INTEGRATIVE SYSTEMS METHODOLOGY

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Contents

Summary

In this chapter, a systemic methodological framework for dealing with complex issues is presented, named Integrative Systems Methodology (ISM). ISM is a general heuristic for helping actors at different levels (individuals, groups, organizations) to achieve requisite variety when dealing with complex issues. For this purpose, numerous problem-solving approaches have been developed. ISM is aimed at overcoming the drawbacks of many established methods and methodologies, in particular: narrow orientation, fragmentation/lack of comprehensiveness; mere eclecticism, lack of methodological rigor; exclusive focus on the problem or issue, and insufficient consideration of the organizational context into which the issue is embedded.

ISM provides an extended perspective. It leverages the complementary aspects of positivistic/representationist and hermeneutic/interpretive perspectives, and allows for combining qualitative and quantitative modeling techniques. This is outlined by means of a polarities framework which emphasizes several antithetical aspects of the methodological landscape, namely quantitative versus qualitative methods; objectivist

versus subjectivist worldviews; conceptual/instrumental versus communicational rationalities; and structuralist versus discursive approaches.

The need to consider these polarities as complementary aspects has triggered the development of ISM as a means of overcoming the limitations of methods which are too narrowly focused or have to be combined and orchestrated. ISM specifies a general procedure and underlying methodological principles for such a synthesis, which reaches beyond mere eclecticism. Also, ISM is based on a process which operates on both the content and context of the issues at hand at the same time.

The potential of ISM is illustrated by means of a case study, in which different methodologies are synthesized to overcome their respective limitations. Several applications developed over the years have led to new insights which enable the handling of complexity more effectively with the help of ISM.

1. Introduction

In the light of the turbulence in the economical, social, technological, and ecological environments of contemporary organizations, Ashby's Law of Requisite Variety has become most topical: since "only variety can absorb variety", management has increasingly been conceived as a task of coping with complexity. This applies as much to leading authors in general management (e.g. Peter Drucker) as to members of the operations research, cybernetics, and systems communities. The overwhelming complexity faced by actors in organizations and society calls for devices to enhance the action potential of those actors. This has led to the development of specific methodologies focused on coping with complex issues in general as well as their dynamics. This category subsumes issues which concern complex dynamical systems, organizations in particular, and which are of a multidimensional or multilevel nature.

Complexity is the ability to adopt a large number of states or behaviors. The approaches to handling complexity systematically are not always systemic. Applying a distinction which is meaningful for the purpose of this paper, I shall talk about systemic and non-systemic modes of dealing with complex issues.

The non-systemic approaches usually fail to take account of the nature of socio-cultural interrelationships inherent in the organizations with which they are dealing. Examples include some of the Business Process Reengineering Methodologies, which handle organizations in a technocratic mode. These approaches tend to look at an enterprise or a business unit as if it were a machine: In many cases, structures have been reengineered without sufficient consideration of the cultural web of interrelationships which constitutes the social system of the respective organization. A large empirical study by Khandwalla specifically focused on turnarounds concludes that surgical (i.e. hard) turnarounds are inferior to non-surgical (i.e. soft) turnarounds, both as to the duration of time for recovery and the rate of recovery in profitability.

Systemic approaches on the other hand, pay sufficient attention to the socio-cultural and political aspects of organizations, not only to their structure. Yet, "systemic" does not denote one coherent group of methodologies, nor is the application of a systemic methodology a guarantee for success in a given project.

The reasons for the superiority of systemic over non-systemic methodologies are traceable to a theoretical principle: systemic methodologies for dealing with complex issues meet Ashby's law of requisite variety better than the non-systemic ones.

In section 2, a brief overview on the state of the art of systemic problem-solving will be given, and some drawbacks of current methodologies will be outlined. Section 3 will be dedicated to a presentation of ISM as a conceptual approach to overcome these limitations. An up-to-date application will then be documented in section 4, in order to visualize the benefits resulting from ISM, and also some of the difficulties involved in its competent use. Conclusions will be drawn in section 5.

2. The State of Systemic Problem-solving

2.1 Two Methodological Roots

In classifying existent system methodologies we can, at the outset, adopt a (somewhat simplified) classification of two strands rooted in different paradigms:

First, methodologies in the positivistic tradition adopt a rather objectivist worldview, aiming at observer-independent, true representations of reality. Their rationale is conceptual insofar as they continually strive for better models. This is linked to an instrumental or structuralist orientation which is intended for tools to cope with complexity. Often, albeit not necessarily, the models generated in the positivistic vein of the systems approach rely heavily on quantification. Therefore, they are frequently termed hard systems methodologies. We can assume that methodologies originating in the classical strands of OR, management science, and systems research fall into this group. One of the most widespread methodologies is probably System Dynamics (SD), developed by Jay Forrester, at MIT. The technical core of SD is a widely applicable method for the continuous simulation of systems with many variables and feedbacks. SD is guided by the insight that the dynamic behavior of complex feedback systems is generated by their structures.

An essential element of SD methodology is modeling a system in terms of stocks (levels), flows (rates), and constants (parameters), and connecting them by means of quantitative functions (equations, input-output tables). Visual representation of these models and simulation can help generate valuable insights into the functioning of the system. Applications of SD in the social and ecological domains range from global models to models of national economies, regional systems, and organizations, including the most varied aspects of corporate management. The System Dynamics Society provides the System Dynamics Review and an exclusive bibliography to document the progress achieved in the field. Other methodologies in this vein include the General Systems Problem Solver by George Klir (see *General Systems Problem Solver*) and Abstract System Theory by Mesarovic and Takahara.

Second, methodologies in the interpretivist tradition adopt a subjectivist worldview, emphasizing individual perceptions and interpretations of the world, and the interaction between multiple perspectives by which consensual domains are negotiated and (new) shared realities are constructed. The rationale underlying these methodologies is essentially communicational, but also discursive and political. At the level of modeling the hermeneutic methodologies rely on qualitative aspects, and thereby primarily on verbal expression. Therefore, they are often termed soft systems methodologies.

Diverse heuristics rooted in the behavioral, and particularly organizational, sciences fall into this group of methodologies. The term Soft Systems Methodology (SSM) denotes a methodological framework developed by Checkland and his associates at the University of Lancaster to tackle real-world problems in which multiple perspectives are involved (see *Soft Systems Methodology*). SSM developed from action research. The heuristic process frameworks of SSM are based on a distinction between the conceptual, formal aspects of modeling (systems thinking), and actions in the real world (systems practice). Special emphasis is laid on the consideration of multiple perspectives in the definition and determination of the subject matter: An issue-based root definition should explicitly refer to the following elements, for which the acronym CATWOE is used: Customers (C), actors (A), a transformation process (T), a worldview (W)—Checkland uses the term Weltanschauung—which gives meaning to the root definition developed, the owner(s) of the system (O), and environmental constraints (E). In the process of applying SSM, strategies and measures are developed which are systemically desirable and culturally feasible.

Representative examples of the many heuristic frameworks which stem from systemic research, and mainly focus on the redesign of organizations, include Ackoff's "interactive planning" and Banathy's "organization design" methodologies (see *Designing Social Systems*). Additionally, Critical Systems Heuristics (W. Ulrich), which can be considered a variant of SSM, is a methodology for democratic planning. It is aimed at developing critical consciousness as well as the self-reflective and argumentative skills needed for meaningful and effective participation in processes of planning (see *Critical Systems Thinking*).

2.2 The Quest for Synthesis

As managerial issues have become ever more complex and dynamic, the need to combine positivistic and interpretive methodologies has become increasingly evident. This quest has resulted in a series of methodologies which combine essential aspects of both paradigms. Among these are Vester and von Hesler's Sensitivity Model (SM), and Gomez and Probst's Methodology of Network Thinking (MNT).

These methodologies are rooted in SSM and SD. In each case, qualitative heuristics and some limited quantitative techniques are combined to form a coherent "package" of methods. SM was developed in the context of applications to regional planning, but it is now also applied to corporate issues. A sophisticated software package called Sensitivity Model (by Studiengruppe für Biologie und Umwelt, Munich, Germany) supports this methodology with extensive documentation features but only limited simulation capabilities. MNT was developed for the specific purpose of supporting managerial problem-solving and has been widely applied to all kinds of organizational issues. The tools GAMMA (by Unicon, Meersburg, Germany) and Heraklit (by Know

How Systems, Teufen, Switzerland) are available for the documentation of networks. All of the tools mentioned contain features which support the automatic classification of variables according to their appropriateness for steering purposes (see section 4.1).

2.3 The Challenge of Implementation

Solutions to problems are only as good as their implementation. This is common sense, and most of the systemic methodologies have dedicated an explicit component to the practical aspect of putting solutions to work, of establishing a learning process which leads to continuous improvement, and so on.

Nevertheless, implementation continues to be a crucial deficit in many organizations. Probably as much potential remains unrealized because of implementation atrophy as is due to diagnostic error or design flaws. Empirical research by Espejo, Schuhmann, and Schwaninger points to a crucial causal link: implementation gaps, unrealized ideas or solutions, and the frustration of those who originated them, can in most cases be explained by one dominant factor: The insufficient care for, and understanding of, the (organizational) context in which the problem at hand and its solution are embedded. The problem is that problem solvers are focused on the problem, "...concentrating on the content of the issue they are dealing with, while neglecting the context". Effective problem solvers have always known about the challenge of including the larger whole, the milieu, or the environment into their frameworks of analysis, diagnosis, and design. Family therapy, for example, treats the immediate family members of the patient as obligatory and integral parts, right from the beginning of the anamnesis. Competent managers and their consultants have sought analogous procedures when dealing with organizations. But the heuristics developed to support them have mostly failed to balance content and context appropriately, by omitting to anchor the latter explicitly in their frameworks. Conclusively, the variety of pertinent solutions in practice tends to be insufficient: They fail as they are non-compliant with Ashby's Law.

Recently, at least three methodological innovations have brought about some progress in the direction indicated here. First, Robert Flood and Michael Jackson from the University of Hull developed a framework for intervention into complex systems, named Total Systems Intervention (TSI). This framework is very general, embodying the central message that coping with complex problems requires taking advantage of the complementary strengths of different methodologies. The basic schema is a diagram of the building blocks to hand, indicating how they interrelate (by arrows between the blocks). Yet the real progress made lies in an important heuristic device: by utilizing a typology of problem contexts, with dimensions of simple/complex and unitary/pluralist/coercive, Flood and Jackson elaborate on which methodologies should be used according to the specific properties of a situation. This heuristic originated from earlier work by Jackson and Keys (see *Total Systems Intervention*).

Second, David Lane from City University and Rogelio Oliva from MIT proposed a synthesis of SSM and SD. They present a scheme in which logic-based analysis is complemented by an extended cultural analysis, which is supposed to comprehend what they call analysis of the intervention, social system analysis, and political system analysis. The distinctions made by these authors come close to meeting the need raised above—to deal with both the content and context of an issue synchronically. The epistemological stance and the boundaries of the proposed synthesis have been thoroughly developed, but the procedure outlined needs further operationalization.

Third, Raúl Espejo from the University of Lincolnshire and Humberside developed a Cybernetic Methodology (CM), a framework for problem-solving which inspired much of the work reported here. This is a methodology meant to support the interplay of content and context in the operational domain of agents, and the interplay of the observed and the observing systems in the operational domain of observers. This methodology builds on the terminology of SSM. However, it introduces a distinction between two loops, an external one dealing with the content of the problem at hand (learning loop), and an internal one focusing on the context (cybernetic loop). While the categories of CM have been exposed (Espejo) and illustrated by applications (e.g. Bowling and Espejo), the author’s experience with students has shown that the notations used to name the phases of the process, and particularly the terms denoting the two loops (cybernetic versus learning loop), have led to difficulties in understanding the logic of the methodology. Furthermore it would seem necessary to further operationalize the categories used in the CM framework.

It must also be added that other sophisticated approaches focused on system design have been developed that differentiate between different logical levels, and levels of rationalities of design, respectively (see *Metamodelling*). In these cases a differentiation between—and a connection of—issues and their organizational context can be formed, comparable to the one made in CM. Another case in point is Gasparski’s designology, which distinguishes between a core of design and its situational complement.

2.4 The Challenge of Creation

Another difficulty with many of the systems methodologies is a common trait expressed in their terminology: They focus on problems. There is no doubt about the ubiquity of problems in organizations and societies. Yet semantics are of crucial relevance in this: focusing people’s attention on problems tends to draw their attention away from opportunities. The architects of some other methodologies—given the terminology they use—must have been aware of this problem (and opportunity); but those methodologies, for example Strategic Assumptions Surfacing and Testing (SAST), are of more specialized kinds than the synthetic ones being dealt with here.

At a time when innovation is needed, the emphasis on problems can set the wrong priorities. Also, the very term problem often carries a connotation of the short term as opposed to the long term, of therapy rather than prevention, and of retrospective more than prospective orientation.

The necessity of posting alerts for opportunities, and of setting incentives for innovative thought and action, calls for a semantic adjustment that is subtle, but the smaller it seems the more important it may be. I recommend substituting terms such as “issues”, “system-in-focus” etc. for “problems”. This applies to the labels on the main schemes outlining the heuristics, but not to more detailed descriptions or checklists, where problems are one of the options to which the methodology can be applied.

In connection with this, two additional remarks are worth making: terms such as “create”, “design”, or “find” would be more stimulating than the ubiquitous “problem-solving”. Also, the word “intervention” is being used too often. Knowing that people tend to get trapped in their own metaphors, caution is needed here as well. A phase called “intervention” would seem to confirm the mental model in the minds of actors who already have a bias towards interventionism. A terminology which balances extrinsic and intrinsic control, but mainly reinforces self-regulating capabilities such as the faculties of auto-organization, self-reference, and self-transformation, would seem likely to do a better job.

2.5 The Challenge of Validation

Finally there is another issue which must be raised, as it has received insufficient attention, although it is crucial to any process of dealing with complex issues. In the literature on methodology many instructions on how to proceed can be found, but very little has been said about how to ensure the quality of models and strategies. From a theoretical standpoint this question is essential, because the result of any (management) process cannot be better than the model underlying it, except by chance. This is the principal implication of the Conant–Ashby theorem: “Every good regulator of a system must be a model of that system.”

On the basis of these theoretical underpinnings, the *validity* of models (including strategies) has been neglected. Validation should, and probably will, become a foremost issue of methodological concern. It is all about questions such as: “Do our assumptions hold? Does the structure of our model correspond to the issue modeled? How well does the model reproduce the dynamic behavior of the system modeled?” Given its crucial importance, validation will be made an integral and explicit component of the methodology developed here.

3. Outline of Integrative Systems Methodology

3.1 Purpose and Scope

Based on the issues raised in the last section, an integrative methodology for dealing with complex issues in organizations and society has been developed. This methodology will be outlined here with the purpose of providing a reasonable overview while leaving enough room to discuss application-related issues in a case study in the next section.

This methodology is called Integrative Systems Methodology (ISM). The focal purpose of this methodology is helping actors in organizations and society attain requisite variety. This was expressed by the specification heuristic for requisite variety when ISM was published for the first time. Heuristics can best be translated as the art of finding. Stafford Beer defines heuristic, a contraction of heuristic method, as “a set of instructions for searching out an unknown goal by exploration, which continuously or repeatedly evaluates progress according to some known criterion.”

A heuristic, then, is used to search for objects whose contents are unknown or only partially known. However, to be able to assess a process, criteria must be known. They are not necessarily clear in advance, but they have to be generated, and will respectively emerge as the process evolves. In practice, far-reaching processes in organizations must usually meet several criteria at the same time. Viability, i.e. maintenance of identity or separate existence is often referred to as the ultimate goal of an organization. However, recent theoretical work on organizational fitness has shown that the range of pertinent criteria needs to be extended. The viability which is at stake is beyond survival. An intelligent organization aims at development which may even include the abolition of its current identity, and resort to the creation of a new, or even several new, identities. From this new perspective, ISM is also meant to be a process-oriented methodology for social systems to become more intelligent, to learn, to enhance their organizational fitness.

3.2 An Outline of ISM

A representation of the proposed methodology is given in Figures 1 and 2. As shown in Figure 1, ISM operates with two loops, a content loop and a context loop. This scheme was inspired by earlier works of Espejo on CM and Pettigrew on Organizational Change. The two loops in figure 1 are only separated for the purpose of analysis. In fact, they are intertwined and they often show overlaps. They revolve along a set of operations iteratively. The number of these operations could vary as a function of the notation. Here, a set of four operations is used—modeling, assessing, designing, and changing—which can be sufficiently distinguished and specified.

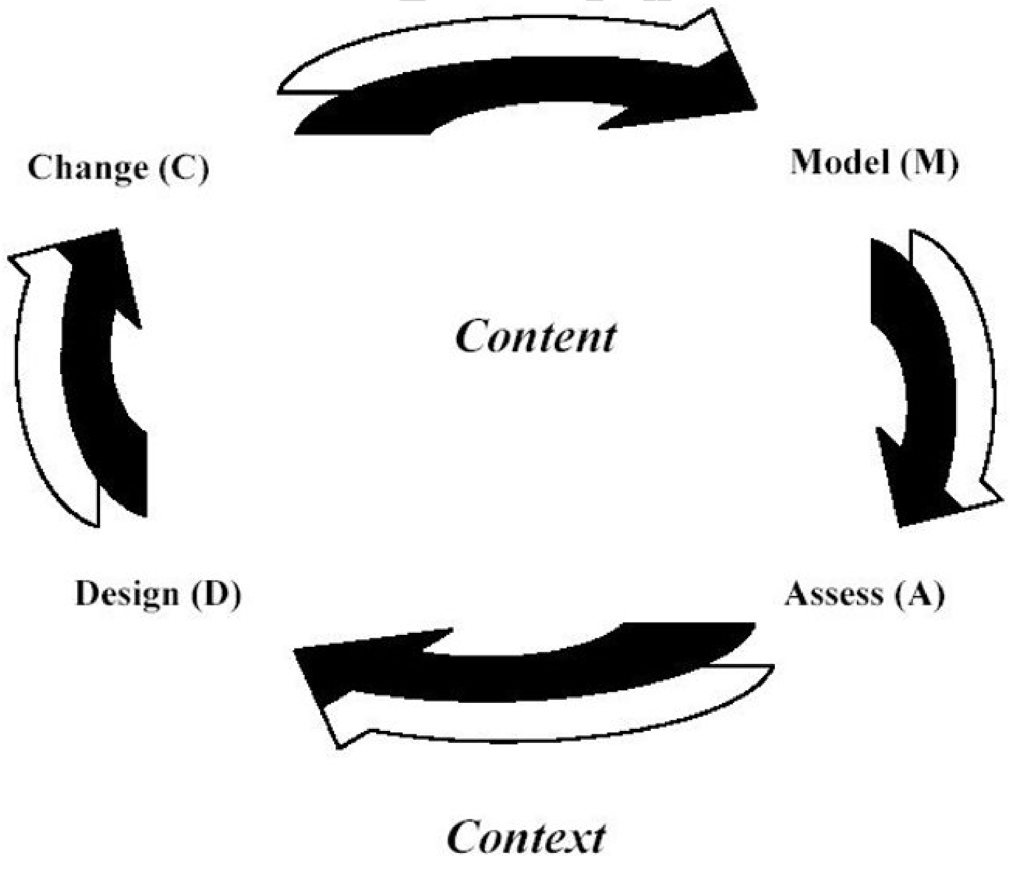

Figure 1. Integrative Systems Methodology: An Overview.

Modeling includes tasks such as ascertaining relevant perspectives, the goals and factors critical for attaining those perspectives, surfacing issues, and elaborating models. Assessing includes tasks such as apprehending the dynamics of the system, simulating and exploring scenarios, and interpreting and evaluating simulation outcomes. Designing includes tasks such as ascertaining control levers, and designing strategies and action programs. Under the term “change” are all the tasks that encompass the realization of strategies and action programs. Other terms such as “realizing” or “bringing about change” would also be appropriate.

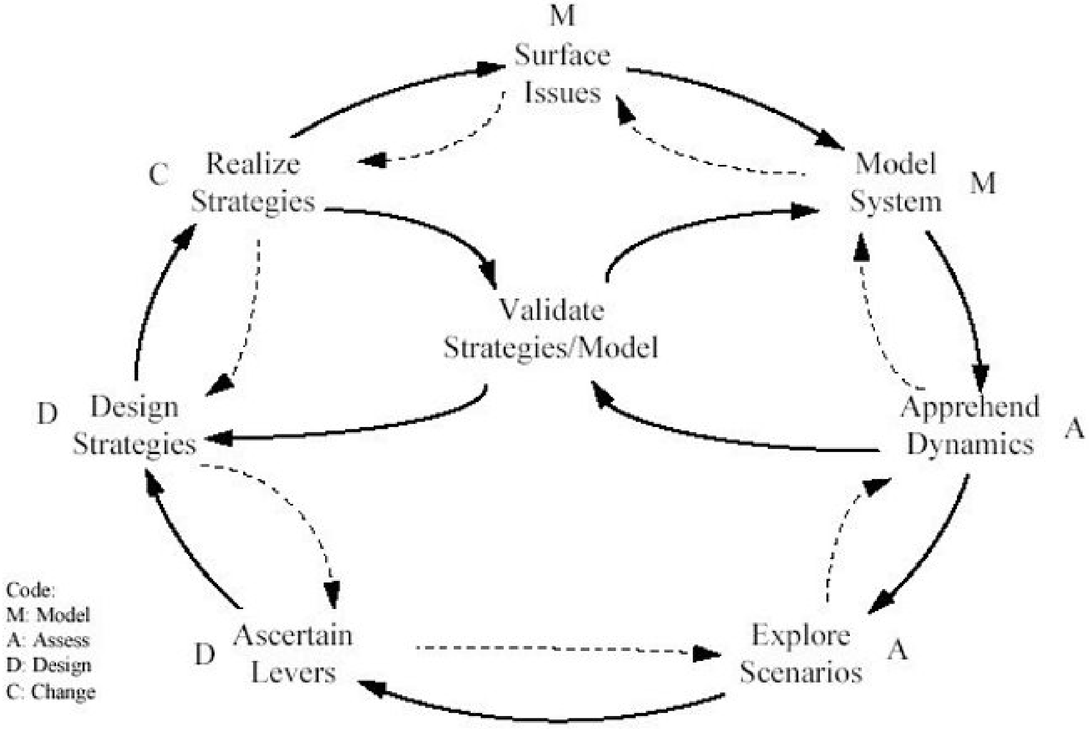

Figure 2. ISM-Integrative Systems Methodology - Heuristic outline for handling the content and the context dimensions.

The more detailed diagram (Figure 2)—which builds on MNT—gives concrete hints concerning the nature of the process at the levels of content and context. The sequence outlined is almost self-explanatory, but some aspects need clarification. First, the number of discrete types of activities could also be changed to a few more or less. However, the current number seems reasonable: the number of activities presented is big enough for the sake of making sound distinctions, and small enough for handling it in a sovereign manner (“The magical number seven, plus or minus two” of George Miller). Second, the practice of handling complex matters superbly implies more of a reticular picture of the activities outlined, which the simplified diagram expounds sequentially. For example, in a strategy-making process, there often is a loop which links the steps of strategy design, exploring scenarios, and ascertaining levers, that passes through many iterations. Third, the issue of the quality of models and strategies is of prime importance to ISM. Therefore validation is an activity which is located at the center of the process diagram. Linked to the chain of activities via two main loops, it is conceived as a crucial, ongoing endeavor to ensure the validity of models and strategies.

The process of validation must not be limited to the application of a few statistical tests. In the context of systemic modeling and design, a whole set of tests, structural and behavioral, theoretical and empirical, need to be applied in combination. A good introduction to validation techniques is provided by Barlas.

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Biographical Sketch

Markus Schwaninger is professor of management at the University of St. Gallen, Switzerland. His research is focused on Managerial Cybernetics and System Dynamics, applied to studies of complex socio-technical systems. Research projects to date have been related to organizational intelligence, the design, transformation and learning of organizations, and to systemic issues of sustainability. Schwaninger is author of numerous publications in six languages, including Intelligente Organisationen, Organizational Transformation and Learning (with Espejo and Schuhmann). He has lectured widely and is involved in several international, transdisciplinary research and consulting projects.