

THE ART OF MODELLING IN SSM

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ABSTRACT

Within Soft Systems Methodology (SSM) we are advised to improve our understanding of the real world by making models of it. To a minimum these models comprise the art of producing a coherent model of root definition, CATWOE, and activities. The art of producing activity models, and especially the formulation and use of root definitions and criteria in community pharmacy practice in The Netherlands is discussed here. In the present SSM literature, little attention was paid to descriptions of what was problematic in terms of formulation of root definition and criteria in practice. We concluded that root definitions should be made measurable in the modelling process in order to improve their quality. This also provides a proper link between root definition and criteria 3xE: linking X to efficacy, linking Y to efficacy on a lower level, and linking Z to effectiveness. The formulation of criteria can be improved by using norms, the measures of performance with which a certain activity, set of activities or model can be judged, and monitor instruments, to visualize to what extent the norm has been achieved. Finally, the monitor activity should comprise both reality judgements and value judgements and the control action should consist of instrumental judgements.

Keywords: Community pharmacy practice, Criteria 3xE, Monitor and control action, Root definition, Soft Systems Methodology

INTRODUCTION

Within Soft Systems Methodology (SSM) we are advised to improve our understanding of the real world by making models of it. To a minimum these models comprise the art of producing a coherent model of root definition, CATWOE, and activities. The root definition comprises a systems description of a transformation process, the means or human activities boosting the transformation process, and the ends to be achieved. In the CATWOE the transformation process is described in the context of the roles and the worldview of the humans involved, and, in addition, in the context of the systems environment. Within the

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activity models the activities described should be linked and form a purposeful whole. The methodology adds a sub-system of communication and control in the activity models in order to enable survival of the system. This sub-system includes a description of the measures of performance on which the system is monitored and on which it is decided whether or not control action needs to be done. The art of producing activity models, and especially the formulation and use of root definitions and criteria is discussed here in the context of community pharmacy practice in The Netherlands.

DESIGN OF THE STUDY

The aim of this recent study was to describe managerial problems in change within community pharmacy practice in the Netherlands. The study took four years and was named APOM, the Dutch abbreviation of pharmacy, organization and management. The study was made at 169 pharmacists in the Dutch community pharmacy sector (N=1521) trying to improve the customer orientation of their pharmacy. The study comprised three main phases. Phase 1 consisted of an analytical description of three pharmacy mixes of activities: pharmaceutical, financial and customer activities and the validation and selection of methods (n=24) to be applied in phase 2. Phase 2 consisted of empirical observations; the analytically postulated pharmacy mixes were fleshed out in a survey (n=169). Phase 3 also consisted of empirical observations. With a selected group (n=63) distilled from phase 2, a quasi-experiment was set up in order to study the implementation process of customer activities. With 31 pharmacists we produced SSM models visualizing the intended customer activities (freeze) and we evaluated these models after a year (unfreeze). For the empirical results and other details we refer to other articles (Mobach *et al.* 1998a, 1998b, 1999). Here our main interest is what has been learned from the process of formulating and using root definitions and criteria of SSM.

POSITIONING IN THE PROCESS OF SSM

A guide in the modelling process is the seven-stage model. This meta model was defined by Checkland in 1975 and separated the real world from systems thinking about the real world. Within the real world, involvement of people in the problem situation is required. Within systems thinking, involvement of people in the problem situation depends on the circumstances of the study (Checkland 1981). The seven stages of SSM can, but do not have to be, used sequentially. Iterations are possible, maybe even advisable since the use of SSM is one of trial and error. In a sequential description the starting point would be the 'Problem situation considered problematic' and the end point the 'Action to improve the problem situation', both in the real world. As such the seven stages of this systems approach should help us to tackle problematic situations in the real world. However, in this paper we concentrate on the modelled world, defined by Checkland as: systems thinking about the real world. The modelled world of SSM is expressed in the 'Root definitions of relevant purposeful activity systems' and 'Conceptual models of the systems (holons) named in the root definitions'.

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MODELLING THE REAL WORLD

As we mentioned above, in our reflection we isolate stage 3 and 4. So, based on the outcome of stage 1 and 2, the clarification of a messy problem situation by a rich picture, we can start to model the real world (one might however as well argue that this picture is more than an overture to the modelling process, but also part of the modelling process itself). Stage 3 is the first step in the modelling process. Here the root definition is described: “a system to do X by Y in order to achieve Z” (Checkland and Scholes, 1990: 36). Normally, the root definition is formulated by considering the elements of CATWOE. Checkland and Scholes (1990: 35-36) argued that a root definition formulated with attention to the elements of the CATWOE will be rich enough to be modellable. The CATWOE relates to Customers (C), Actors (A), Transformation process (T), Weltanschauung (W), Owners (O), and Environmental constraints (E). The ‘customers’ are the victims or beneficiaries of T. The ‘actors’ are those who would do T. The ‘transformation process’ is the conversion of input to output; T should be related to X of the root definition. The ‘Weltanschauung’ is the worldview which makes this T meaningful in context. The ‘owner(s)’ are those who could stop T. Most of the time, the owner is the person which formulates the longer term aim Z. The ‘environmental constraints’ are the elements outside the system which it takes as given; E visualises the systems border or systems level.

In stage 4 we start to construct conceptual models based on the root definition. In the conceptual activity model the minimum necessary activities are assembled in order to meet the requirements of the root definition and CATWOE. In general, they aim to express the main operations and bring about the transformation (in the light of the CATWOE) in a handful of activities. For reasons of practicality we are advised to limit the activities to 7 ± 2 activities. Next, a detailed description of the processes of communication and control is given. In its basic form this sub-system comprises the formulation of the criteria for effectiveness, efficacy and efficiency, a monitor and a control action. With the criterion of effectiveness, it is monitored in what way the longer term aim Z is achieved; ‘is the transformation meeting the longer term aim?’. With the criterion of efficacy, it is monitored if the means chosen actually work in producing the output; ‘does the means work?’. With the criterion of efficiency, it is monitored whether the transformation is being carried out with a minimum use of resources; ‘the amount of output divided by the amount of resources used’. The monitor comprises a detailed description of the monitor activities by using the measures of performance from above. In the control action it is decided whether or not control action is necessary.

PROBLEMS EXPERIENCED IN APOM

We mentioned earlier that 31 community pharmacists modelled their real world problem situations. It should be stressed that the modelling process in this study was different from the ‘normal’ SSM processes. In ‘normal’ SSM processes the researcher is intensively involved as an expert in developing SSM models. The community pharmacists in this study were only assisted once in the modelling process with the technicalities from SSM (for

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example: the formal structure of a root definition or the fact that they had to formulate criteria 3xE); after a year these models were evaluated by them. This freeze-unfreeze-process is not common in SSM, we therefore expected the respondents to have special problems with their models when compared to the descriptions made so far. We give you a concise description of the problems experienced.

It has been rather tricky for pharmacists to define a usable root definition and related criteria which 'covered' the modelled activities. The link between root definition and modelled activities was disputable and in some cases even weak. In terms of the aim Z they experienced a hard time finding proper criteria for effectiveness. After some time, in other cases pharmacists found their root definitions to be abstract, vague and not usable in practice. Others experienced problems with their criteria for efficacy: what to do with the result if a measurement was made without having a usable norm? Another problem (although not experienced by pharmacists as such) was that some pharmacists did not monitor the modelled activities at all. It is noted that a system should always be monitored in order to enable survival; following Checkland and Scholes "the hierarchically organized whole, having emergent properties, may in principle be able to survive in a changing environment if it has processes of communication and control" (1990: 19). With these problems we decided to take a closer look at the modelling process of SSM and the handles passed by Checkland c.s.

HANDLES PROVIDED BY SSM

Checkland (1987: 92) argued that ways of making sure the root definitions are well-formulated have been developed earlier and referred to one of his earliest articles with David Smyth (1976: 83). They advise us to debate the six characteristics of CATWOE in formulating root definitions in soft systems. As such this would improve the quality of the root definition. In this context however we would argue that this does not help us any further since the CATWOE analysis was used, but obviously did not provide enough help for researcher and pharmacists. In the books of Checkland, the problems of formulating a root definition were disregarded. At best, he informed us that he did formulate root definitions. Compare, for example, the case description of Airedale Textile Company (Checkland 1981: 171), the case descriptions of ICL describing a product marketing division (Checkland and Scholes 1990: 158) and an organizational change programme (Checkland and Scholes 1990: 194-195), and the recent case description of an information department of the NHS (Checkland and Holwell 1998: 179-180). In these and other case descriptions, one can see that the formulation of aims, the according activities to change the state of the system, and according evaluation criteria to monitor this transformation appeared rather uncomplicated. In this context we find it also piquant that Checkland places SSM in the 'soft' tradition of Vickers in which social entities seek to manage relationships (Checkland and Holwell 1998: 48), and not in the 'hard' tradition of Simon (1945) in which social entities set up and seek to achieve goals. Be reminded that a core of the root definition is the aim Z which is to be *achieved* (Checkland and Scholes 1990: 36).

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Specific articles about help with the formulation of criteria within SSM are not known by the present authors. Checkland distinguished 'measures of performance' and 'monitor'. The 'measures of performance' relate to criteria 3xE and 'monitor' is a comparison between the measures defined and the modelled activities; based on this comparison a decision is made whether or not to change the model. Although it is clear that the 'monitor' can only take place with information from the 'measures of performance' and the activity model, SSM fails to give a description of both terms useful in our context.

REFINING THE MODELLING PROCESS

Since the descriptions presented so far do not help us with the problems experienced, we may as well decide to refine some of the concepts defined in SSM. Starting with the main problems experienced by pharmacists, we believe that the modelling process in SSM may be improved by making some additions to it. Before doing that we may however as well define some activities ourselves to provide help for the problems experienced by the pharmacists. We therefore decided to look for tools which enable us to formulate concrete and relevant root definitions and for tools which enable us to define a proper monitor and control sub-system

Activity 1:. Prevent root definitions from being abstract, vague and not usable in practice

Following the work of Checkland the root definitions can be made relevant through an intense contact between researcher and respondent. In this contact the researcher acts as an expert and should be vividly present in the modelling process. You are reminded that SSM is a methodology based on action research. This means that researchers join closely with the participants in the field. We assume that the continuity in this contact ensured that eventual problems with abstract, vague and unusable Zs were solved right a way in 'normal' SSM processes. In the APOM study this contact was restricted to two half days. On one hand this limited time spent for the modelling process and the evaluation (after a year) may have caused some of the problems described. On the other hand we may as well use this occasion to take a closer look at the formulation of the aim Z.

Before taking a closer look we may however ask ourselves: should we be worried in the first place? These days it is rather clear that the manager does learn 'along the way' from intentions to realization. Sometimes, this learning involves the adaptation of earlier intentions, even if this means that some intentions were not realized at all. In this context we refer to the learning cycle of Soft Systems Methodology (SSM): "each time round the cycle the world experienced is a somewhat different place ..." (Checkland and Scholes, 1990: 3). We hope to have learned something from our past experience. In principle, this learning process is never-ending. So, in terms of SSM we would argue that it is not only wise to adapt your intentions, but it appears to be inevitable. We have to keep in mind that learning could mean performing activities, but as well could mean adding, changing or even striking intended activities. Additionally, with respect to time, we should note that not all intentions might have been realized. Intention is ahead of realization, as it were. The organization might be on its way to realizing what was intended. This more 'modern' way of thinking

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about intention and realization has been confirmed by others as well. Among them were Johnson and Scholes (1988: 115) in saying that the objectives of organization should not be regarded as an unchangeable set of expectations. The objectives should be viewed as open to amendment and will change as strategies develop. In addition, Mintzberg (1994: 130-131) opposed to the ideas of formal strategic planning: “our argument is rooted in the essential [but false] characteristic of all planning systems: formalization through decomposition. To formalize requires analysis, specifically the reduction of a process to a procedure, a series of steps, each concerning a well-defined category. Moreover the result of the process must itself be decomposed in the form of plans. ... Any joint effects that different proposals may have, any synergies that may naturally exist or might be encouraged among them, have to be ignored for the convenience of formal analysis (unless, as noted by Hayes *et al.* (1988) ..., all proposals are to be combined into one large one).” With these words Mintzberg explained that formal strategic planning discourages creative strategic thinking, and he said good bye to “the long tradition in the planning literature, that likes to decompose and determine the importance of things a priori, and the fact that every failure of implementation is, by definition, also a failure of formulation” (1994: 26).

So, we then should not be too worried about abstract, vague and not usable root definitions. By making judgements about the quality of the root definitions as observed in the APOM study the understanding of the problem situation has improved. So, the conclusion by pharmacists that their root definition was abstract, vague and not usable was actually part of a learning process. Following SSM this conclusion is a theoretical consistent position. We would however argue that this position is not very useful as a handle in the field work.

With the root definition there is a paradox in the formulation of the aim Z. Although Checkland and Holwell (1998) claim not to be in the hard tradition of Simon, we believe the formulation of the aim Z invites a modeller to think in terms of Simon. In their view, this hard tradition defines the concept of organization as social entities which set up and seek to achieve goals. We would argue that this is what we do when we formulate a root definition as such. Being in that field we should be aware that our Zs may be incomplete, incorrect and not constant which might have led to abstract, vague and not usable Zs after a year (as experienced by the pharmacists). To prevent that from happening, we may as well decide to construct measurable root definitions. We are supported by De Leeuw (1994). He argued that the main reason to formulate an aim is for evaluation purposes. Evaluation should always be possible: “more than this is not necessary, and less is not possible.” (1994: 70). Put in other words: “effective control is impossible if one cannot at least evaluate if the system is going in the right direction. Minimally, there should be a comparison possible: the situation improved compared to the preceding period” (1994: 70). In addition, this provides us with a good (direct) link between root definition and criteria 3xE, and an (indirect) link with the modelled activities.

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First, we conclude that the root definitions should be formulated with great care with respect to measurability. In addition, the root definition 'a system to do X by Y in order to achieve Z' should be linked to the criteria. The system X in the root definition should be linked to the criteria for efficacy on the highest level. The activities Y in the root definition should be linked to the criteria for efficacy on a lower level and linked to the X. The aim Z in the root definition should be linked to the criteria for effectiveness.

Activity 2: Provide help for defining a proper monitor and control sub-system

Following the work of Checkland processes of communication and control are necessary in order to survive; activities should logically be judged on efficacy, effectiveness and efficiency. De Leeuw (1990) noted that an evaluation is a minimum requirement to exert effective control. Minimally, there should be some kind of a comparison possible, in order to determine, for example, that the situation improved compared to the preceding period (De Leeuw 1994).

What we distilled so far, is that evaluation is vital. Pharmacists experienced problems in formulating them, but how about other authors? Is it problematic to formulate criteria? According to Thompson, this would appear a rather simple matter. Thompson (1967) argued that aspirations as well as appropriate standards or norms will guide the purposive individual. However, Thompson did not provide us with information about the specific problems of studying these aspirations or when the standards or norms were appropriate. Let us take a closer look at the analyses of some other authors. Schön (1983) provided us with an interesting context in which the manager operates with respect to the interpretation of organizational troubles: the manager usually has no clear, consensual account of the trouble, and human sources of whom he will receive his information tell different and often conflicting stories. If the manager is to take action, he must make some sense of this situation. The manager faces a twofold problem: 1) how to find out what (if anything) is wrong, and 2) how to do so in a way that enhances rather than reduces his ability to fix what is wrong. Vickers (1983) described some other basic difficulties with the definition and use of criteria. He described: 1) the problem of disparity. Is a cheap sewer preferable to a river you can safely bathe in?, 2) the problem of success definition under uncertainty. Most future promises and threats are not predictable with absolute assurance; some are highly uncertain, 3) the problem of success definition in time. How far ahead should the policymaker look?, and 4) the complexity of the concept of success. This implies criteria by which success is to be judged; criteria with a cultural, sometimes almost wholly individual basis.

So it is tricky to formulate criteria; they have to be formulated with great care and caution. But how can we improve the formulation of them in the context of SSM? First of all, we argue that researchers and respondents need to be aware that evaluation is vital. From a systems perspective we stress that formulation of root definition and criteria are necessary in order to survive, and to be able to judge whether or not the modelled activities and/or performed actions had made a contribution to the transformation process, or were a waste of effort. One might however argue that the modelled activities could as well have been performed without the use of a root definition and related criteria. But then we would not be able to say much about the sensibility, and that is a problem if the pharmacist would like to operate effectively.

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Second, we are convinced that the description of the set of activities to monitor and control could be improved. Checkland provides us with three questions for the measures of performance: 'Is the transformation meeting the longer term aim?' for effectiveness, 'does the means work?' for efficacy, and 'was resource use minimum?' for efficiency. As we mentioned earlier, pharmacists experienced problems in defining a usable norm, although they performed a modelled measurement. This observation made us conclude that a definition of measures of performance comprises both the formulation of a monitor instrument and a related norm. We therefore argue that all criteria of SSM consisted of *norms* which are the measures of performance with which a certain activity, set of activities or model can be judged. Furthermore, such criteria would involve *measurements* or *monitor instruments* in order to visualize or monitor to what extent the norm has been achieved.

Furthermore, with the performance of the monitor and control action the work of Vickers is of help. Although Vickers (1965) described many problems in defining criteria he also added a useful taxonomy in this context: reality judgements, value judgements, and instrumental judgements. Reality judgements are judgements of fact about the 'state of the system'. Value judgements are judgements about the significance of these facts to the appreciator or to the body for whom the appreciation is made. Instrumental judgements are the selection of a way to reduce the disparity between the current or expected course and the desirable or acceptable standard. We argue that these judgements should be incorporated in the monitor and control system as defined in SSM. Following Vickers (1965) we believe that the monitor activity, the decision *if* an intervention is necessary, should involve both reality judgements and value judgements, concerning both what is or is not the case and what ought to be or ought not to be the case. The decision *how* to make an intervention into the system would be subject to instrumental judgements; a decision on the best means available to reduce the mismatch between is and ought.

CONCLUSION

In the present SSM literature, little attention was paid to descriptions of what was problematic in terms of formulation of root definition and criteria in practice. For example, during the process the researcher helped to formulate a usable and consistent model, like root definition and according criteria. It seems right to assume that the unproblematic expert view was used for most case descriptions. Although the issues were discussed elaborately in a theoretical sense, Checkland does not provide us with much information about the problems of formulating a Z for the root definition and the according criteria.

Starting with the problems experienced by pharmacists we add some of our own flavour to SSM. First, with the formulation of a root definition it is important to construct measurable ones. In this study measurability is the core issue to prevent root definitions from being abstract, vague and not usable. This also provides a proper link between root definition and criteria 3xE: linking X to efficacy, linking Y to efficacy on a lower level, and linking Z to effectiveness. The formulation of criteria can be improved by using norms, the measures of performance with which a certain activity, set of activities or model can be judged, and

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monitor instruments, to visualize to what extent the norm has been achieved. Furthermore, the monitor activity, the decision *if* an intervention into the system would be appropriate, should comprise both reality judgements and value judgements, concerning an assessment of the facts and an assessment of the significance of these facts. Finally, in the control action, where it is decided *how* an intervention could be made into the system, instrumental judgements are useful. A decision on the best means available to reduce the mismatch between is and ought.

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