects such as atoms, molecules, cells, organisms, people, groups, organizations and communities. In a living system, the "objects" are themselves decision-making systems. Our studies of living systems can begin with the demography, by examining age distributions, birth rates, death rates, and migration rates. Understanding, however, must go beyond demography to insights into the collective wisdom, mores, and decision-making processes.

In El Salvador, the system we were targeting was the entire population. Because of our focus on environmental behavior, we were more concerned with attitudes and behaviors than with ages or growth rates. Our first step in creating an environmental education (EE) campaign was to assess the population's knowledge, attitudes and practices regarding the environment. We did so through surveys and interviews.

2. **A system is part of a hierarchy of systems, made up of subsystems and supra-systems.**

Systems are made up of subsystems. In turn, each system is also a subsystem of a larger system or supra-system. (Some people may relate more easily to the concept of "nested" systems.) Atoms are subsystems of molecules, which are subsystems of cells. In society, institutions are subsystems of the community; communities are subsystems of states or provinces, which are subsystems of nations.

In the El Salvador case, we identified strategic subsystems of the population. We chose teachers, students, and journalists, all subgroups capable of influencing other subgroups at various levels within the system.

3. **All living systems are defined as objects in coupled motion.**

Every system has objects in coupled motion. Think of the predator—prey relationship in ecology. Or the image of dance partners. We can call them "teamed objects in balance." Identifying these teamed objects and understanding what creates the balance between them is key to understanding the nature of the system. A system often contains many teamed objects.

The most salient example in El Salvador was the public-private partnership. In order to deliver information and materials to our target audiences as quickly and efficiently as possible, we paired our environmental knowledge with the national newspaper's ability to print and disseminate to a large audience. As one result, the newspaper, El Diario de Hoy, created a multi-page, full color, once-a-month insert for children. The insert arrives with the Sunday paper, and each issue spotlights one environmental topic. The insert is named El Guanaquin, after a little armadillo turned into a spokes-mascot for EE; more than 60 issues have appeared so far.

4. **Living systems receive energy inputs from outside. Thus they are open as opposed to closed systems.**

A system's objects must expend energy to survive. Living systems must import usable energy (originally from the sun). We were prompted by this idea to find the outside sources of "energy" that sustain our systems.

The GreenCOM project imported material and approaches, which were very useful to students and teachers alike, developed outside El Salvador and heavily adapted them to fit the culture and ecology of the country.

5. **Each subsystem is defined by its capacities for matter-energy/information input, short-term storage, metabolism, long-term storage and output.**

In function, subsystems are processors with specific capabilities. They take in matter-energy or information, store it, convert it to other forms, and use it to do work. Each subsystem performs a specialized function necessary to the whole system (e.g. consumption, reproduction, transportation, or communications.)

As we address an environmental issue we must identify the capacities of each subsystem. What role do they play? How do they sustain themselves if the resource flows increase or decrease? Can the officials in office carry out a recommended new policy? Can local journalists interpret the new policy to those regulated by it? Can people understand the political, environmental or financial perspectives? Will special interests such as trade organizations advocate a course of action? Can the stakeholders stay active even if the battle is long?

The concepts of short- or long-term storage may be more easily thought of as the ability to withstand increases or decreases in resources—a buffering capacity. Are these subsystems flexible and adaptable? or are they fragile and at risk? Environmentally we often see the biological application of these concepts: fragile ecosystems can be damaged or obliterated by a severe storm but resilient ecosystems may spring back the next season. The social subsystems' ability to withstand fluctuations in information or financial flows are just as critical. Can a fledgling organization manage a big influx of funding? Can a corrupt government support a long-term commitment to sustainable forestry? Capacity development and sustainability are the ways we have come to think of these questions.

In El Salvador, each element of the strategy—printed materials, broadcast slogans, training strategies for journalists was pre-tested before scaling up. Pretesting is a way of testing the capacity of a subsystem to withstand change. Will new information given to teachers change the content of their lessons? Will information distributed to the media change the behavior of their readers and listeners? If the materials did not have the desired effects, how could we improve them before their general release? Pre-testing thus examines the system's capacity for information input, short-term storage, and metabolism (Day, 1997, Hough 1975b, 1996, and Kaplan & Kaplan, 1982).

6. **The structure of a system is defined by the subsystems it can activate, by the supra-systems that may activate it, and by the linkages through which the activations take place. Subsystems are activated in response to changes in other subsystems.**

A system's structure is the total of all the relationships of its subsystems. These relationships are set by the capacity and connections of the channels among the subsystems through which matter-energy or information flows in and products flow out.

Any changes in information, energy, or resource flows activate various subsystems. For example, when the human body (a system) is exposed to a disease, our immune systems (subsystems) are activated to ward off the threat. Likewise in communities, when resources—natural or financial—increase or decrease, a whole set of actors respond to these opportunities or threats. In countries where GreenCOM has worked, we have seen a cascade of positive and negative reactions to the mere *presence* of the donor resources of money, training, technical assistance and potential contracts. These are all natural subsystem responses to a change in resource flows. We can not only understand these changes, but also plan our education and communications activities to address them. For example, donor resources can distort local salaries and create a new social structure. When these resources are withdrawn the project can collapse. We need to consciously design programs that can continue without outside support by putting in place the knowledge, training, funding skills, and facilities to allow continuation.

In El Salvador, people needed information about what was being done by government, the private sector, and what they needed to do for themselves to protect the environment. To serve those needs, GreenCOM worked to train a cadre of reporters to cover the environment. The coverage of environmental issues not only increased peoples awareness, but also increased the relative importance that both individuals and political leaders gave the environment.

By providing additional capacity building resource—training to journalists—the relative relationship between a number of subsystems changes. The nature of coupled motion has been changed.

7. **A system may use energy inputs to add more objects, to change the linkages or relationships among its subsystems, or to produce an output.**

A system can choose to use its energy in any of these three ways. The choice is often determined by the systems stage of development. Before a system can grow or develop it must have the critical mass of objects. As it grows further it develops relationships with other subsystems (coupled motion). After growing larger it can produce more products. (Hough, 1975). When examining international development issues, many focus on increasing the production of products. But the strength of a society is its ability to sustain the relationships that provide its own continuity—the relationships between subsystems—developing the important coupled motion that allows for sustainability. Training, a form of capacity-building, is one way to improve the relationship between subsystems—of orchestrating the nature of coupled motion. A system that becomes more efficient in its use of energy and information may be able to produce more products without a great deal of growth.

An example of how an energy input changed the linkages among subsystems is an environmental education training workshop for 5,000 teachers in El Salvador. The workshop included demonstrations of interactive methods of teaching. These, methods, when put into practice in the classroom changed the relationships between teachers and students.

8. **Growth creates form.**

A system's form is its outward appearance. When a system grows, its form changes. If growth takes place as an increase in the population of objects, the system becomes larger and requires more energy inputs to sustain these objects. If growth comes from changes in the relationships among teamed objects, then the system may not become physically larger, but new subsystems are developed with new capacities and complexities. Growth and change in form can cause confusion among objects and subsystems until a new order is established. For instance, the growth of the Internet during the 1990s created some confusion among computer systems managers. Some managers thought their mainframes would be overwhelmed by the rapidly growing message flows. However, the growth took a different form. Rather than relying on centralized mainframes and dumb terminals, computer systems have become comprised of decentralized servers and intelligent terminals all of which interact with the Internet.

Another example of the second type of growth described above—in which growth comes from changes in relationships among subsystems, comes from El Salvador. When journalists were trained in environmental issues, they responded by creating a new institution: an association of environmental journalists. Hundreds of articles on the environment now appear in print and broadcast each year. The association holds a national awards ceremony for the best environmental articles published each year; the ceremony is attended by up to 800 people.

As the public became better informed by this increased press coverage, a popular movement *developed. The energy of this movement was focused in a "national encounter" for environmental education, bringing together 1,000 people from all walks of life to help set policy for a national environmental education strategy.*

9. If a system's energy exports exceed its energy imports the system is entropic.

While a system may operate on stored energy for a time, if less energy is coming in than going out, the long-term will see vital maintenance tasks ignored, with resulting losses of objects, links among the objects and/or coupled motion. The system becomes stressed by the loss of the channels through which matter-energy/information is received or by the inability of an internal subsystem to sustain its coupled motion. Most biodiversity concerns and nonrenewable resource questions are concerns about entropy, or the death rate or use rate exceeding the birth rate of objects in the system.

Inputs provided by an international donor in the form of training, materials development, and organizational skills all serve to offset the tendency toward entropy. We also involved both public and private sectors, so that when the project ended, the processes and products will live on. Often involvement of the private sector will lead to the sustainability of a project because the firm has additional incentives to keep the project going. El Guanaquin, *for example, is now free standing due to financial inputs from the private sector. The national environmental journalism awards, originally project-based, held a successful first annual event without direct project involvement.*

10. Structure limits growth.

In centralized systems, the distribution of products depends on the processing capacity of a single, central object. In decentralized systems, distribution may be achieved in many ways without using any single component of the system. Every structure comes with its own limits and needs for sustainability. Devising structures that can sustain systems is what we are all trying to do. Where can providing the right information in the form of education or communications support the system? This is what we are trying to learn.

To increase growth, the system must be decentralized, with many subsystems engaged. In El Salvador, we managed to enhance the effectiveness of the EE campaign by engaging multiple subsystems—media, teachers, students. Monitoring and evaluation steps told us how well this worked. We ran separate evaluations of effectiveness among schoolchildren, teachers, and the general public.

Using this set of principles requires one to back away from the details and see the broad view. It offers the potential to identify new windows of opportunity to improve environmental problems. As mentioned elsewhere in this book, human or social portions of environmental problems are often overlooked in the process of protecting a reef, a wetland, a watershed or an endangered population. Nearly all environmental problems are human behavior problems. As human beings ourselves, we needs to back away from daily details to really understand why people behave as they do. People usually have very good reasons for why they do what they do. Often, a good systems analysis of the situation will offer surprising and effective options for solutions.

References

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