Chapter 11
On Methodology: Context and Content

Abstract This chapter gives methodological guidance to support transformational processes rather than occasional problem solving exercises. It offers guidance to manage change in situations where organizations absorb problematic challenges. The methodology is grounded in an appreciation of issues of communication and complexity. It highlights structural shortcomings hindering the implementation of change. The Viplan Methodology puts the emphasis on the distinction between systems as 'epistemological' devices and systems as unities emerging from human communications with closure. Systems are always languaged by observers, but as epistemological devices they are ideas to think about the world; as emergent unities they are constructs to diagnose and improve human communications. Therefore systems are not only bounding ideas but also the 'real world' communicative processes that underpin the quality of the ideas created and produced by a collective. For diagnosing and improving organization structures the methodology uses the Viplan Method. Diagnosis can help seeing the necessary structural changes to improve communications of stakeholders in change processes. This is a methodology to understand both systemic shortcomings and to work out desirable improvements.

This chapter explores a methodology for problem solving grounded in the Viable System Model. The VSM is a powerful construct that helps our thinking about organizations; however its use is often in response to problematic situations. In our practice it is not modelling the organization for its own sake that triggers its use but the fact that we are constantly confronting transformational situations. The value of the VSM is that it helps seeing these situations in holistic terms as part of learning processes.

Beer's following words summarize what we want to overcome with the Viplan Methodology (VM):

> We are the inheritors of categorized knowledge; therefore we inherit also a world-view that consists of parts strung together, rather than of wholes regarded through different sets of filters. Historically, synthesis seems to have been too much for the human mind – where practical affairs were concerned. The descent of the synthetic method from Plato through Augustine took men's perception into literature, art and mysticism. The modern world of

R. Espejo and A. Reyes, *Organizational Systems*,
DOI 10.1007/978-3-642-19109-1_11, © Springer-Verlag Berlin Heidelberg 2011

> science and technology is bred from Aristotle and Aquinas by analysis. The categorization that took hold of medieval scholasticism has really lasted it out. We may see with hindsight that the historic revolts against the scholastics did not shake free from the shackles of their reductionism. (Beer 1980)

The VM is a response to our entrenched reductionism. Fragmenting complexity is often easier and more manageable than bringing parts together; however reductionism in social situations is more likely to produce undesirable consequences and inadequate performance. In this chapter we use the VM as a joining up instrument to deal with the multiple transformational challenges that we confront today in all kinds of enterprises, large and small.

Mapping an institution or a set of institutional parts onto the model is a starting point but not enough to get the best out of it. Once the mapping is done, often the question is: and now what? Equally, broad diagnostic points may be insightful at a first glance but they seldom help to uncover deep systemic failures. The VSM contributes with systemic insights to effective organizational learning processes (Espejo et al. 1996).

Diagnostic points such as asserting that a company has inadequate intelligence and policy functions or that the policy function has collapsed onto the cohesion function are fine but the model can offer less obvious insights than finding out that management is short sighted and inward looking and that the organization lacks vision. Seldom relevant situations are as clear cut as suggested by these examples; it is in the assessment of relationships that the most insightful diagnostic points are found. For instance, to find out that an organization is being weakly challenged by environmental agents and that as a result of this its intelligence function is not developing a deep grasp of the 'outside and then' and therefore that this function is not challenging effectively those trying to grab resources for the organization's 'inside and now' gives us a deeper insight about the shortcomings of an organization's policies. In this example people experiencing the situation may be aware that the enterprise is missing market opportunities or that managers are recurrently unaware of environmental challenges that have the potential to influence the company's performance. These are the common ways managers experience and express their difficulties; it is the systems thinker that needs structuring the situation to help seeing the situation in relational terms. This kind of thinking is what we want to support with the Viplan Methodology (VM).

We all experience problematic situations and express them in our idiosyncratic terms. As we plod ahead with conversations new evidence helps structuring situations in one form or the other. This is a process of situational clarification that may lead to corrective actions. If the situation recurs, further enquiries may follow coupled to more action in an effort to learn from the situation. These are common learning loops triggered by a variety of symptoms. Our view here is that this learning can benefit from systemic thinking grounded in organizational cybernetics. This is the methodological challenge that we discuss in this chapter.

In this chapter we discuss first some of the philosophical underpinnings of the methodology. Secondly, we clarify how the VSM helps contextualising the symptoms that people experience as they try to make sense of problematic situations.

We argue that the learning triggered by problematic situations is enhanced if it happens in an organizational context that enables distributed performance. Thirdly, the methodology is presented as the embedding of situational learning loops in cybernetic organizational loops. It is necessary to make the organizational context of a problematic situation more effective; these loops are at the core of the Viplan Methodology. Finally, to make this methodology more accessible we offer its full application to nuclear waste management in Sweden.

System thinkers ask questions about resources and their relations. These are questions that people encounter and answer one way or the other as they operate in any organization. If the situation is an implementation failure then questions about the implementers' competencies may be necessary but certainly not sufficient. Among many, questions about relations and resources as well as about related organizations are necessary. These are necessary to make meaningful implementation shortcomings. It is this systemic context that needs clarification. The VSM gives us a wide range of questions to test whether the complexity management strategies of implementers have been adequate or not. Furthermore the VSM gives us heuristics to improve the situation. Though improving problematic situations can be achieved in the short term by treating symptoms, in systemic terms improving the structures underpinning them gives a much stronger and durable improvement. It is the interplay between people's experiences and the structural context of these experiences that concerns the Viplan Methodology. This interplay between content and context happens in both directions; on the one hand problematic symptoms may well be signals of yet unseen structural deficiencies, on the other glaring structural weaknesses may underpin classes of problematic situations.

Our discussions of complexity in Chaps. 3 and 4 made apparent that organizational actors are confronted by an unknowable variety and often an unmanageable complexity. They use models that trigger many distinctions that give them the impression that they are controlling the situation, however unless these distinctions are matched by effective actions they will be lost. And, the need for this matching makes apparent that distributed performative learning processes are necessary. Actors have to increase the effectiveness of their complexity management strategies. New distinctions emerging from a situation may require more ingenuity to deal with them. It is the collective evolution of shared models and distributed performance that may make situations more transparent. To make situations more transparent problem owners depend on communications among themselves and with a wide range of stakeholders. Actors require negotiating meanings among them and together finding effective means for action (i.e., learning). *The cybernetic point here is that these communications are often restricted by the structures in which actors operate*. Who are the relevant participants in these communications? This is critical to establish the strategies for managing complexity in problematic situations. Indeed it is not the analytical skills of a few people creating sophisticated models that will ground these meanings in the organization and improve its performance. Even the analytical skills of many actors may not be enough for this purpose if they are not the *right ones*. These are important epistemological and methodological issues. Who are the right participants in a situation?

What are the relevant communications that need attention? How do we know who should be involved in the relevant communications?

Actors construct problem situations in their conversations (Maturana 1988; Glasersfeld 1995); this is a relational approach where actors develop their appreciation of the situational complexity as they experience new challenges for which they need to find new responses. Their existing response complexity may not be enough to handle these situations. They need to relate distinctions to response capacity in loops of circular causality. This is an ingenuity challenge (Homer-Dixon 2001). Different participants articulate differently these problems; they have different experiences. In a methodological sense they are *naming different systems*. The challenge is making explicit these systems to support their communications. These communications are at the core of making sense of situations. Through them actors make explicit their tacit conceptual models and as they negotiate these models possibly they agree actions to influence the situation. Learning happens if these *learning loops* trigger effective action in the shared action domain. For this purpose the key issue is to have the right participants in these communications. Without the right participants necessary inputs to appreciate better the situational complexity may not be available, nor may resources reach those who can produce effective action. This is where the VSM plays an important role. Problem situations don't happen in a vacuum; they are embedded in organizations of one kind or another. Just as *naming organizations* was offered as a methodological tool to find out about structures (see Chap. 7), naming systems for performative situations is suggested as a methodological tool to focus attention on these situations. This is a variation of Checkland's issue based root definitions (Checkland 1981, 2000).

Organizational names provide a platform to diagnose the structure of relevant organizations (as discussed in Part II). As these structures are improved, necessary actors are involved and resources reconfigured and deployed. The participation of the right actors, for the shared purposes, improves the quality of conversations, which in its turn improves the recognition of relevant actors and resources, thus increasing the collective appreciation and management of problem situations. This is the *cybernetic loop* to deal with problem situations. It is apparent that there is an interplay between the learning and cybernetic loops. The VM aims at clarifying further this interplay.

> The heuristic for problem solving of the Viplan Methodology is involving the relevant participants in situational conversations and creating effective communication mechanisms between them to deal with the problematic situations to the best of the organization's available resources.

While the idea of naming systems comes from Checkland's Soft System Methodology (SSM), our understanding of systems is significantly different; the Viplan Methodology (VM) has evolved within a constructivist rather than phenomenological framework. The philosophical position of the phenomenological stance gives primacy to the mental processes of observers rather than to the external world (Checkland 1981, p. 305), while the constructivist stance gives primacy to the communications producing coordinated action, thus constituting the life-world.

This clarification is necessary since we share with SSM its emphasis on purpose, learning and appreciation but the VM emphasises that *human communications produce systems in the life-world* rather than *human activity systems* helping to think about the world. The emphasis of the VM is managing complexity to enable learning in related change processes.

Maturana's statement that 'everything said is said by an observer to another observer that could be him or herself' (Maturana 1988, p. 27) is of significance. Whatever view we might have about a reality independent of ourselves, it is apparent that that *reality* is construed by observers. As already said we emphasise the distinction between systems as *epistemological* devices (Checkland 1981) and systems as human communications with closure (cf. Chap. 1). Systems are mental constructs, because in the end they are always languaged by observers, however in the first case they are constructs of ideas for thinking about the world and in the second they are constructs of people's relationships (with closure) in the world. Systems are not only bounding ideas to make sense of the life-world, but are bounding communications. The related communicative processes are critical to the construction of *reality*. It is this last aspect that makes of communications and complexity such important concepts in the Viplan Methodology.

Communications constitute the operational domain of participants in an action domain where they communicate and coordinate their actions (see Chaps. 3 and 4). In contrast, the informational domain is the domain where people reflect upon their relevant worlds. In this epistemology the models in-use (that is, the operational models as opposed to the models in the informational domain) are not representations but constructions emerging from networks of communications. The valuable aspect of this distinction is that anyone can think and reflect about an organization, something that, if the opportunity is seized, may give to the organization a huge potential for innovation and creativity, however if in the end these reflections are not geared with the organization's processes, these reflections remain as irrelevant in the organization's informational domain. Problem formulation may be in the operational domain of a think tank; their domain of action is problem structuring. But, to be in a particular organization's operational domain this structuring has to be the outcome of processes producing this organization. However, if problem structuring is weakly articulated with the organization's implementation processes these reflections will not be embodied in that organization's structure.

The organization's performance in its environment is constituted by the myriad communications among actors and between them and external agents. In this context disembodied problems remain as constructs shared by strategists but not by the organization. The other way around is also interesting; if the communications of actors produce high organizational performance in the environment, which has not been explicitly reflected by them, it would appear that they are implementing a very successful tacit *strategy* (see the example of a car manufacturer in Chap. 5). What is important to reinforce is that the complexity of the organization is in its operational domain and though conversations in the informational domain could be extremely useful to speeding up learning processes if they are not structurally coupled within the organization, they may remain as valuable ideas

but not more than that. However, in organizations it is natural to expect that over time multiple informational domains will transfer to their operational domains.

As for the epistemological grounding of naming systems the Viplan Methodology understands them as constructs of life-world transformations. Furthermore we can say that while the phenomenological stance gives priority to the informational domain the constructivist stance gives priority to integrating the creation and production of meanings in the operational domain. What is significant is that the emphasis of the Viplan Methodology is *creating and producing meanings* through the effective communications between the *right actors*. It is clear that unless an effort is made in this direction reflections will remain outside the organization's boundaries.

The VM aims at increasing the chances of creating meanings that are aligned both with the collective's purposes and its operational capabilities. How do we increase the chances for the *right participants* to trigger these new meanings and how do we increase the chances for these new meanings to trigger effective action? For transformative situations it is important to clarify the context in which meaning creation and production take place. Often this context is not a particular institution or enterprise; it can be a number of groups, people, institutions and/or institutional parts. The challenge is to understand their systemic contribution; are they contributing to the policy, intelligence, cohesion, coordination or implementation functions of what organization? And how are meaning creation and meaning production intertwined? This intertwining is complex and happens at multiple structural levels. These are methodological issues for the VM.

Transformative situations are appreciated differently by the participants. These appreciations are grounded in culture and more specifically in the distinctions that these participants make about the situation. We have already argued that a transformative situation makes necessary new distinctions and also makes necessary new practices to improve performance; in other words the participants have to recognise and develop new complexity about the situation (as explained in Chap. 3). Developing complexity requires creativity. This is the purpose of a wide range of possible modelling techniques, starting from simple conceptual models (Checkland 1981) going to sophisticated complex adaptive models (Arthur et al. 1997). But more than modelling and new distinctions it is necessary performative responses in the life-world. These responses, using the language of this book, are amplifiers of the variety created by those contributing to modelling the situation. These responses are resource enabled communications, leading to the coordination of actions among organizational actors and between these and environmental agents. These communications are intended as complexity management strategies. These are structural couplings where participants make sense of their communications and hopefully steer them in directions that are aligned with the organizational shared purposes.

In summary, the Viplan Methodology is a methodology to increase the chances of coordinated actions in an organization, with the purpose of aligning participants' actions with the requirements for organizational viability. This organization is not necessarily a well defined institution or enterprise; working it out is in itself a methodological challenge. We have said that however relevant might be

distinctions and practices in a domain different to this organization's action domain they will remain in its informational domain. Distinctions and practices need to be incorporated in the organization's operational (action) domain. This incorporation, when it happens, may lead to developing transformative complexity to deal with break experiences (Fig. 3.5 explains these learning processes).

We now explain more in depth the Viplan Methodology and its use. Two loops are necessary to explain the VM; the (*situational) learning loop* and the *cybernetic (organizational) loop* (see Fig. 11.1).

The *learning loop* depicts the situation from the perspective of observer participants. These observers may or may not all be actors of the performative situation; however together they create new insights from within and/or outside the situation. This loop's purpose is supporting situational appreciation. Actors naturally experience, over time, breaks that trigger performative situations; problems or possibilities. They experience these breaks as changes that trigger the need to language new distinctions and incorporate new practices; both as individuals or organizations they are learning along the way. The learning loop is no more than the well known 'observe-analyse-design-implement' loop (Kim 1993). Here the loop is discussed from a methodological stance.

Learning loops relate to all kinds of performative situations from public participation in policy processes, educational failures, innovation breakthroughs, introduction of best practices in an industry, absorbing significant climatic changes, or dealing with structural weaknesses. Observations increase participant's sensitivity

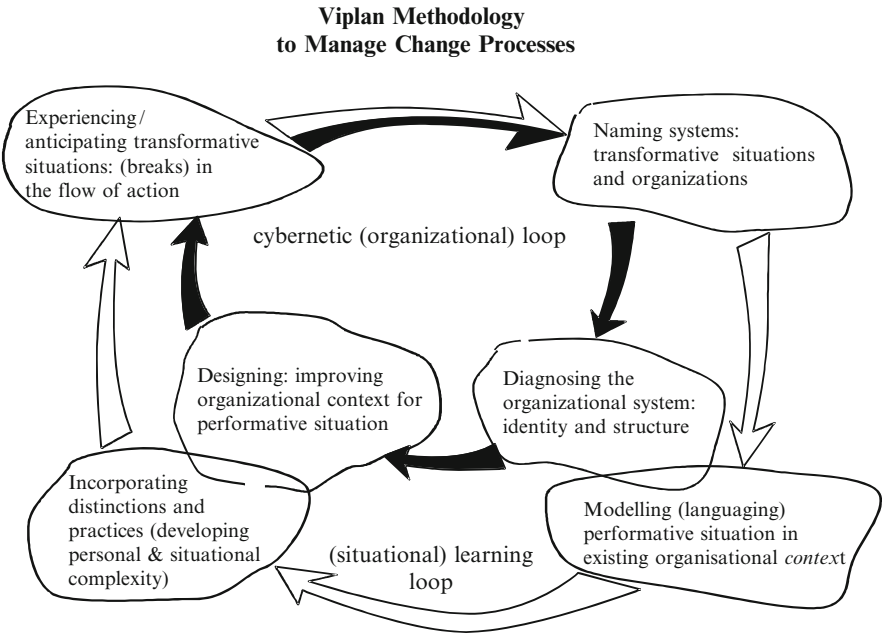


Fig. 11.1 The viplan methodology to manage change processes

to breaks of all kinds. Methodologically enhancing and improving participants' observational capabilities is a major issue and we don't delve in it (see Zeeuw 2004).

However, participants construe situations differently; they may share the same inputs (or signals) but construe them differently; they are structure determined. Individuals or groups express their *viewpoints* as they construe situations. This construing happens naturally as people converse with each other and share their appreciations of the situations at hand. From our methodological perspective the concern is making explicit these constructs emerging from human communication systems.

Our emphasis, as already said, is on human communication systems, which emerge from the closure of people's communications. It is this closure that makes them distinguishable to observers, who name systems from their particular viewpoint. It is clear that several if not many meanings can emerge from the actors' interactions. However, in the VM a primary concern is working out the meanings *created* by participants and stakeholders about performative situations. Different viewpoints assess the situation differently and name, tacitly or explicitly, different systems. Some of these names may lack insight others may be insightful but all are relevant if produced by relevant actors. In all cases the systems we are interested in are those focused on real world transformations. We use the mnemonic TASCOI to clarify the participants (see Chap. 7):

T: Transformation (what inputs are transformed into what outputs)
A: Actors (those producing the transformation)
S: Suppliers (those providing the inputs to this system)
C: Customers (those receiving the outputs of the system)
O: Owners (those responsible – accountable – for the values and the resources used by the system)
I: Interveners (those setting the parameters within which the system operates)

TASCOI, as explained in Chaps. 7 and 8, is a tool to name meaningful chunks of complexity in the world.[1]

This concise naming of observations is the second activity of the VM. Names are platforms to enhance the participants' appreciation of performative situations. Often these names for the transformations relevant to the situation are produced by *enabling viewpoints*.

Modelling the situation is the third activity of the learning loop; this modelling underpins languaging the situation in a process similar to that illustrated in Chap. 3 (see Fig. 3.5). Languaging helps articulating new distinctions, so far not appreciated, relevant to the situation. This is a conversational process supported by different forms of modelling; going from conceptual models as used in the COMLIS example of the previous chapter to communicative action models as illustrated by the Swedish nuclear waste management issue below. Any form of

[1]See note 8 in Chap. 7.

modelling can be used to increase the participants' appreciation of a shared situation. Modelling is a means to make distinctions that are relevant to the problem situation. Methodologically this modelling at early stages is likely to happen in the informational domain of the relevant organization; however the idea is to involve over time the *right actors* in this process. The aim of this modelling is to increase the participants' understanding of the shared situation in the organization's operational domain. The purpose of naming systems and modelling activities is to use them as catalysts of relevant situational conversations in the methodology's fourth activity (i.e., incorporating distinctions and practices).

Incorporating the distinctions made in the informational domain is the fourth activity of the learning (outer) loop in our methodology. For this the *right people* need to be involved in the situational conversations. The cybernetic loop will come, as is explained next, to our rescue for this purpose. The related issues of appreciation and implementation are of particular significance in this activity. As it is the case for Checkland's methodology, Vickers' idea of appreciative systems (Vicker 1970) is relevant to this methodology. It is apparent that through time, in healthy learning processes, with the right participants and communications, participants develop a more sophisticated view of situations. Their individual and situational complexities develop. Relevant conversations enrich their situational constructs, which help them to adjust their judgments of facts (what is the case?) and values (is this good or bad, acceptable or unacceptable?), developing in the process desirable relationships. The participants' actions keep appreciative processes evolving; they make decisions and implement desirable transformations. Though the incorporation of new distinctions may produce personal learning, methodologically we are interested in organizational learning, that is, in the development and incorporation of organizational practices (Espejo et al. 1996, Chap. 7). Participants need involvement in collective change. This is action in the situation's operational domain, which closes the loop by triggering new observations about the situation.

How good is the quality of the learning process? To what extent are actors appreciating the consequences of their actions? Key to these assessments is the organizational system giving context to the problem situation. We have made clear that organizational systems are different to formal institutions (see Chap. 5); through self-organization resources come together to produce organizational systems with different boundaries to those of the most obvious formal institutions related to the situation. The Swedish example below will illustrate this idea of organizational system. Performative situations may or may not be contained in particular institutions; often they are shared by several institutions and/or institutional parts. However, one way or the other, we postulate that they have a systemic embedding. The situation may emerge from relation within the system or from relation with environmental agents; in all cases we identify an organizational system, which provides the context to the situation. Working out which is this system and diagnosing the quality of its relationships is the concern of the cybernetic (organizational) loop of the methodology. Discussions in the previous four chapters have illustrated methodological aspects relevant to observing organizations. Here we want to highlight the significance of naming organizational systems relevant to

particular performative situations. These are the systems where relevant change processes are expected to happen. These are the systems that focus the study of complexity management and support systemic thinking. These names help us to work out the stakeholders relevant to the situation.

From interviews, workshops and related observations it is possible to hypothesise the organizational system relevant to the named situation. We *name* this organizational system. Weaknesses in some of its relationships may be the root of the performative situation. Equally, effective structures may open new possibilities; perhaps additional resources and new relations may be necessary to enable the reconfiguring of resources to overcome currents constraints. The purpose is producing effective complexity management strategies.

Organizational learning is triggered by current breaks or by symptoms anticipating possible breaks in the organizational system. We name these systems and model their strategies to manage complexity using the VSM and the Viplan Method; these models identify relevant systemic roles and their relation. All this may happen in the informational domain, however, methodologically, if possible, it makes sense to involve the relevant actors. Methodologically we are naming the relevant organizational systems to the situation; we are naming the system and working out participants with the support of TASCOI. In fact each named system is a working hypothesis (see Swedish illustration). We diagnose the organization's structure and design improvements using the Viplan Method. Reconfiguring the resources and relations directly related to the problem situation is the main purpose for this diagnosis and design. This reconfiguring may be led by experts. However, the fourth activity of the cybernetic loop – concerned with producing necessary structural changes (i.e., reconfiguring the use of resources and their relations) – happens in the operational domain; participants stretch each other using all their political and communicative practices. This is a transformational process in the operational domain which is dealing with the context of the problem situation.

Anticipating possible changes, by improving the organization's structure, is an important aspect of the Viplan Methodology. This is the cybernetics of anticipation. Capacity to anticipate breaks is not forecasting specific events but building structural capacity to deal with the unforeseeable. In the next chapter we argue that by observing particular symptoms it is possible to diagnose structural and identity problems, we call them archetypes, which may hinder the anticipation of possible breaks. This is systemic thinking in practice. Equally, experiencing breaks as opportunities for higher organizational performance is of particular interest to us in this methodology. This relates to reconfiguring resources and developing new capabilities (Teece 2008).

From a processual perspective the *enabling viewpoint* is improving the *cybernetics of the situation*, that is, improving the complexity management of the situational context. This is the point of *intersection of the cybernetic and learning loops*; we can now answer questions about who should be the situational participants. These are the roles that should ground the learning loop's modelling work in conversations between the right stakeholders.

The Viplan Methodology (VM) guides change processes in the relevant organization. As such, in general, it is used as a heuristic for learning rather than as a contrived, formal framework for problem solving. The activities of the learning and cybernetic loops are pointers for thinking over time rather than activities that need to be followed in sequence. Iterations between them are natural and may take place over relatively long periods of time. In the end the methodology is fundamentally heuristic. No doubt the cybernetic loop requires studying the identity and structure of relevant organizations and for this the Viplan Method is used, however flexibility in its application is paramount. What is necessary is having good catalysts or enabling viewpoints, with a critical perspective, of change processes. Actors need not know about the methodological tools in use, though in practice they will be aware of their systemic epistemology. The VM facilitates change processes as participants articulate and implement new policies and/or programmes. Often these change processes produce significant breaks and the challenge for actors is absorbing the implications and possible consequences of these changes for their own good and for the good of the affected stakeholders. This is an issue of boundary judgments that is fundamental for ethical changes.

The last part of this chapter illustrates the use of the Viplan Methodology. This methodology has been applied in a wide range of situations, mainly with clients in processes of intervention and also in research (Bowling and Espejo 2000). It has been applied in large manufacturing companies, banks and also in policy studies (Espejo and Gill 1998, p. 4; Andersson et al. 2004, p. 8, 2006). Recently it has also been applied by Harwood in SMEs (Harwood 2010). An application of this methodology over several years was done by the book's first author for the management of nuclear waste in Europe (Andersson et al. 1998, p. 5, 2004, p. 8, 2006); an aspect of this application is illustrated in what follows.

In recent years nuclear energy is receiving a great deal of attention; the use of fossil fuels for energy generation is becoming more restricted as their extraction becomes ever more difficult and their environmental impacts become clearer. For many, even for people who opposed it in the past the option of nuclear energy is becoming more attractive; however a significant problem affecting its development is the long-term impact of its waste. What to do with it? The problem was considered of sufficient significance by countries like Sweden and Germany to decide to set time limits for their nuclear energy programmes. In any case the disposal of existing and future waste needs a solution. A favoured option is its disposal in deep repositories underground. However, beyond technological and geological issues, a key problem is acceptance by the affected communities of repositories in their backyards. At the same time, over the past decades, communities are increasingly aware of their rights and the fact that in democratic societies it is unacceptable for central governments to impose unilateral solutions. In fact, in countries like Sweden, with long democratic traditions, the process of finding a site for this waste is taking decades rather than years. Licensing a proposal for a repository is increasingly more difficult and requires the full participation of the affected communities. They are not prepared to accept solutions already agreed by the experts; they expect participation in the appreciative process from the beginning

and this poses difficult challenges to politicians and experts. In particular these communities are concerned with the legitimacy of decision processes and the authenticity and scientific competence of the experts involved in the related studies. It is in this context that the Swedish nuclear regulators (SKI: the Swedish Nuclear Power Inspectorate, and SSI: the Swedish Radiation Protection Institute) asked to energy and cybernetic experts an appraisal of government and private institutions' communications with affected communities.

Interviews with key individuals, workshops with the regulators' representatives and a Team Syntegrity (Beer 1994) meeting with participation of Swedish and British players (Andersson et al. 1998, p. 5) gave to the team responsible for this study a deeper appreciation of nuclear waste management in Sweden. This appreciation of the situation highlighted some of the issues involved in the interactions between experts, policy-makers and external stakeholders in the communities potentially affected by the proposal of a deep repository. What was the meaning of the proposed repository? Was it a 'waste container' as seen by private sector companies or was it a 'safe container' as those with a public concern suggested? These two different identities for the Nuclear Waste Management System appeared at the core of the problem situation.

These two names emerged for the situation: one emerged as a public concern and the other as a private concern. Though safety was *increasingly* paramount for all concerned, there was evidence that *tacitly* resource allocation did not always follow this priority. Eventually, in line with much of the debate that had taken place in Sweden through the early 1990s, the issue was seen as the *transparency of policy decisions*, which was understood not only as an issue of making information available to stakeholders but of building up effective communications among institutions focused on nuclear waste management and between them and the communities. The study of these interactions was the beginning of the application of the Viplan Methodology to the Swedish nuclear waste management programme (Espejo and Gill 1998, p. 4).

From the perspective of the cybernetic loop the problem was defining the organizational system embedding this problem of transparency. Considering the above discussions two hypotheses were advanced for the Swedish Nuclear System;

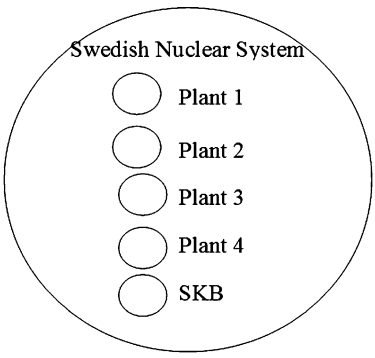


Fig. 11.2 Hypothesis 1 (the Swedish Nuclear System example)

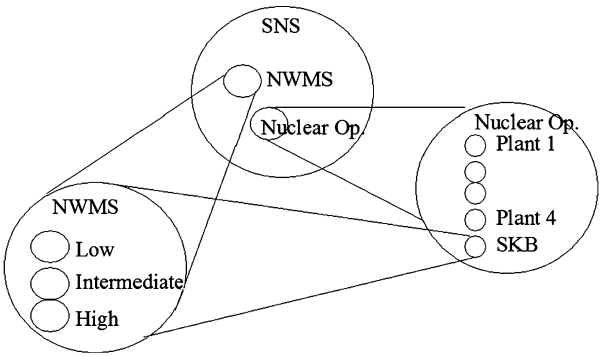
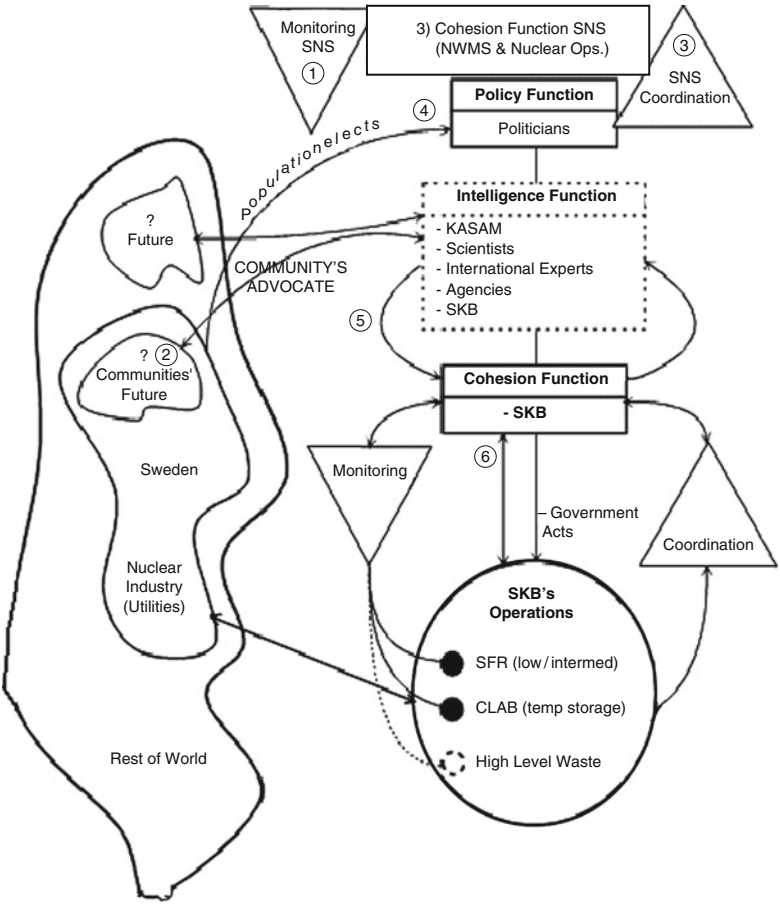


Fig. 11.3 Hypothesis 2 (the Swedish Nuclear System example)

the first (Fig. 11.2) put the emphasis on the Swedish Nuclear Fuel and Waste Management company (SKB) owned by the nuclear plants. Together this waste management company and the nuclear plants constituted a privately-owned Swedish Nuclear System (SNS). In this perspective they were referring to what people saw as a commercially oriented organizational system operating in the regulatory context of the Swedish Ministry for the Environment. The second name put the emphasis on the public responsibility of nuclear waste management (Fig. 11.3). The hypothesis was of a publicly accountable Nuclear Waste Management System (NWMS), which included all the government resources focused on nuclear waste management and the privately owned SKB, which, together with the Nuclear Operations constituted the SNS. This second hypothesis made apparent that the unclear identity of the NWMS, most certainly, had an influence in its transparency. The identity of this system was blurred in the eyes of the people. Was the NWMS identical to SKB as in Hypothesis 1 (a private enterprise) or was it a publicly accountable system as in Hypothesis 2? It was necessary for transparency purposes to clarify the system in focus. While SKB had a good reputation as a private sector organization, the NWMS was more than SKB; it also included a number of other public resources, such as the National Council for Nuclear Waste (KASAM) and parts of the Ministry of the Environment, SKI and SSI. Was the nuclear waste management system an organization driven by the private ethics of commerce or was it driven by the ethics of the public good. This issue dominated discussions with SKB and more generally with stakeholders. In the end it was clear that the system in focus was the public Nuclear Waste Management System and not SKB alone. This agreement made clear the need to study the quality of the communications within the NWMS and between this system and the communities. SKB's organization structure was considered in general good, but it was more difficult to say the same about the NWMS.

A mapping of the NWMS resources onto the VSM is in Fig. 11.4. This mapping was intended as a platform to discuss the communications and systemic roles of different institutions in the SNS and NWMS. In Fig. 11.4 the system in focus is the NWMS, except for the two triangles and box at the top of the figure, which relate to



Systemic roles of SKI/SSI

Role 1: as regulators monitoring total industry

Role 2: as stretchers of NWMS Intelligence Function (Community ´s advocate)

Role 3: as auditors of operational coordination between NWMS and Nuclear Ops

Role 4: briefing Government Ministers on nuclear matters in addition to KASAM

Role 5: as auditors of balance between the Intelligence & Cohesion functions

Role 6: reviewers of SKB 3 year Plan including R & D; authorise spending of Nuclear Waste Fund

Fig. 11.4 Using the VSM for diagnosing NWMS

the higher level of recursion (i.e., SNS). The systemic points that are made in what follows were offered as discussion points rather than as definitive diagnostic points; in the end the issue of communities *stretching* the NWMS became the most insightful. This issue is discussed below. Much debate happened around the diagnostic points; something that helped to increase the appreciation of the structural

context for improving communications between communities and the NWMS. From a structural perspective our key concern was discussing the public sector's auditing of the quality of the multiples communications producing the NWMS; this quality was necessary for transparency (cf. RISCOM Model inWene and Espejo 1999).

The fact that the NWMS, rather than SKB, was the system in focus meant to see the Swedish Nuclear System as a system aligned with the public sector. But this required appreciating the communication consequences of Hypothesis 2; not developing effective communications within this system increased the risk of seeing the NWMS only as SKB, that is, as a private sector enterprise (Hypothesis 1). Of course everyone was aware of the nuclear plants and SKB as private enterprises, however without an awareness of Hypothesis 2 the plants would not be seen as an organizational system in their own right (i.e., Nuclear Operations), constituting the SNS together with the publicly focused NWMS. The fragmentation of a private SNS and public institutions focused on nuclear waste would have made more likely that necessary communications between these institutions, SKB and communities were not considered and developed. And, it also made more likely an overlap of SKI/SSI roles with SKB roles, as it would have required the formers' more detailed regulation of nuclear waste management activities, something that would have been necessary had SKB not been seen as part of the NWMS. These are implications of seeing the SNS as the synergistic interactions of two primary activities: Nuclear Operations and the NWMS. However, are there resources to manage SNS as a whole? This view of the SNS implies that there should be resources focused on the cohesive management of Nuclear Operations and the NWMS. In fact the energy produced by nuclear plants in Sweden has a levy for each distributed kwh, which forms the Nuclear Waste Fund. This fund could be used to develop a mechanism of monitoring-control with a holistic view of Nuclear Operations and the NWMS. This mechanism required in addition to capacity for resources bargaining, the monitoring and coordination of the two primary activities. From this view, which assumed Hypothesis 2, several systemic communications were suggested for the cohesive management of both the SNS (the total system) and the NWMS (one of its primary activities).

In our role of enabling viewpoint and using Fig. 11.4 as a discussion reference we challenged the key situational actors. Questions like: to what extent is there a clear structural difference between monitoring (auditing) the Central Interim Storage for Spent Nuclear Fuel (CLAB) and the Final Disposal Facility for Low and Intermediate-level Waste (SFR) as well as monitoring the NWMS as a whole (systemic Role 1 in Fig. 11.4)? In other words, to what extent is it clear for the regulators the difference between being internal or external auditors to the NWMS? It seems that both SKI/SSI and SKB do the monitoring of CLAB and SFR, albeit in different aspects. What was not clear to us was why should SKI/SSI get involved in monitoring safety indicator limits and not leave that to SKB, keeping for them the responsibility of monitoring whether SKB was doing this job properly? Figure 11.4 shows SKB as the only instance of monitoring its embedded programmes. This is the way it should be in order to avoid possible inefficient overlaps. In a normative

sense we were suggesting that SKI/SSI's role should be monitoring the NWMS as a whole (external auditors) and not its programmes (internal auditors). However, the unwitting fragmentation of the public sector regulators and SKB, a consequence of seeing the SNS as in Hypothesis 1, apparently had made necessary, in the view of the relevant actors, to have SKI/SSI as internal auditors. In systemic terms this situation makes less likely that SKI/SSI will stretch SKB, as implied by the Role 2 that is discussed below.

How are the operational oscillations between Nuclear Operations and the NWMS damped? For instance, are there operational systems in place to avoid, over time, a mismatch between waste management capacity and waste production? What anti-oscillatory systems are in place to align the decommissioning of nuclear plants with the nuclear waste management programmes? These are particularly interesting systems to avoid the uncoordinated development and use of resources in the two subsystems. What's the role of SKI/SSI in this task? Do the regulators have adequate resources to audit how is the SNS dealing with these possible oscillations? This is systemic Role 3 for regulators in Fig. 11.4.

The *implementation function* of the system in focus is the activity of the contractors responsible for SFR and CLAB current waste management operations. This last primary activity is evolving towards a Deep Repository for high radioactive waste. That is the reason for the third circle in dotted lines in the Figure; it will not exist until the deep repository is operational and this is likely to take some time.

How efficient is the 'inside and now' management (the *cohesion function* in Fig. 11.4) of these nuclear waste management programmes? This is the management of existing programmes as approved by government on the advice of the Environmental Protection Agency, SKI/SSI, the Environmental Court and others (Licensing process). While it is clear that SKB is responsible for this management, what are the responsibilities of the public sector regulators? The perceptual illusion of Hypothesis 2 has here an effect. It is clear that SKB negotiates waste management programmes with contractors (Role 6) however we may also expect that SKB negotiates resources with those in the public sector managing the nuclear waste fund. Role 6 takes place at two levels, the internal to SKB and the external between the NWMS and the embedding SNS. Are people's views of these contractors' activities in the communities consistent with the activities these contractors negotiate with SKB? Should these views be inconsistent then people in the communities will fail to experience authenticity in the implementers' operations. Indeed this inconsistency can be seen as a lack of transparency.

The *intelligence function* in Fig. 11.4 is concerned with the outside and then of the NWMS. How are relevant resources integrating their contributions? This question relates to SKB's R&D work on the transportation, encapsulation and disposal of nuclear waste in a deep repository. All this research is considered in the context of social concerns about the long-term effects of this waste to local communities and society at large. This suggests the need to consider the dialogue between these communities and the NWMS (Role 2 in Fig. 11.4). In the interest of society it is important to create independent capacity to challenge the views

and decisions of this system, perhaps in the form of academic centres supporting communities and environmental NGOs, but also in the form of SKI/SSI's role of *communities' advocates*. This is at the core of transparency. Paradoxically, even if it is not apparent on the surface, there is the risk of conflating the interests of society with those of the nuclear industry. This is likely to be the case if those, like SKI/SSI, responsible for society's interests are also made part of the NWMS, by being too close to SKB, as it appears to be the case today (see discussion of Role 1 above). Their systemic role should be creating relevant issues for the NWMS to respond, rather than operating from within. Since it is necessary to regulate the industry at the same time of challenging it, it may be necessary to consider two types of roles, those focused on auditing (Role 1) and those focused on challenging the NWMS. This role of creating challenging complexity for SKI/SSI is Role 2. If for instance SKI/SSI carry out nuclear waste management R&D and de facto operate from within the NWMS, the chances are that their role as *stretchers* of that system will suffer. They will reinforce the NWMS intelligence work from within and thus produce pre-emptive closure, that is, reinforce internal perspectives, rather than stretch directly or indirectly policy making from the outside.

Finally, from the perspective of the *policy function* there is a need to monitor the quality of debates forming policy (Role 5) and to make policy recommendations to government about licenses for SKB (Role 6). In particular it should be considered the quality of the debates between those doing Environmental Impact Assessments (EIAs) for planned developments and those responsible for agreeing NWMS programmes. Is there an adequate balance between the resources available for those operating under the Natural Resources Act (NRA) and those operating under the Nuclear and Radiation Protection Acts? It would appear that if this balance does not exist, and for instance those making decisions under the Nuclear and Radiation acts are much stronger than those under the Natural Resources Act, then, the long-term of the communities may be compromised to the detriment of society at large. This would be the case if those in the cohesion function, that is, those operating under the nuclear acts, have more resources than those in the intelligence function, that is, those operating under the NRA. The argument is that those operating under the NRA should be creating complexity (i.e., issues of concern) for the nuclear industry to take a more enlightened and robust view of the longer term. In order to increase this robustness it is necessary to increase the challenges of society (Role 2) and also increase the quality of decisions within the nuclear system. This improvement of policy processes is Role 5 in Fig. 11.4.

The above discussions braided the learning and cybernetic loops of our methodology. Without intending to offer a comprehensive study of the cybernetics of the situation, the discussions showed the use of the VSM as a *systemic tool* that helped in the discussion of transparency. The NWMS was hypothesised as a viable system and its boundaries and mechanisms were discussed with a focus on the communications of experts and policy-makers with community groups. Perhaps Role 2 was one of the most insightful for this particular situation; stretching guided the response to nuclear waste management of one of the most affected local

authorities. Stretching makes apparent that the system in focus becomes stronger as environmental agents increase their pressure to improve communications within it. This idea of improving communications was seen as essential to making the system more transparent and therefore more trusted by stakeholders.

A good deal of work has followed this initial study making increasingly clear the conditions for a genuine communication between nuclear experts and lay people who know about their local conditions. Communications between those constituting the public sector (e.g., experts and policy-makers) and the private sector (e.g., SKB) and those in the communities (e.g., those communities proposed as possible sites for a deep repository) became the crucial issue. Clarifying the communicative competence of participants in the multiple dialogues in progress became the core of the methodology's learning loop. Indeed, communicative competence is much more than a good organization structure (Habermas 1979). It was more than an issue of experts' scientific competence; it was also about participants' individual authenticity in their interactions as well as actors' legitimacy (see Fig. 11.5). This aspect of communicative competence applied at all levels of meaningful debate, and this was a problem of variety engineering where the recursive model had something to say. It became clear the need to design levels of meaningful dialogue between the local and the global. The design of meetings lacking in requisite variety between senior people in central government and hundreds of community representatives at the same time was replaced by a cascading of dialogues following the recursive structure of the organizational system (see Fig. 11.6). The triangle of communicative competence together with the Viable System Model became the

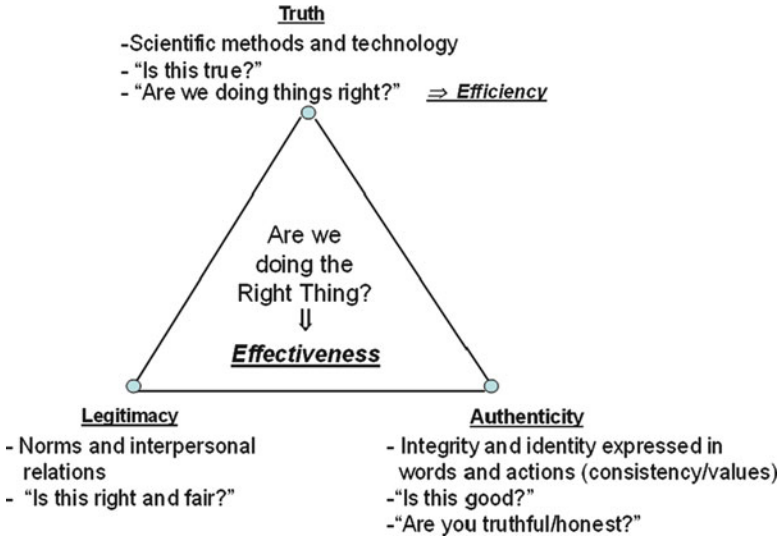


Fig. 11.5 Communicative action: a competent speaker makes three claims that he is willing to redeem
Source: Wene and Espejo 1999

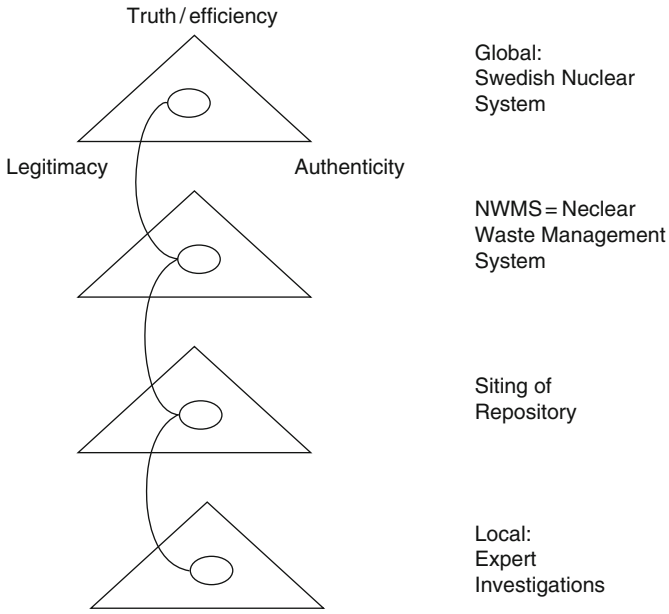


Fig. 11.6 Levels for meaningful dialogue (Source, Wene and Espejo 1999)

cornerstones of the RISCOM Model (Wene and Espejo 1999), which was developed over a number of years. RISCOM has spearheaded significant work for transparency in nuclear waste management in Sweden in the last few years (Andersson et al. 2003, p. 32).

The Viplan Methodology in nuclear waste management was used with all the sophistication of its structuring and modeling requirements. Issues and organizations were named; the structure of the NWMS system was studied and its braiding with the issue of transparency gave significant insights. These were efforts in the informational domain of the institutions involved. However, a number of workshops, including the Team Syntegrity meeting, work of stakeholders in the communities and multiple conversations with policy-makers and experts took the outcomes of this work into the operational domain of the NWMS where it has had significant influence (Andersson et al., 2004, p. 8).

The VM is offered as means of overcoming reductionism in dealing with performative situations. Often this reductionism is the outcome of our inability to deal with the huge complexity of our world. This *recursive methodology* offers a heuristic to counteract fragmentation and to design communications with requisite variety. This is going to be further explored in the next chapter of the book, where structural and identity archetypes of systemic problems are discussed.

References

Andersson K, Drottz-Sjöberg B-M, Espejo R, Fleming PA, Wene C-O (2006) Models of transparency and accountability in the biotech age. Bull Sci Technol Soc 26:46–56

Andersson K, Espejo R, Wene C-O (1998) Building channels for transparent risk assessment, RISCOM pilot study. Swedish Nuclear Power Inspectorate, Stockholm, Sweden, p 5

Andersson K, Wene C-O, Sjöberg B-MD, Westerlind M (2003) Design and evaluation of public hearings for Swedish site selection. SKI Report, Stockholm, Sweden, p 32

Andersson K, Westerlind W, Atherton E, Besnus F, Chataîgnier S, Engström S, Espejo E, Hicks T, Hedberg B, Hunt J, Laciok A, Leskinen A, Lilja CM, Pierlot S, Wene C-O, Vira J, Yearsley R (2004) Transparency and public participation in radioactive waste management. RISCOM II final report. SKI Report, Stockholm, Sweden, p 8

Arthur WB, Durlauf S, Lane DA (1997) The economy as an evolving complex system II: proceedings of the studies in the sciences of complexity. Perseus Books, Reading, MA

Beer S (1980) Prologue to autopoiesis and cognition by Humberto R. Maturana and Francisco J. Varela (*Autopoiesis and Cognition*). Riedel Publishing, Boston, MA

Beer S (1994) Beyond dispute: the invention of team syntegrity. Wiley, Chichester

Bowling D, Espejo R (2000) Exploring computer supported cooperative work in a retail bank. In: J Allen and J Wilby (eds) ISSS 2000 Intenational Society for the systems sciences: accession number 20151. CD-ROM, Toronto

Checkland P (1981) Systems thinking, systems practice. Wiley, Chichester

Checkland P (2000) Soft systems methodology: a thirty year retrospective. Syst Res Behav Sci 17:11–58

de Zeeuw G (2004) Fighting for science. Kybernetes 33(3/4):717–725

Espejo R, Gill T (1998) The systemic roles of SKI and SSI in the Swedish nuclear waste management system. SKI Report 98, Swedish Nuclear Power Inspectorate, Stockholm, p 4

Espejo R, Schuhmann W, Schwaninger M, Bilello U (1996) Organizational transformation and learning. Wiley, Chichester

Habermas J (1979) Communication and the evolution of society. Beacon Press, Boston, MA

Harwood SA (2010) The management of change and the cybernetic methodology in practice. under review (author's personal communication)

Homer-Dixon T (2001) The ingenuity gap: how can we solve the problem of the future. Vintage, London

Kim D (1993) The link between individual and organizational learning. Sloan Manage Rev (Fall):37–50

Maturana H (1988) Reality: the search for objectivity or the quest for a compelling argument. Irish J Psychol 9(1):25–82

Teece JD (2008) Technological know-how, organizational capabilities, and strategic anagement: business strategy and enterprise development in competitive environments. World Scientific Publishing, London

Vicker G (1970) Freedom in a rocking boat. Penguin Books, Harmondsworth, Middlesex, UK

von Glasersfeld E (1995) Radical constructivism: a way of knowing and learning. Falmer Press, London

Wene C-O, Espejo R (1999) A meaning for transparency in decision processes. In: Andersson K (ed) VALDOR; values in decisions on risk, Symposium, Proceedings. Stockholm, Sweden, pp 404–421