

Organizational Design with System Dynamics and Radical Change Approach

Ricardo Sotaquirá G.

Hugo Andrade S.

SIMON Research Group
Systems and Informatic School
Universidad Industrial de Santander
AA.678 Bucaramanga, Colombia
e-mail: handrade@uiscol.uis.edu.co

Lilia Nayibe Gélvez P.

SIMON Research Group
Engineering and Technologies Dept.
Universidad de Pamplona
Pamplona, Colombia

As Simon points out (1969), to design is a purposeful activity aimed at changing a current situation into a desired one. When the entity to be designed is a human organization, then the current situation, the desired situation and the resultant design can't be clearly defined. Consequently, we can't adopt an optimization approach in the organizational design. To design an organization implies to develop a process of gradual understanding about our current situation, about our expectations regarding ideal situation and about the way to intervene, through the design, in the organization. Moreover, this activity of organizational understanding and action goes with the organization during all its life. Therefore, organizational design, viewed as a permanent activity of understanding and action, could be recognized as a process of organizational learning.

Because of widespread use of System Dynamics as formal tool for facilitating the organizational learning, we consider valuable to apply it to organizational design of a Research and Development Center recently established at Colombia.

In the initial step of the organizational design of R&D Center, we proposed to use influence diagrams as means for achieving understanding, that is for beginning the learning, about the mentioned organizational phenomenon. Before to enter the influence language we should must to make explicit our knowledge about organization and to structure it in a way that promotes to build influence diagram. We name organizational conceptualization to this phase which is previous to influence representation. This paper presents a conceptual model of human organization for leading the organizational conceptualization under a systemic approach.

Conceptualization of organizational phenomenon

The theoretical approach adopted for the conceptualization of organizational phenomenon is based on interpretive streams of systems thinking, particularly on Interpretive Systemology (Fuenmayor, López-Garay et al. 1991). According to this interpretive-systemic approach, the reality only takes form, is structured, into an interpretation made from some perspective. The structuring is possible because some previous knowledge and ideas, related with the perspective, concur in the interpretation. These previous ideas act like templates that ordering the appreciation from reality in a determined way. The existence of an infinity of possible perspectives entails the existence of an infinity of possible interpretations.

If we understand the conceptualization of organizational phenomenon as a *formal* interpretation of a human organization, it will be necessary to formally define a set of knowledge that structure such phenomenon in certain way. We further must to consider that the interpretations that take into account the wholeness of the phenomenon are the most valuable interpretations. To satisfy this conditions we propose a conceptual model of human organizations as mean for the conceptualization of organizational phenomenon. This model is a formally structured set of knowledge that take into account the wholeness of organizational phenomenon.

For the conceptual model, Systems Thinking is the main source of knowledge about organizations. First, because of the emblem of systems thinking has been to understand a phenomenon as a whole. Second, because the organizational phenomenon has been the core subject of most of the current systemic methodologies, many of these ones work exclusively at conceptual or qualitative level. Finally, because the resultant conceptual model constitutes a systemic bridge between organizational phenomenon and systemic modeling with system dynamics. Hence we achieve a systemic process throughout organizational design.

The secondary conceptual source for the model arises from some methodologies that promote radical change in organizations, particularly the Business Process Reengineering (BPR). The choice of this second source replies, first, to the successful application of system dynamics in several BPR cases, and second, to the affinity between some BPR concepts with some systemic concepts.

The method to develop the conceptual model consisted in interpreting, in the described sense, ideas concerning with systems thinking and BPR from a perspective that regards organizations as if they were complex and dynamic wholes. This interpretive activity consists in interweaving a conceptual web around the idea of complex dynamic whole. This web must be concerning with human organization phenomenon. The conceptual model of organizations is the resultant web.

The conceptual model is mainly based in ideas from system dynamics but also it is enriched by concepts from Cybernetics, General Systems Theory and BPR. Therefore, we can understand the conceptual model as a theoretical creation that integrates system dynamics with elements arising from other systemic streams and from BPR. This theoretical integration, for organization studies, is a main purpose of this research.

Systemic conceptual model of human organizations

As Morgan (1986) indicates, the vision of organizations as dynamic wholes is a result of the influence of General Systems Theory (GST ; Bertalanffy 1979) and Cybernetics in the field of organization studies. Under this perspective, the organizations are able to detect environment changes and to produce suitable strategic answers. Thus, internal and external forces act in the organization. External forces correspond to the influence of its dynamic environment. Internal forces are actions that tend to sustain the organization in the fulfillment of its purposes under conditions of environmental change. The development of conflict between these forces makes the organization a dynamic whole by nature. In other words, the essential conflict of the organization occurs between its dynamic nature and what is bound to remain unchanged : the fulfillment of its purpose.

The cybernetic concept of negative feedback (Wiener 1948; Forrester 1961) allows us to understand the way in which the organization faces this conflict. The dynamic behavior leads the organization through different states, but only a few ones coincide with the ideal state associated to its purpose. The organization must be able to receive information about its current state in

such a way that corrections can be taken concerning the ideal state, by means of organizational actions ; or even, modify the definition of its mission and its ideal state. The negative feedback represents this process of information flow that resolves the conflict between what is dynamic and stable in the organization.

System Dynamics bring into its theory the concepts of dynamic whole and negative feedback in one approach that understands organization as a complex web of cause-effect relations (Aracil 1986). The value of the concept of causal web or structure is that allows to explain the dynamic behavior of the organization. The causal structure is a theory-for-explaining organizational dynamic. Besides, the knowledge of causal structure allows to manipulate strategic elements or relations to lead the behavior of the organization to its ideal state (López-Garay 1988). This characteristic contributes clearly to the purposes of organizational design. System Dynamics proposes a basic unit for the causal structure : the feedback loop. These loops link the internal elements of the organization as well as the key factor of its environment.

Up to this point the conceptual model deals with the dynamic nature of the organization. Now, to treat the organization as a complex whole is necessary to use the concept of hierarchy of complexity coming from GST (Boulding 1956; Checkland 1981). A phenomenon can be understood as constituted by an ordered set of layers, a hierarchy, each one of those having a different complexity level. One layer is more complex than its adjacent because present certain emergent properties that cannot explain on the base of the components of the less complex layer. These properties indicate a new level of order, that is of complexity, in the layer. We cannot understand to the layers of complexity hierarchy as "parts" composing the system, since layers cannot be separated inasmuch constitute a whole. In the layer of higher hierarchy, the lower complexity layers are present, plus the emergent properties of the higher order.

The concept of complexity hierarchy applied to the organizational case requires to consider not only the material aspects of the organization but also the human and social elements. Consequently, the complexity hierarchy gives an interpretation of organization as a complex whole.

There exist different proposals of complexity hierarchy for the study of organizations, done by Beer (1959) in the field of Organizational Cybernetics, or that recently presented by Gouillart and Kelly (1995) in the field of BPR. In this research a hierarchy has been proposed to permit to situate contributions of BPR, especially the orientation to core business processes or added value processes (Hammer y Champy 1993; Johansson et al. 1993). The hierarchy under evaluation contains the following layer in increasing complexity order : entity layer (people, equipment, resources) ; activity layer (entities integrated in a punctual purpose) ; layer of core business processes (activities oriented to the creation of added value products) ; layer of mental models (interpretations about what organizational reality is) and ends layer (interpretations about what organizational reality must be).

On each of these complexity layers a causal structure can be elaborated, in such a way that the causal structure of the organization be ordered by complexity layers. In this manner, the conceptual model of organizations becomes a mix of its complex nature and its dynamic nature, by means of hierarchy and causal structure, respectively. Besides, this conceptual model integrates around the System Dynamics contributions from other systemic stream and partially by BPR, for the design of organizations.

Final remarks

The building of the conceptual model required to make evident some assumptions of the perspective adopted by System Dynamics for studying organizations. Besides, it appreciated that these assumptions, summarized by the concept of complex and dynamic whole, are similar to those belonging to GST and Cybernetics. The theoretical validity of the integration lies on the fact that these three systemic streams are sustained by common foundations. Nevertheless, cannot be affirmed that this theoretical complementarism (Jackson 1994) could be achieved with systemic streams located in a different perspective about organizational phenomenon, this is the case of Soft Systems Methodology (Checkland 1981). About this subject we are beginning a new research work.

References

- Aracil, J. 1986. *Máquinas, sistemas y modelos*. Madrid: Tecnos.
- Beer, S. 1959. *Cybernetics and Management*. New York: Wiley.
- Bertalanffy, L.V. 1979. *Perspectivas en la Teoría General de Sistemas*. Madrid: Alianza.
- Boulding, K. 1956. General Systems Theory: The skeleton of science. *Management Science* 2(3):197-208.
- Checkland, P. 1981. *Systems thinking, Systems Practice*. UK: Wiley.
- Forrester, J.W. 1961. *Industrial Dynamics*. Cambridge, U.S.A.: MIT Press.
- Jackson, M.C. 1994. Critical systems thinking: beyond the fragments. *Sys.Dyn.Rev.* 10(2-3):213-223.
- Fuenmayor, R.; López-Garay, H. et al. 1991. Special: Interpretive Systemology. *Systems Practice* 4(5).
- Gouillart, F. and Kelly, J. 1995. *Transforming the Organization*. Nueva York: McGraw-Hill.
- Hammer, M. and Champy, J. 1993. *Reengineering the Corporation*. New York: HarperCollins.
- Johansson, H.J. et al. 1993. *Business Process Reengineering*. Chicester: Wiley.
- López Garay, H. 1988. *Bosquejo de un modelo organísmico de las organizaciones humanas*. Documento de investigación. Mérida, Venezuela: Departamento Sistemología Interpretativa, ULA.
- Morgan, G. 1986. *Images of Organization*. U.S.A.: Sage.
- Simon, H. 1969. *The Sciences of the Artificial*. New York: Macmillan.
- Wiener, N. 1948. *Cybernetics: control and communication in the animal and the machine*. USA: Wiley.