7

SM1: Addressing Complex Issues and Problems

Mankind always sets itself only such problems as it can solve; since, looking at the matter more closely, it will always be found that the task itself arises only when the material conditions for its solution already exist or are at least in the process of formation.

Karl Marx, *A Critique of Political Economy*, 1859

Problem-solving Paradigms

We have already encountered two problem-solving paradigms on page 172 *et seq*. There are many ways to address problems, depending on the nature of the problem. Doctors, for example, have an effective way of finding out what is wrong with patients by looking for symptoms of variation from the norm, such as temperature, blood pressure, pallor, and so on.

Complex systems, such as the human body, major enterprises and socio-economies, exhibit problems generally as dysfunctional behavior, that is by something not behaving as it should, or as it has previously (and satisfactorily) behaved. Dysfunctional behavior may emerge because a system, or systems, are not functioning as they were, or as they should, or because of some interaction irregularity.

Confusingly, and especially with complex systems, the symptoms may emerge where the problem isn't. We are familiar with this in our personal health. A headache need not indicate anything wrong with the head — it could be something we ate. A pain in the upper left arm need not indicate anything wrong with the upper left arm — it could be the onset of a heart attack: then again, it may not be . . . .

Such confusion arises within our bodies, and within complex systems in general, because of the coupling and interactions that occur between subsystems/parts of complex systems, which result in the behavior of each subsystem both depending upon, and impacting, the behavior of other subsystems, both directly and indirectly through intervening systems — so-called transitive effects.

With complex systems, trying to solve problems by treating the symptoms would be tantamount to treating smallpox by putting calamine lotion on the spots — not a lot of use. However, this

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is what we tend to do in everyday life. Politicians in particular, and managers too, may see (or choose to see?) a symptom of some issue or problem, and address that symptom in isolation. Not only is this ineffective, but it can mean that precious resources are wasted in salving rather than solving.

Linear, Complex, Nonlinear and Intelligent System Behavior

It is often much easier (cheaper, safer, expedient) to recognize the symptoms of some issue than to dig deeper and find the underlying or root cause. And with complex systems in particular, it may be difficult to find the root cause, even if the investigator were willing to dig and delve.

Systems can behave in unexpected ways. We expect linear, cause and effect type of behavior: pay more money, get better results; depress the pedal further, the car goes proportionally faster; shorter exposure freezes motion more precisely; and so on. Life, as we know, does not turn out like that: pay more money, results stay the same, but staff wastage reduces; depress the pedal further, wheels skid, lose traction; shorter exposure admits less light, picture underexposed, motion-freeze indiscernible.

Behavior, then, is rarely linear — even within our digital computer based systems, linearity is something of an illusion as we sample, round-off, work to N digits, etc; generally, behavior is nonlinear in the real world. (See Nonlinear Systems Thinking on page 78.) In addition to the kind of nonlinear, but continuous, behavior exhibited when foxes, rabbits and grass interact, breed, eat, predate, etc., there are also chaotic systems, where the next instance of behavior may be related to the previous instance, but in an unpredictable way (like the weather) or may even be random (like a roulette wheel or a lottery).

There is also a tendency, again notably amongst politicians, although we are all guilty, of presuming that there is a singular cause to any problem. We look for something, or someone, to blame: we look for the one silver bullet that will put everything right. Looking back on past problems may convince us that there are no silver bullets: complex issues generally involve a number and variety of source problems, each of which has to be addressed if we are to have any hope of resolving the whole issue.

As though to confuse a confused issue even further, there are intelligent systems, where the next behavior may be based on the previous behavior, but is also considered in the light of context, situation, strategic alternatives, tactics; see Behavior Management on page 130. An eye for an eye may not always be the best response: sometimes, turning the other cheek works miracles . . . . On the other hand . . . .

System Dysfunctions: the POETIC Acronym

The kinds of situations and systems where we might reasonably want to address issues and solve, resolve or dissolve problems are generally complex, invariably nonlinear, sometimes obscure, generally sensitive, and involved. In such circumstances, we may need to be objective, impartial, insightful, sensitive, culturally aware, etc. Indeed, we may not only need to *be* these things, but be *seen* to be these things — else we may be deemed unacceptable as problem-solvers.

In such circumstances, method is important. Method not only helps us to organize our approach to problem-solving, it also inspires confidence in others, particularly where the method can be

presented to interested parties, so that they can see for themselves that it is rational, sensible, reasonable, objective, etc.

Nonetheless, method on its own is of limited value — practitioners also need domain knowledge and experience, neither of which is embedded in a method or methodology. Experience of addressing complex problems in businesses, enterprises and industries suggests that many have their dysfunctions rooted in areas indicated by a useful acronym — POETIC.

- *Politics*, sometimes with an initial capital letter, where politics refers to interrelationships, tactics and strategies involving power, authority, influence and manipulation. Many problems, or so it seems, arise from entrenched positions arising within corporate boardrooms, leading to standoffs, failure to take action, and stagnation.
- *Organization*. The manner in which an organization is set up, the way it is configured, a surfeit or shortage of internal communication, coordination and synergy — all of these and many more can contribute to systematic issues and problems
- *Economics*. The amount, availability, distribution, withholding, investment, movement, etc. of finances, together with a desire for short-term profitability at the expense of growth and stability
- *Technology*. Access to, availability of, incorrect choice of, cost of, reliability of, capability of, unreasonable expectations of, and blind faith in, etc., etc.
- *Inertia, Inactivity, Indolence*. Open, complex systems are active and interactive, or they are inconsequential. Issues and problems arise not so much from doing the wrong thing as from not doing anything . . . .
- *Culture*, or 'the way we do things here.' Cultures are palpable within organizations with major divisions: different cultures will pervade each division. Culture need not be bad, in that it encourages conformity — which can be valuable in traditional engineering companies, for example, where innovation in the wrong place, or at the wrong time, can cause havoc. However, it may effectively stifle innovation, inhibit intelligent behavior, and cause an organization to become so 'set in its ways' that, like the dinosaur, it becomes outmoded. Other companies, not so shackled, may continue to develop and improve, leaving the isolated culture to its fate. It is possible, too, to encourage an open, enquiring, thinking culture, to encourage rather than to blame, to be open to new ideas rather than rely on experience . . . .

Soft Systems Approaches

Methods of addressing complex problems and issues, particularly those involving people, are sometimes called 'soft' methods, where soft refers to the lack of hard, concrete material, evidence, etc. A soft systems method, then, would be one that considered the people working, perhaps, in some organization, their individual interests, objectives, attitudes and mutual interactions, perhaps. A soft system is one that, although comprised of people, and therefore technically 'manmade,' nonetheless does not have a clear, singular purpose: instead, it may have many, conflicting purposes, lack synergy, etc. A soft situation might be described as 'messy.'

A hard system, by contrast, would have a clear, singular purpose, and would have all the parts within that system contributing towards that singular purpose. One might say, then, that the objective of a soft system method is to convert a messy, soft system into a coherent, hard(er) system.

Some people use the terms 'soft' and 'hard' to refer not to the coherence of the system in question, but to the predominance or otherwise of technology in the system. So, they might describe a Boeing passenger aircraft as a hard system, or an avionics system within the aircraft, perhaps, on the basis that the system in both instances is very largely technological in nature. While understandable, this would be a misuse of the term, and might obscure the fact that some technological systems can be 'soft,' while some human activity systems can be 'hard.'

It is also the case that some see 'soft' and 'hard' ideas, systems, methods, etc., as quite different, and having little or nothing in common. That, too, would be inappropriate: 'soft' and 'hard' might better be viewed as the extremes of a spectrum, not of color, but of coherence, clarity and purposeful behavior — in other words, an entropic spectrum, where soft corresponds to greater disorder, or higher entropy, and hard corresponds to greater order, or lower entropy. It is the objective of systems engineering, in this context, to move from disorder to order, from higher to lower entropy. This might be achieved, methodologically, by first using soft systems methods to bring some degree of order to soft situations, issues and problems, and then by using appropriate methods to progressively increase order to the point that specific (i.e., hard-ish) designs and solutions can be manifested.

Degrees of intervention

It is not the case, however, that a specific hard solution is appropriate to every problem, or issue. Many commercial organizations, enterprises and industries would be reluctant to entertain the idea of reconfiguration, or indeed any significant change, simply to resolve some internal issue. Instead, they might seek the services of some consultant to help them understand the issues, and to suggest some sensible way of moving forward. (Notice how the words and expressions used are quite different from the ideas of firm specifications of whole solution to complete problems — this is moving from disordered to slightly less disordered — maybe!)

Bringing in some external 'help' is sometimes called 'intervention:' such events come in various guises. A consultant may visit, work with some managers, suggest some changes to organization, process or procedure, some retraining, or whatever, and leave: this might be a relatively minor intervention.

A complete redesign of the organization and the implementation of that design might be called a major intervention. Such events are less common, but do occur from time to time, under the banner: 'revolution, not evolution.'

A halfway house may exist, in which a complete redesign is done from first principles, and then compared with that which currently exists; this is Ideal World against Real World. Comparing the two to see the differences can result in minor changes in the Real World to move it more in the direction of the Ideal World: alternatively, the two worlds could be so far apart that a decision is taken to replace the Real World lock, stock and barrel with a new, and hopefully Ideal, World — the major intervention. Or, there may be a middle path, where elements of the Ideal World design are implemented and added to, or inserted into, the Real World.

As an example of this 'middle-of-the-road' approach might be the introduction of a quality assurance system to an existing assembly line, a new division to an existing, multidivisional organization, a new anti-rain mode to a ground control radar, a new, high-precision, anti-armor weapon to the range of weapons carried by a ground attack aircraft, a decision support system to an existing command and control system, or a neonatal unit to an existing hospital. In each case, the pre-existing Real World is left relatively unscathed, except for the need to adapt to and

accommodate the new addition envisaged as part of the Ideal World. The resulting whole is a changed Real World, and may — or may not — substantially equate to an Ideal World, according to whether the intent is to resolve, or to solve the original problem that prompted the redesign. The term 'intervention,' however, is associated with human activity systems, their organization and management, rather than with technological systems.

Consultants, or consultancies, conducting these so-called interventions bear a heavy responsibility, since their recommendations, if acted upon, could make or break an organization. They need method, and such methods seem to come in two forms.

Consultants may have a preconceived idea of the ideal functions, form and behavior that a successful organization should possess. Such preconceptions may have been developed by examining organizations deemed to be successful, usually in financial terms, and observing the value of various key parameters. These might include turnover per employee, profit-to-turnover ratio, percentage of profit dedicated to research and development, percentage of employees in various age brackets, innovative ideas generated per employee, average span of employment, and many, many more. The consultant will use 'approved' values for many of these parameters, determine the equivalent values for the organization under investigation, and recommend changes to bring these in line. This can be a somewhat procrustean approach, since in reality 'one size does not fit all,' and it is more applicable to commercial organizations than to those, say, in the public sector.

Consultants of a different breed concern themselves with finding out what makes the organization 'tick,' where any dysfunctions might be and how best to restore function, behavior and form to its (presumed) former good state. Consultants will be aware that they know little about the organization, while the people with whom they will interact within the organization may have decades of experience, knowledge and understanding of the organization, its characteristics, markets, competition, limitations, etc. The consultant, then, draws this information from the organizational members and effectively enables them to perceive their own problem; he may then advise them as to how best to ameliorate the situation.

Because this second approach concerns itself with the people in the organization, it may be deemed 'softer' than the first approach. However, it seems to be the case that many organizations are made up of groups with different purposes, such that the whole has no clear purpose, while the groups pull in different often conflicting directions. Sorting this out, so that all parties 'face in the same direction,' may be a 'people problem.' So, while the first approach carries with it a preconceived Ideal World, it may be less than ideal for a particular organization and moving toward that supposed ideal may require surgery. The second approach, on the other hand, is more likely to invoke a lifestyle change, one that is culturally acceptable to the organization as a whole. Both will involve change and change management.

Consensual Methods

The second of the two approaches to intervention requires that the consultant conducting the intervention should draw upon the knowledge and experience of the directors, managers, employees, etc., of the organization, helping them in the process to recognize their own problems and how to go about resolving them. Consultants may draw upon a variety of methods to extract such information, the idea being to develop a consensus from a representative group of individuals, and possibly then to use that group as future 'agents for change.' The following sections introduce some of the methods in use.

Brainstorming

This is a well-known approach in which a selected group of people is encouraged by a moderator to come up with ideas in response to a topic or a trigger question. Ideas may emerge at random around the room, and may be recorded on a flip chart.

The method is so well known as to require little description: it may not work too well, however. Problems can arise in the choice of people; junior members of the group are likely to defer to senior members, or may be unwilling to come forward for fear of ridicule. Brainstorming sessions can be slow to start, and difficult to moderate, particularly if some senior member decides to flex his authority. Although popular, brainstorming sessions can be limited in practice.

Nominal group technique (NGT)

Nominal group technique is also well established as a method of developing consensus, and is used to develop plans for future organizational activities and developments. It can be used to great effect in conjunction with Interpretive Structural Modeling — see below.

A topic is presented to a representative group of people; the topic may be concerned with, for example, some problematic situation facing the organization either internally or externally. A moderator, often the consultant, then conducts a discussion of the topic, before asking participants to write down their ideas on sheets of paper provided for the purpose.

After a suitable delay for people to generate their ideas, the moderator will invite participants to read out their first idea in turn, while the moderator, or assistant, copies them on to a flip chart or board. Each participant will then proffer their second idea in turn, and so on until all the ideas have been collected on to flip chart sheets, which may be posted around the room. The intention is to distance each idea from its originator, so that it may be considered objectively.

The group will next discuss the various ideas, combining those that are essentially duplicates, and reaching a group understanding of what each idea really means — not always obvious. Each member of the group is now afforded a rank scoring opportunity, often from ten to one. Participants are invited to rank order the ideas they preferred by allocating a ‘score’ of ten to the most favored, nine to the second most, and so on, down to one. The moderator then aggregates the ‘scores’ for the group. Some ideas may receive no scores, and will be dropped. The remainder will be reproduced as a rank-ordered list, from which will be selected perhaps the top twenty or so. These constitute the ideas — responses to the topic — that have been produced by the group as whole. Hence the term, ‘nominal group.’

These various favored ideas may then inspire strategies to achieve them, and the formulation of plans to implement them. If the consultant/moderator has done his job well, he will have contributed little in the way of intellectual content to the resulting plans, which will have been conceived and drawn up by the participants, and which, therefore, are most likely to endorsed by them. The participants may then become the agents for change, as well as the proselytizers of the plan to the other members of the organization.

Idea writing

Idea writing takes NGT a little further. After discussion of a topic, participants in the group are invited to write their ideas, suggestions, etc., on a sheet of provided paper, using the provided

pencil. After only two or three minutes, the moderator will request that each participant hand their sheet to the participant, say, two to their left. The receiving participant can then see the ideas already written by the providing participant, which should trigger a new set of ideas in his or her mind. After a further short period, the papers are handed round once more, this time by a different number of spaces. The process repeats for maybe thirty minutes, or until the moderator sees that most participants have run out of ideas.

The purpose of this convoluted procedure is twofold: to stimulate different strands of ideas within the group; and to conceal the source of any particular idea so that each may be treated objectively during subsequent discussion, without *ad verecundiam*, or *ipse dixit* (appeal to revered authority), and without disdain; such attitudes may be brought about by knowing that an idea was generated by someone senior/experienced, or junior/inexperienced respectively. Using standard paper and pencils, requiring responses to be printed in upper case, and complicating the path that sheets have followed from participant to participant will hopefully muddy the waters sufficiently.

Thereafter, the list of generated ideas may be handled as with NGT, and developed into a strategized plan of action to which all should agree, since all have participated and are then most likely to 'buy in' to the process and the product.

Warfield's interpretive structural modeling (ISM)

John Warfield proposed interpretive structural modeling (ISM) in 1973, and it has proved a most powerful approach to understanding complex relationships and situations, for formulating complex strategies and plans, and hence for making sound decisions. (Warfield, 1973, 1989, and Janes, 1988).

ISM has been described as a computer-assisted learning process that enables individuals or groups to map complex relationships between many elements, so providing a fundamental understanding, and providing the route to developing courses of action and solving problems.

ISM does not essentially require computer support — it can be executed by hand, using pencil and paper, but the process can be somewhat laborious, so computer support is often used to reduce the labor. There are few calculations, per se, within the processor — it is used largely to store, handle and reconfigure the information that participants in an ISM 'session' generate. ISM is, essentially, context free, as should be any sound systems method/tool.

ISM starts with a set of entities, between which relationships are yet to be established; in this respect, it may fit well with NGT and Idea Writing, both of which can be used to produce the list of entities. ISM typically produces a network, or tree of the entities as nodes, with the relationships forming the branches between the nodes. These trees, or networks, may be typically of four types:

- Intent structures, where the entities are objectives, and the links are 'helps to achieve.' The tree can then be read from root to tip as 'objective A helps to achieve objective B, which helps to achieve objective C,' and so on. The root objective is the one at the bottom of the tree — if that cannot be achieved, then none of the others is likely to be achievable. The objective at the top of the tree is the one that all the other objectives help to achieve — it is generally the mission. The development of intent structures is a powerful means of coordinating the various objectives and purposes of seemingly-disparate interests within an organization
- Attribute enhancement structures, where the entities 'contribute strongly to each other.' This is an invaluable way to establish the rationale for project or system designs, for example.
- Precedence networks, where activities precede each other. Precedence networks can be used to formulate rational, logical project plans early on in a project, at a time when the durations of

various activities may not be known. (Conventional project management tools require activity durations as an input.)

- Priority structures, where projects are 'more important than each other.' This can prove a valuable way of establishing priorities where there are differences of interests and opinions within a group. Every member of the group contributes to the end result, and is morally obliged to buy into the result, even if it is not what he or she expected or wished for at the start.

ISM is an invaluable tool for individuals, working out their own priorities and plans. In group practice, a moderator or facilitator may employ ISM in a session, where information is projected on to a screen in front of the 'nominal group.' For an intent structure, the information would appear as a pair of objectives, with the question pose 'does objective A help to achieve objective B?' The group has to decide if the answer is yes, no, or not related, which may take some discussion. The screen will then present the question, 'does objective B help to achieve objective A?' i.e., the first question reversed. So, to each pair of entities there may be four responses — A helps to achieve B 'Y/N,' and B helps to achieve A, 'Y/N.' The results are stored, and the process is repeated, but with entities B and C as a pair, C and D as a pair; and so on. There could be scores of objectives.

The resultant reachability matrix is comprised of ones and zeros, and can be mapped directly into the corresponding structure. The structure, or network, may be drawn up on a board using sticky notes, and it may surprise the participants, even although they contributed all the information from which the network was constructed. Such surprise is curious, but not uncommon — participants are unable to forecast the outcome, even although they have participated fully in the process. (Using ISM, which I do almost daily, I have found — to my surprise — that I am greener than I would have supposed, i.e., I have a far greater concern for the environment than I had suspected. A tool/method that can teach you things about yourself clearly has hidden depths! (Hitchins, 1992, 2003.)) The participants will then be invited to change anything in the structure with which they disagree by rearranging the sticky notes — providing other participants agree to the change.

The whole process can be time consuming, particularly where there are divergent view about what is causally related to what, and in which way . . . . However, the strength of the method lies partly in this time consumption, since it allows participants time to understand, to recognize the merits of others' arguments and to move towards a consensus. On the other hand, it seems likely from experience that the time taken for a session rises approximately with the square of the number of people participating, so smaller groups may be preferable to larger groups, especially where addressing a large number of entities.

It is also noticeable that some people can become impatient with the whole process, especially where they feel that it is likely to interfere with their decision-making opportunities, or to provide a considered response where they prefer to manifest a visceral response. Such people are, of course, not particularly interested in consensus . . . .

Checkland's Soft Systems Methodology (SSM) in Intervention

The problems that surround issues of purpose are well appreciated. Stafford Beers, creator of the Viable System Model (see page 110), once remarked, 'the biggest confusion in which I was ever professionally involved concerned the purpose of a health system to which there are as many answers as interests involved'. The ease with which an organization can examine and deal with issues related

to purpose depends on the view it holds about the nature of organizations. That view will fall between the two extremes recognized in academic research: positivist and interpretivist. According to the positivist view, organizations are rational and goal seeking. This makes it straightforward to identify the purpose of an existing system within an organization or to design a new system. The positivist view also simplifies the task of change management. The disruptive influences that might form the basis of opposition to the new system are considered to be aberrant, but amenable to management action: opposition can be overcome by changing some elements of the system or by replacing the people.

The interpretivist view sees an organization as being built up from social relationships between the individuals and groups within it; as the individuals and groups interact, they construct and reconstruct the network of relationships that defines the organization. Purpose is harder to expose in this environment, not least because the various groups are likely to hold differing views as to the purpose of the organization or a component system.

Problems in exposing the purpose of a system make it harder to establish what any supporting system is actually supposed to do and any project carried forward in these circumstances risks failure. Change management also becomes problematic. If some system is implemented based on a flawed understanding of the purpose of the wider system it is supposed to support then that relationship will be damaged; however, in this case redesigning the system or even changing the people is unlikely to improve the situation.

SSM was designed to help managers address unstructured problems that relate to the purpose and actions of an organization or subcomponent. (Checkland, 1972, 1981; Wilson, 1984). It arose out of work done by staff at the Systems Engineering Group at Lancaster University, England. They embarked on a program of action research — a combination of organization interventions and academic reflection — that started out by trying to apply traditional systems engineering methods to address managerial problems. Members of the Group found that their efforts were regularly frustrated because they could not always determine the purpose of the system or organization they were trying to assist. SSM represents their development of systems thinking which they believed would address the problems they had encountered.

SSM is built around the seven-stage model shown in Figure 7.1. The key point to note is that the analyst is required to address the problem situation from two perspectives: parts of the method require the analyst to relate to what is actually happening in the situation being analyzed (the Real World), whilst other parts should be driven only by logic and systems thinking (toward an Ideal World). The aim of the first two stages is to try and build a picture of the problem situation as a precursor to identifying a number of possible purposes for a system. The system can either be a new system designed to alleviate the problem or a redefinition of an existing system and the statements of purpose might take account of a number of different viewpoints. In the third stage, a root definition is developed for each system that describes six key aspects of that system:

- 'Customers' of the system — the victims or beneficiaries of the transformation that the system carries out.
- 'Actors' within the system — those who carry out the transformation.
- 'Transformation process' carried out by the system — what the system does in converting the input to the output.
- Weltanschauung — the worldview that makes the transformation meaningful in the context of the system.
- 'Owners' of the system — those with the authority to stop the transformation process.
- 'Environmental constraints' — elements outside the system that it takes as given.

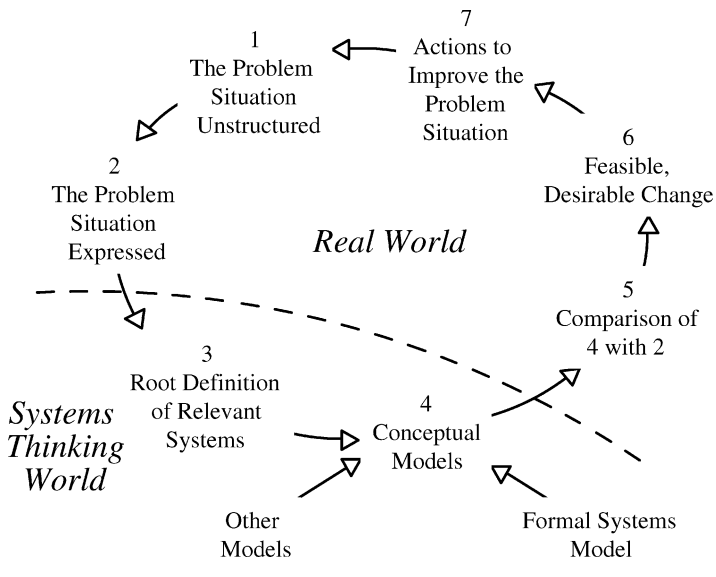

Figure 7.1 Checkland's soft systems methodology — the outline process (Hitchins, 1992).

In the fourth stage, each root definition is elaborated to produce a conceptual activity model that includes the core activities required to service the needs of the root definition. The elaboration can be pursued to any level of detail — each activity simply acquires its own root definition — and can be done in a single step or through a number of iterations so that the analyst ends up with a set of hierarchical models. In either case, the elaboration should be the result of systems thinking rather than of explicit reference to existing organizations and processes and should expose only those activities that are logically necessary.

Stages five, six and seven are primarily concerned either with change management or with situations where the system design effort forms part of a wider (e.g.) business reengineering program. The aim of stages five and six is to develop courses of action that are both feasible — i.e., can be started and hopefully carried through given the existing culture in the target organization — and desirable — i.e., they will bring about beneficial change. The courses of action are derived by comparing the models developed in stages three and four with existing systems and processes in the organization. In stage seven, the developed courses of action are put into practice. A single iteration of SSM is unlikely to solve a problem: it will alter the situation that caused the problem to surface, i.e., action will simply create a new situation that may benefit from further analysis and intervention using SSM. In this respect, one iteration of SSM may resolve the problem, while several may be needed to solve the problem — which may morph in the meantime, requiring continual intervention.

Given the description of SSM it is clear that its contribution to the implementation of a system is during the problem solving and design effort, which it can support in a number of ways. At the most fundamental level, it can be used to develop and clarify the purpose of a proposed system by allowing analysts and stakeholders to examine the implications of any number of root definitions. Having developed an agreed purpose, activity modeling — stages three and four from the model in

Figure 7.1 — can be pursued to the point at which the information required to enable the system to function and the necessary transformations can be meaningfully described. This information can be used to drive later stages of the design process. Alternatively, given an assumption of agreed purpose, the activity modeling from stages three and four can be pursued in the manner just described to generate an abstraction of existing processes and activities. The risk in this approach is that the assumed purpose is not the real purpose and that any implemented change may encounter significant resistance.

There are two major points that differentiate SSM from other methodologies or methods that might be used at the start of a design exercise: the ability to abstract and the ability to surface issues related to the purpose to be served by the wider system. Models in SSM are made up of sets of dependent activities; they make no assumptions about the structure of the organization that will carry out those activities or about the precise nature of the information artifacts that will be produced or required as inputs. Analysts can instantiate the models by assigning activities to existing or planned organizational elements and by naming the artifacts required to help define the way a system should be implemented, how it will fit in with other, existing systems and what functionality it should provide.

SSM offers the analyst an opportunity to examine the purpose of the wider system within which some new system will be implemented. Whilst there is nothing to stop an analyst doing the same thing using another method, it is not required: indeed, it requires a conscious decision on the part of the analyst. SSM, then, pursues the Systems Approach and considers a system as open, adaptive and an interactive part of some whole.

There is one other, perhaps more minor point that sets SSM aside from other means of depicting systems and that is its accessibility to the layman. Nonspecialists are more comfortable with the 'softer' approaches to depicting systems, rather than 'harder' approaches: whilst the harder methods may produce the detail required for detailed system design, they are not as effective tools for communicating with the untrained.

The value to any organization of such an intervention/investigation depends strongly on the view it holds about the nature of organizations generally. If it believes that it is a rational, goal-seeking body then the investigation will be appear to be of limited value — system purpose will be obvious and unambiguous. Organizations that recognize the more social view will also recognize the value of the intervention/investigation.

Hitchins' Rigorous Soft Method (RSM) in Intervention

Like SSM, the rigorous soft method (RSM) is based around the General-Purpose Problem-solving Paradigm (page 172). RSM is intended for addressing complex problems and issues, and for supporting the conception of potential remedial solutions. It may therefore serve as the first 'stage' in the systems methodology. RSM is context free — analysts and investigators working in the problem domain, and having intimate domain knowledge, bring information about the issue or problem into the method. Investigating the sources of dysfunction within some complex system can generate large amounts of data and information; unlike SSM, RSM employs tools and processing methods to handle, organize and process the information, where 'process' implies the progressive reduction of entropy as disordered source data is transformed into specific solution information.

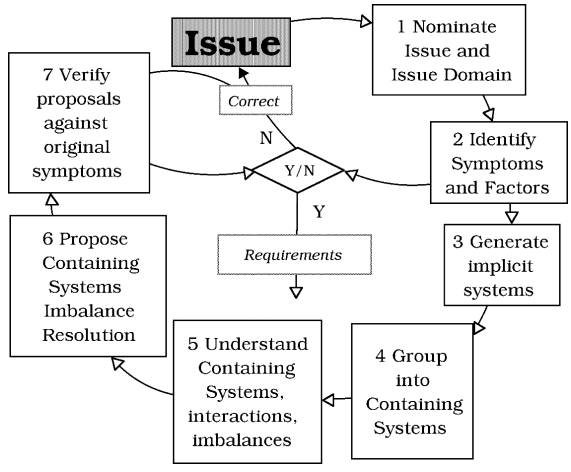

Figure 7.2 Rigorous soft method (RSM) — the process icon.

As Figure 7.2 may suggest, RSM is a self-checking system for conceiving remedial solutions to complex problems. So, how does it work? It uses processes that are analogous to the way in which a doctor may diagnose a patient's illness.

A doctor is trained and experienced in diagnosing dysfunctions in the human body — one of the most complex systems on the planet. To do this, doctors have established norms for various aspects of the healthy human body, according to age, sex, size, occupation, working environment, etc. Symptoms of dysfunction for an individual, then, are seen as divergences from the norms for such an individual.

Suppose that a patient came into a doctor's surgery complaining of feeling 'out of sorts,' but having no idea of what was wrong. The doctor might follow the following procedure:

- Ask the patient about their background and recent activities, visits abroad, etc., to identify recent environment and exposure to risks
- Check for symptoms of variation from the norm: temperature, respiration, pulse, blood pressure, pallor, skin lesions, perspiration, agitation, etc. If none shows unusual variation, then check deeper, testing urine and blood for variations, inclusions, infections, imbalances, etc.
- Wherever a symptom is identified, relate it to the potential dysfunctions within the body that could cause that symptom. Skin rash, for instance, could be caused by some infection, by food poisoning, by organic disorders, etc. High pulse rate could stem, similarly, from a variety of organic causes, as could raised temperature, and so on.
- The objective, then, is to identify as many symptoms as possible, and to find the organic dysfunction or external factor that is common to them all. The more symptoms, the more likely that, although each symptom may point to a variety of causes, the whole set will point to only one or two causes, as being common to all symptoms.
- Where more than one possible cause is perceived, the doctor will then consider how one of these may generate the other, i.e., he/she would mentally model the behavior of patient's body, seeking causal relationships.

- Note that doctors rarely have to go through such an elaborate procedure; experience of having seen conditions before generally leads them to a quick diagnosis. Rarely, however, problems arise with obscure disorders, and where a patient is suffering from more than one complaint, each of which is generating symptoms.
- Having determined what the source dysfunction(s) may be, the doctor can then propose a remedy, which may vary from doing nothing, through medication to surgery. The doctor will consider at all stages the risks involved from any course of action in relation to the patient's condition, and will endeavor to 'do no harm,' where unsure of the efficacy of the remedy.

Figure 7.3 shows the diagnostic process generalized, with the proposed remedies being tested for minimal side effects. The diagnostic process is embedded in the RSM process, shown graphically at Figure 7.4.

1. RSM starts with the identification of an issue of problem, or perhaps . . .
2. . . . with the identification of symptoms that point to some issue of problem. It would not be unusual to redefine the nature of the supposed issue once a number of symptoms has been identified and explored.
3. Each symptom 'implies' the existence of a set of so-called implicit systems contained within the issue/problem space; these are open, adaptive, interactive, functional systems that must exist for the symptom to emerge — and that emergence signals that something is dysfunctional within the set. Structure within the issue domain is generally irrelevant.
4. The sets of implicit systems (one set per symptom) are unified, clustered/aggregated to identify implicit containing systems. A hierarchy shift results in the highlighting of problem themes within the issue; this stage presents a rich picture of the whole issue.
5. The clustering process reveals potential interaction imbalances . . .
6. . . . resolution of which would be required as a minimum to neutralize the original symptoms
7. Conceive and test candidate remedies to see if they would, if implemented, eliminate/eradicate all of the symptoms identified in 2, and all the imbalances of 6. Candidate remedies would also be tested for cultural acceptability.
8. Nominate one or more sensible and acceptable remedies – provided there are any, which is not guaranteed

RSM can be used by individuals and by teams. The quality of the output, is, of course, limited by the quality of the input, in particular by the knowledge skill and insight of those exploring the problem space and exposing the various symptoms and factors. Factors are those aspects of an issue that make it 'special,' unusual, out of the ordinary, perhaps even unique, but which are not of themselves symptoms of dysfunction.

Working with symptoms of dysfunction makes it is possible to use them to formulate the requirements for addressing and remedying the issue — in effect, the problem (Real World) suggests its own remedial solution (Ideal World).

Figure 7.5 presents the rigorous soft method in the form of a behavior diagram, which some may find more familiar, and which lends itself to the establishment of a resourced process model for formulating a remedial systems solution, or solutions, to a particular problem. These are conceptual only, at this early stage in the systems methodology, but interestingly and importantly conceptual remedies to the whole issue or problem are suggested intrinsically by the application of RSM — effectively, they 'emerge' during the process of creating Ideal World views.

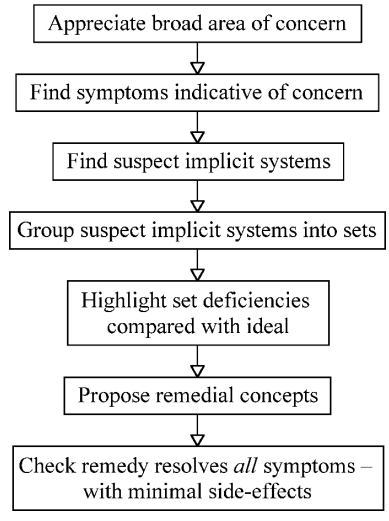

Figure 7.3 Outline diagnostic procedure.

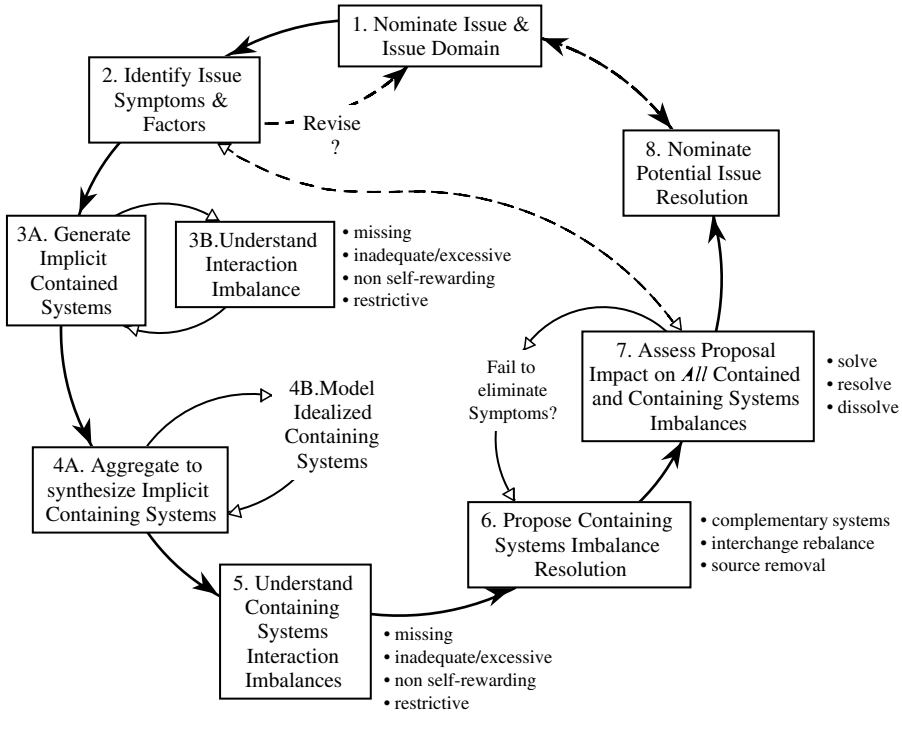

Figure 7.4 Conceptual model of the rigorous soft method — process view. See text.

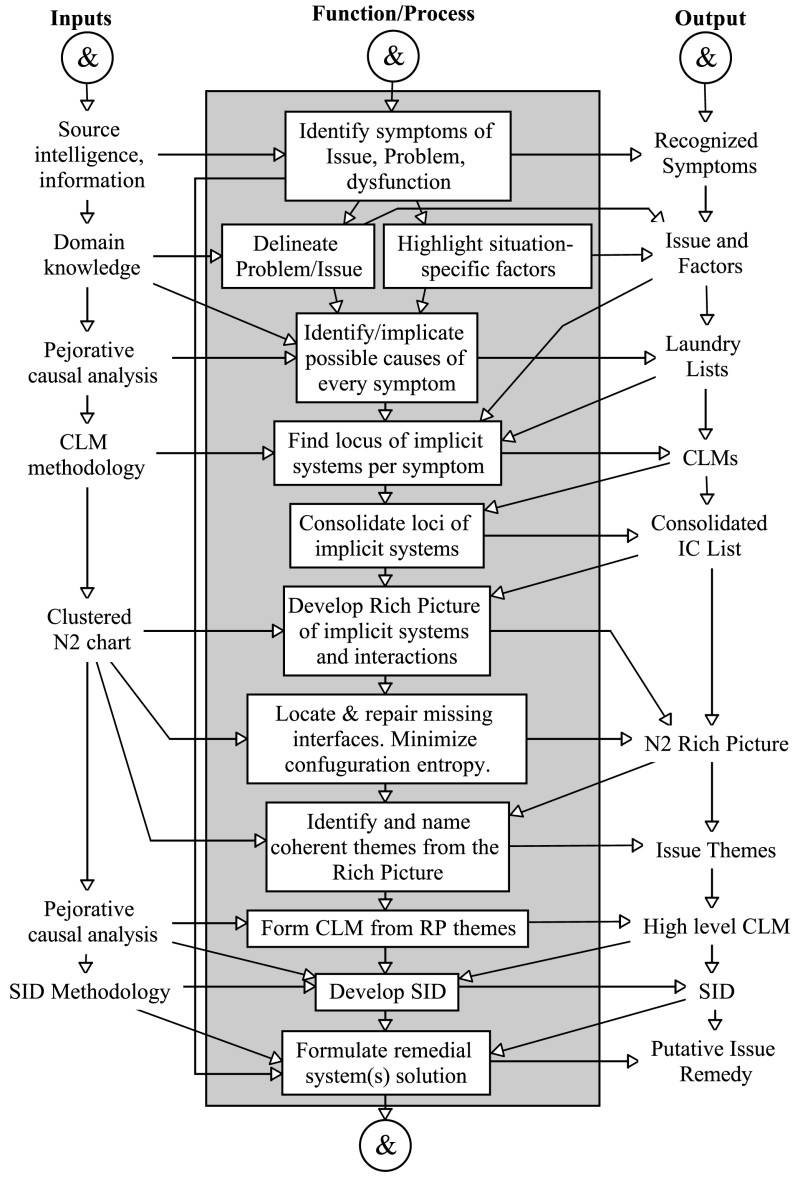

Figure 7.5 The rigorous soft method as a behavior diagram, showing sequential/parallel functions in the center panel: these are enabled by inputs at left, and by the outflows from previous functions/activities, resulting to outputs in the right hand column. SID is systems interaction diagram. IC is implicit system. Note that remedial system solution concepts 'emerge' as a natural byproduct of the RSM process.

Summary

There is a variety of ways of that complex issues and problems may be addressed. Some of those associated with interventions are addressed, including Warfield's interpretive structural modeling, Checkland's soft systems methodology, and Hitchins' rigorous soft method, with the latter being designed specifically as the front end of the systems methodology.

Interventions are often associated with issues that arise in organizations from disagreements about the purpose of the organization, with different people holding different ideas as to purpose. Two views are cited: the positivist view, which sees organizations as purposeful and goal seeking, so that differences may be ironed out, if necessary by removing people; and the interpretivist view, which sees an organization as made up of people and groups of people interacting purposefully, but not necessarily with the same purpose. An interpretivist view would see the social systems within the organization realigned, such that they worked together harmoniously. Both views are expressive of systems engineering, with the positivist view being 'harder' than the interpretivist view; neither is right or wrong, *per se*, but one may be more appropriate than the other according to situation.

Assignment

A 10-storey building is proposed for a beach 'beauty spot' where no such buildings presently exist. The building is to provide apartments on the upper stories, while the lower stories are to contain offices, gymnasiums and a large indoor swimming pool for access by the public, with water chutes, artificial tides, etc. The plan has alerted interested parties, including the tourist office, the beach preservation lobby, the local council — which is divided over the plans — local estate managers, prospective owners of apartments, several local sports clubs who would like access to the facilities, and even the police, who are keen to encourage youth facilities to reduce crime in the area.

Using role play to present yourself as each of the interested parties in turn, define the purpose of the project as your role might see it, identify a set of objectives that your role would like to see achieved in relation to the project, which — you are advised — is likely to go ahead in some form or other. Aggregate the objectives to form an intent structure in which 'lower' objectives are linked to, and help to achieve, higher objectives.

Comment on your results; hence determine whether you consider yourself positivist or interpretivist, and why.