System Theory in Development

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Introduction

General System Theory, which was developed by Ludwig von Bertalanffy[1] and others, provides an analytical framework that can be used to describe some of the many factors involved in development. It helps define some key issues such as assessing patterns of power and influence, deciding where to intervene, understanding the dynamics of inter-group relationships, and planning and carrying out development activities. Terms such as systems and sub-systems, closed and open boundaries, the transfer of energy or influence across boundaries and system balance (or homeostasis) as a system moves through time are used to clarify what can seem to be a bewildering array of information involved in development work.

Other System Theory concepts, such as the description of various environments related to a system and the key notion of entropy can also be used in capacity development. These terms are defined as follows:

System

A system is defined by von Bertalanffy as "a set of elements standing in interaction" – in other words, a group of things which have something in common. This includes any grouping with any sort of relationship - a collection of people, a forest, the planets, rabbits on a hill-side, a pile of rocks, or anything else – if it is possible to identify a group of things, this cluster can be seen as a "system."

There can be smaller systems (sub-systems) within other, larger systems - a clear example of this would be a single household in a village (see illustration below). The activities inside that house would be seen as taking place within a system (the family group involved in that household), which in turn exists within the larger system of the village itself. The village can also be seen as a sub-system, one of a number of communities which together comprise an even greater system, the region or territory in which they all are located.

[1] von Bertalanffy, Ludwig (1968) *General System Theory*. New York: George Brazilier.

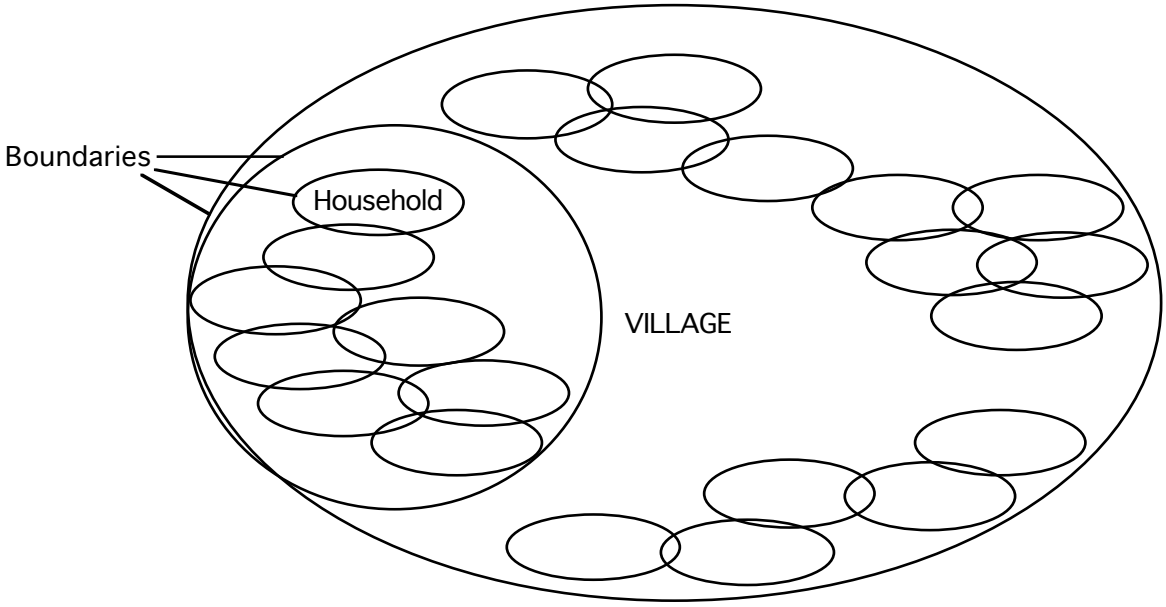

Figure 1
System, Sub-Systems and Boundaries

System Boundary

Each system is defined by some sort of boundary, which can be thought of as an imaginary line which determines what is inside and what is outside of a system.

In the example given above there is a boundary around the small system of the single household, and there could be another boundary which includes several households in that part of the village. There could also be a boundary around the whole community or area in which these people live.

System boundaries can be "drawn" wherever any observer wishes, and for any purpose. In a village, for example, it may be convenient to see the community as a cluster of different households or family groups. In this case boundaries would be imagined which marked out these families. At other times, it may be useful to show the various age groups, levels of education or degree of economic well being, affinity groups, gender distribution in leadership positions, and so forth: boundaries can be defined in whatever manner suits the purpose of the analysis.

Open and Closed Systems

The boundary around any system can be said to be "open" or "closed." A closed system is one which is completely sealed off from its environment by its boundary, such as a candle burning in an air-tight jar. The activity within such a closed system will continue

until all the needed resources are consumed, at which point activity will cease (i.e. the candle flame will consume all the oxygen in the jar and then it will go out).

There are relatively few completely closed systems in our world. All "organic" systems, a term which includes human beings and their communities, are open systems: that is, each has a boundary which is open to some extent and which makes it possible for energy or influence (in various forms, such as information or other resources) to pass into and out of its system.

One of the factors determining the "openness" of the system boundary between a community and its environment would be the ease of communication. If there were roads, or television and telephone links which permitted free exchange of goods and information across the boundary between the village and the rest of the world, that system boundary could be said to be very open. If, on the other hand, there were less ease of communication, if there were no roads, or the phone system did not work, the boundary could be said to be relatively closed.

The same openness would apply if the people were co-operative and worked together in harmony: they would share things across their respective boundaries. If there were tensions in the community, however, and people did not communicate and share things easily with each other, boundaries would be relatively closed. A lack of trust among families in a community, for example, would contribute to making boundaries between these groups seem rather closed.

Energy In System Theory

The various things which pass across the boundaries of systems can be called energy or influence. There are different forms of this influence. A human being requires physical energy in the form of food in order to survive. We also use other forms of influence which can be termed social power or psychological energy. This "social energy," which is often in the form of information, is usually the main product of human relationships and is a necessary element in the functioning of social systems. There are usually various kinds of social energy, and different people in a community hold varying amounts of these types of power. Some energy is able to help communities progress in a beneficial direction, while other forms can be unhelpful. Understanding how to help communities acquire and control beneficial types of energy to further their own progress is one of the main aims of sustainable development.

Entropy In System Theory

The term "entropy" describes a force or tendency which is present in all systems: they all tend to "run down," and to progress to a stage of reduced coherence and eventually to completely random disorder. Especially in relatively closed systems they consume all the energy they have available and eventually stop functioning or "fall apart." An example is organic systems that receive insufficient food: they die and their bodies eventually

decompose. A lack of affection has a similar destructive effect on a child's psychological development.

The tendency toward entropy in organic or social systems needs to be constantly countered through the generation of constructive energy from within or exchange of influence across boundaries from one system to another. This reverse tendency, which has been called "negative entropy," maintains or increases the order or harmony within systems.

Examples of constructive energy or influence which can act as negative entropy are food, affection, education, medicine, or anything else which helps sustain or improve the circumstances and cohesiveness of the members of a community. Destructive forms of energy which will reduce the well-being of social systems, and as such tend toward disunity and disorder, are oppression, injustice, violence, back-biting, malnutrition, poverty, and any other forces which prevent people from working together to achieve mutually-acceptable goals for their collective betterment.

These destructive forces (lack of trust, etc.) are frequently present in post-conflict war-torn societies, and they can make it difficult to establish and maintain the highly-ordered forms of cooperation and social cohesiveness which foster collective action, harmony and well-being among people in these contexts.

"Homeostasis", or Dynamic Balance (and Change) in System Theory

"Homeostasis" is a term which is used to describe a condition inside a system. It is a "steady state" or a "dynamic balance" which occurs within a system when the relationship between its internal and external conditions stay essentially the same from one time period to the next. The concept of homeostasis thus includes reference to the passage of time: a system will move through time in a state of dynamic equilibrium if it can continue to gain access to the resources it needs to keep itself in that condition. This is the system's trajectory.

If there is a desire to help shift a system's trajectory there is a need to alter its "steady state" by modifying some of the conditions inside or around that system. Anything which alters the energy flow within or between parts of a system can bring about changes in trajectory.

For example, a community which has high levels of disunity among sub-groups and is not progressing as a result may be changed by giving influential members of each sub-group an important task to do which requires them to collaborate with their counterparts in other sub-groups. Working on this common task is likely to improve the relationships among sub-groups and foster a system-wide shift from conflict toward cooperation, and change the community's trajectory for the better. It is important to note that the system will move at the rate permitted by the most reluctant member who has any influence on how it will progress.

The core of development work is the process of analysis of a system's conditions and introduction of resources that strengthen forces that alter the system's trajectory and promote beneficial change. In the community example above the resources that were introduced were the design of the shared activity and the ability to help key members of conflicting sub-systems see the benefit in working together for their common benefit.

The following figure illustrates some elements of the concept of homeostasis.

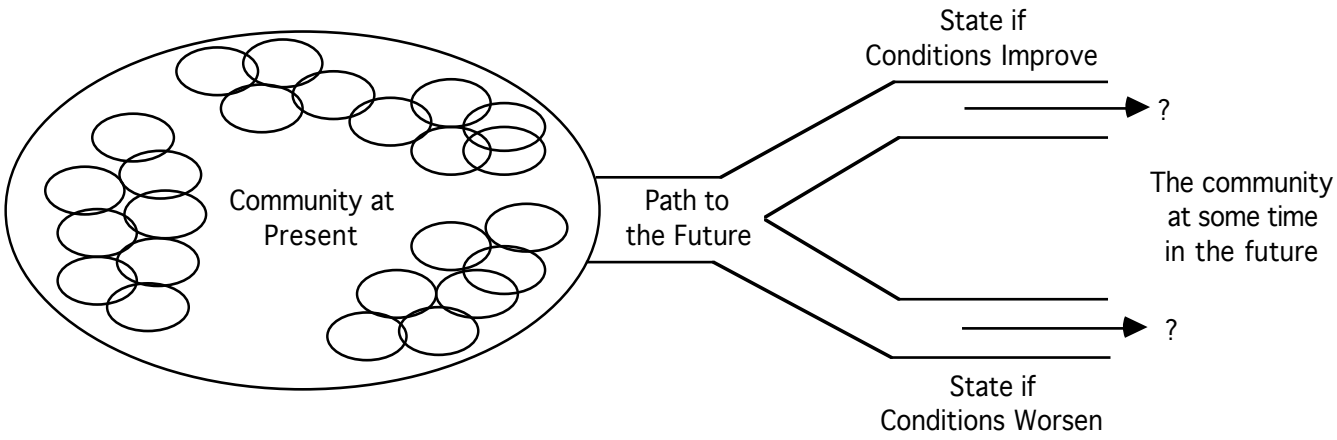

Figure 2
Steady State, or Dynamic Balance
and changes in a community as it goes through time

Boundary Management

As stated earlier, the condition within an open system is in a dynamic balance, or steady-state as it moves through time. The nature of that steady state is influenced by the energy or influence that crosses the system's boundary. If there is a need to achieve (or maintain) a desirable condition within a system, it is necessary to control or manage the flow of energy across its boundaries – to have them be open or closed as appropriate to maintain acceptable internal conditions as the system moves along its trajectory.

In the previous example of overcoming disunity among sub-groups in a community the boundaries were open enough to allow a shared exercise to be introduced, and sub-group boundaries that were previously closed due to inter-group conflict became more open as members worked together on the common task and combined their forces to achieve mutual benefit. Development workers do what they can to help the community make these beneficial changes sustainable.

System Environments

There are several environments related to any system. These are illustrated in the following figure:

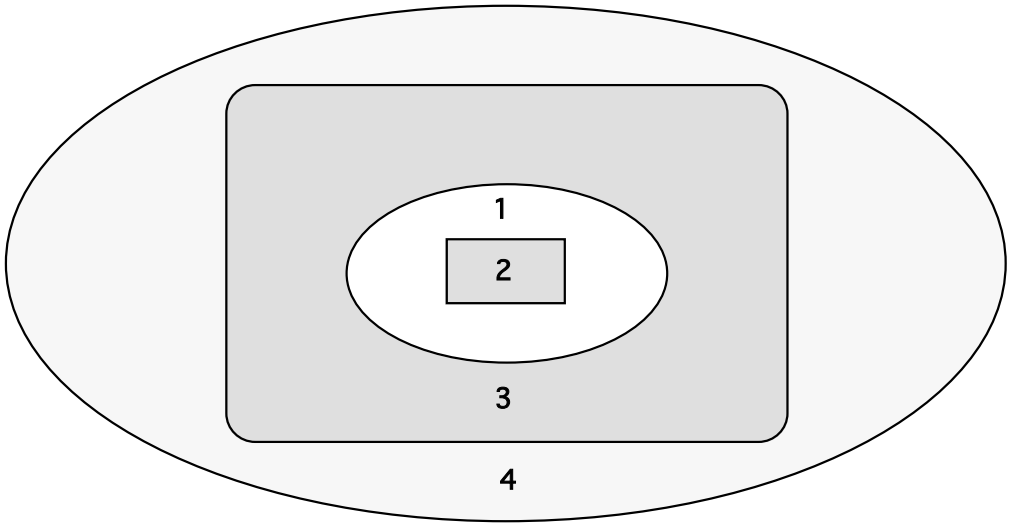

Figure 3
System Environments

1. The system under consideration, and the internal environment of which it is aware
2. The deeper internal environment of which the system is not aware
3. The system's external environment of which it is aware
4. The system's distant external environment of which it is not aware

Environments form the context within which any system exists, and energy or influence might be able to flow across the boundary from any environment to any other to alter the conditions in any part of the system.

These environments can be illustrated using the following example of a village in Afghanistan. If the system under consideration (#1) is the total population and geographical area of the village, examples of the dynamics of these environments could be as follows:

#2. The Deeper Internal Environment of which the System is Unaware - could be an internal struggle among senior clan leaders for control of the community and its attitudes toward the government and/or an insurgency. Although the population of the village may not know about the struggle, it is likely that any outcome of such a dispute will spill over into the public part of the system and cause changes in the way the community operates.

#3. The External Environment - changes in the visible environment, such as a firefight between insurgents and government forces on the edge of town, could make dramatic changes in the internal conditions of the system.

#4. The Distant External Environment - changes in environments which the villagers can't see, such as deliberations in member countries' foreign ministries prior to a meeting at NATO Headquarters to discuss commitments on troop deployments, would eventually create changes in the system. Another example could be a pharmaceutical laboratory's positive findings on the feasibility of using Afghan opium to produce medicinal products and a change in decisions on this matter among the board of directors of the multinational firm involved. This would likely bring about major changes throughout the entire environment and considerably alter conditions in the village.

Whole-system approach

A "whole-system" approach is just what the term implies – that any change strategy must take into consideration as many elements as possible in its planning process so information is provided from a broad an array of inputs before decisions are taken. An example from the auto industry helps illustrate the point. One of the major Japanese firms wanted to explore the feasibility of making major changes in its operations. Before taking any specific actions they convened large gatherings of all the stakeholders they could assemble – those from within the organization, as well as from outside: car owners, private maintenance shops, parts suppliers, regulatory bodies, and more. In a relatively loosely-structured interaction they requested groups to spontaneously form and discuss several basic issues on which they wanted input. The result of these large free-form multi-party consultations were analyzed and incorporated into the company's plans. The information received was far richer than would have been produced by a narrower tightly-structured in-house planning session.

The same concept can be applied in development: all actors with any influence on the environment must be accounted for in some way so their inputs can be appropriately considered in any intervention planning process.

Alignment

The concept of alignment is used in both community development and organizational development and is linked to the system's trajectory. It is based on the notion that all members of a system have resources and social energy and will direct that energy in ways that suit them. If they are aligned toward a common goal or guided by a shared vision of the purpose of their organization, their individual contributions will be mutually complementary and the system is likely to progress in the direction they want to go. If, however, their individual efforts are not aligned toward a common vision or goal, their energies will pull in various and conflicting directions and may tend to cancel each other out and the system will not move as hoped.

Anything which fosters alignment of the social energy of members of a system in a common direction will accelerate its movement along that trajectory.

Formal and informal influencers

Each social system has members who exert more influence than others, and the behaviors and attitudes of the rest of the system's members are effected by these leaders' priorities. Formal leaders are usually those who are elected or who otherwise occupy visible positions of leadership in the local administration. They may or may not have significant influence on their communities. Informal leaders are the people that community members seek out and heed when they want advice or guidance on matters of concern: they may or may not be formal leaders as well.

In Canadian Aboriginal communities, for example, the formal leadership may be the members of the Band Council who are readily visible to outsiders. Informal leaders, however, may be people who remain in the background and who external actors can not readily see, but they are sought out by members of the Band Council and others for guidance before key decisions are taken. They may be more influential than the formal leadership.

Organizations have the same two-level pattern – the visible designated leadership in the formal hierarchy and the people the system's members turn to for advice on matters of concern. These informal influencers may not be the same people as the managers or supervisors on the organizational chart. They don't run the organization, but the organization will not run effectively if they don't support it.

A development intervention needs to take both types of influencers into account if it hopes to implement any changes in the system.

Conclusion

System Theory can be used to describe the various elements and processes in any development intervention, and helps to define relationships and influences that can alter a system's trajectory as it moves through time.

There is another related and more complex approach sometimes called "Chaos Theory" or "Complex Systems Theory" that can be used in understanding situations where there are high levels of instability and unpredictability in a system[2]. This conceptual framework, which is based on quantum physics, is useful in planning interventions in turbulent systems at all levels – from the family to the whole world.

[2] A good practical introduction to this large area is: Stacey, Ralph (1992). *Managing the Unknowable: Strategic Boundaries Between Order and Chaos in Organizations.* San Francisco: Jossey Bass.