



Invited Review

# Problem structuring methods in action

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## Abstract

This paper provides a review and evaluation of the use of problem structuring methods (PSMs) in practice. It starts by describing the origins of PSMs, the type of problem situation for which they are suitable, and the characteristics of some leading methods. An overview of the practice of PSMs is provided from a number of angles, including case studies and surveys of applications. A number of issues in the application of PSMs are discussed, in particular an account of the debate about evaluation of the success of PSMs; the selection of an appropriate method; multimethodology; and a variety of aspects of the maintenance of relationships with the client organisation(s). Finally, some possible future developments are suggested, especially through productive interactions with similar or related practices.

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## 1. Introduction

This paper will give an overview of the achievements of problem structuring methods (PSMs) in practice, in terms of range, of degree of success, and of issues confronting would-be practitioners. This introductory section will set the scene. Then further sections will provide a selective survey of applications; address the debate on evaluation of PSMs; and discuss a number of practical questions which may make the difference between successful application, failed application,

or no application. The paper concludes with some pointers to possible future developments.

In order to situate any survey of the practical applications of PSMs, it is necessary to provide a short account of their scope and rationale. This task is complicated by the fact that, just as with the traditional operational research (OR) approach, PSMs developed pragmatically. That is, by and large they grew out of practice, and were only theorised and systematised at later stages (for this process at work in the early days of OR, see Blackett, 1943). And, while individual methods within the PSM family have developed their own articulated theoretical bases, these bases are drawn from disjoint areas of theory. The pragmatic origins of PSMs make an account of practice, such as we are attempting here, of particular significance. But it also complicates the task of mapping the

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terrain that is to be covered. With categorisation following on behind practice, it is to an extent arbitrary where the PSM/non-PSM boundary lines are drawn.

The methods which have come, collectively, to be known as PSMs were developed independently from the mid-1960s onwards. The principal methods were in being, though in their early forms, by the mid-1980s. These innovations accompanied, and to some extent preceded, an extended critique of traditional OR (for details see Rosenhead and Mingers, 2001). Broadly, this was increasingly being seen as restricted to well-structured problems—that is, problems for which a consensual formulation can be stated in terms of performance measure or measures, constraints, and the relations through which action produces consequences. This limitation excluded whole categories of problem situation, and it was to these ill-structured problems that, in their different ways, the developing PSMs aimed to be relevant.

## 2. Problem structuring methods in outline

Such unstructured problems are characterised (Rosenhead and Mingers, 2001) by the existence of:

- multiple actors,
- multiple perspectives,
- incommensurable and/or conflicting interests,
- important intangibles,
- key uncertainties.

It has been suggested frequently that problems of this kind are more ‘strategic’, in the sense that they set the ‘givens’ of well-structured problems (Ackoff, 1979; Checkland, 1985; Rittel and Weber, 1973; Schon, 1987). This perspective actually makes it difficult to talk of “problems” as such, since the very construction of the situation as being a problem of a particular type is a result of the process of problem structuring rather than being a given starting point. It may therefore be better to talk of different aspects or dimensions of a problem situation, rather than different types of problem (Mingers and Brocklesby, 1997).

What could constitute decision support in such problematic situations? What each PSM offers is a way of representing the situation (that is, a model or models) that will enable participants to clarify their predicament, converge on a potentially actionable mutual problem or issue within it, and agree commitments that will at least partially resolve it. To do this a PSM must:

- enable several alternative perspectives to be brought into conjunction with each other,
- be cognitively accessible to actors with a range of backgrounds and without specialist training, so that the developing representation can inform a participative process of problem structuring,
- operate iteratively, so that the problem representation adjusts to reflect the state and stage of discussion among the actors, as well as vice versa,
- permit partial or local improvements to be identified and committed to, rather than requiring a global solution, which would imply a merging of the various interests.

The consequence of these requirements is that PSMs, although sophisticated in the way that they conceptualise and interact with the ongoing decision process, are relatively rudimentary in the mathematical or statistical apparatus that they bring to bear. In several cases they do, however, employ software to support the process of choice.

Methods with these characteristics can be and have been designed for one-off uses in particular situations. And even those methods that have achieved a considerable weight of applications are commonly employed in creative variants that take account of local circumstances. However description and critique have naturally concentrated on the more standard forms of the principal methods. (See Mingers, in press for an overview of the characteristics of a wide range of PSMs as well as of traditional OR techniques.) The main features of those covered at length in the revised version (Rosenhead and Mingers, 2001) of a widely referenced text (Rosenhead, 1989) may be briefly summarised as follows:

*Strategic options development and analysis (SODA)* is a general problem identification method that uses cognitive mapping as a modelling device for eliciting and recording individuals' views of a problem situation. The merged individual cognitive maps (or a joint map developed within a workshop session) provide the framework for group discussions, and a facilitator guides participants towards commitment to a portfolio of actions.

*Soft systems methodology (SSM)* is a general method for system redesign. Participants build ideal-type conceptual models (CMs), one for each relevant world view. They compare them with perceptions of the existing system in order to generate debate about what changes are culturally feasible and systemically desirable.

*Strategic choice approach (SCA)* is a planning approach centred on managing uncertainty in strategic situations. Facilitators assist participants to model the interconnectedness of decision areas. Interactive comparison of alternative decision schemes helps them to bring key uncertainties to the surface. On this basis the group identifies priority areas for partial commitment, and designs explorations and contingency plans.

*Robustness analysis* is an approach that focuses on maintaining useful flexibility under uncertainty. In an interactive process, participants and analysts assess both the compatibility of alternative initial commitments with possible future configurations of the system being planned for, and the performance of each configuration in feasible future environments. This enables them to compare the flexibility maintained by alternative initial commitments.

*Drama theory* draws on two earlier approaches, metagames and hypergames. It is an interactive method of analysing co-operation and conflict among multiple actors. A model is built from perceptions of the options available to the various actors, and how they are rated. Drama theory looks for the 'dilemmas' presented to the actors within this model of the situation. Each dilemma is a change point, tending to cause an actor to feel specific emotions and to produce rational arguments by which the model

itself is redefined. When and only when such successive redefinitions have eliminated all dilemmas is the actors' joint problem fully resolved. Analysts commonly work with one of the parties, helping it to be more effective in the rational-emotional process of dramatic resolution. (Descriptions based substantially on Rosenhead, 1996.)

Given the ill-defined location of the PSM/non-PSM boundary, there are a number of other methods with some currency that have at least certain family resemblances. These include critical systems heuristics (CSH) (Ulrich, 2000), interactive planning (Ackoff, 1981), and strategic assumption surfacing and testing (Mason and Mitroff, 1981). Other related methods which feature in this special issue are SWOT (Wehrich, 1998), scenario planning (Schoemaker, 1998), and the socio-technical systems approach (Trist and Murray, 1993). Those which are particularly close to the spirit of PSMs in at least some of their modes of use, and therefore thought to merit inclusion in Rosenhead and Mingers (2001), are the following:

*Viable systems model (VSM)* is a generic model of a viable organization based on cybernetic principles. It specifies five notional systems that should exist within an organization in some form—operations, co-ordination, control, intelligence, and policy, together with the appropriate control and communicational relationships. Although it was developed with a prescriptive intent, it can also be used as part of a debate about problems of organizational design and redesign (Harnden, 1990).

*System dynamics (SD)* is a way of modelling peoples' perceptions of real-world systems based especially on causal relationships and feedback. It was developed as a traditional simulation tool but can be used, especially in combination with influence diagrams (causal-loop diagrams), as a way of facilitating group discussion (Lane, 2000; Vennix, 1996).

*Decision conferencing* is a variant of the more widely known 'decision analysis'. Like the latter, it builds models to support choice between

decision alternatives in cases where the consequences may be multidimensional; and where there may be uncertainty about future events which affect those consequences. What distinguishes decision conferencing is that it operates in workshop mode, with one or more facilitators eliciting from the group of participants both the structure of the model, and the probabilities and utilities to be included in it. The aim is cast, not as the identification of an objectively best solution, but as the achievement of shared understanding, the development of a sense of common purpose, and the generation of a commitment to action (Phillips, 1989; Watson and Buede, 1987).

There are a number of texts which present a different selection of ‘softer’ methods than do Rosenhead and Mingers. These include Flood and Jackson (1991), who concentrate on systems-based methods, Dyson and O’Brien (1998) who consider a range of hard and soft approaches in the area of strategy formulation; and Sorensen and Vidal (1999) who make a wide range of methods accessible to a Scandinavian readership. There is clearly an extensive repertoire of methods available. In fact it is common to combine together a number of PSMs, or PSMs together with more traditional methods, in a single intervention—a practice known as multimethodology (Mingers and Gill, 1997). So the range of methodological choice is wider even than a simple listing of methods might suggest.

### 3. Overview of applications

The applications of PSMs to guide decision making in practice are still far fewer than those of OR’s more traditional methods. Nevertheless even the number of published studies is now far too large to permit any kind of exhaustive enumeration. This section will attempt an account of the practical achievements in three complementary ways. First, short descriptions of a small number of varied and mostly high-profile applications will be provided, in order to indicate the rich flavour of what is capable of being achieved by these meth-

ods. Second, some recent consultancy and research interventions by one of the authors will be described in order to supply a more experiential dimension to this account of practice. Thirdly, survey evidence will be summarised, to capture the range and distribution of PSM applications.

#### 3.1. Some published case studies of note

In this section we will give some necessarily compressed descriptions of practical engagements recorded in the literature. They have been selected on a number of criteria:

- involvement with a high-profile client or project;
- involvement with a client group from outside the traditional OR range;
- intervention of some methodological interest;
- diversity.

Cases reported in Rosenhead (1989) have been relatively accessible for some time, and so have been excluded. As will be seen, some of the projects involve the use of a single PSMs, while in others more than one PSM is used, or a PSM in combination with a more traditional modelling approach.

##### 3.1.1. Organizational restructuring at Shell (*Checkland and Scholes, 1990*)

Shell is a large and diverse company highly dependent on the development and exploitation of technological innovations. At the time of the study in the late 1980s, Shell had a 500-strong central Manufacturing Function (MF) department. The primary functions of its staff, many of whom were scientific and technological experts, were to monitor technological developments, plan research, advise the Board on technology policy, and provide help and advice to world-wide production units.

It is often difficult with such service-providing departments, to specify clearly the dimensions of their role, and hence ways in which the effectiveness and efficiency of their operations can be monitored. To address this issue the head of MF had initiated a major internal study involving many interviews with MF managers as well as

their customers within Shell. This process had generated a mass of intelligent, and conflicting, views that had been summarised into headlines covering over 100 pages of flip charts! It was at this point that Checkland, the originator of SSM, was invited to help provide structure for the process of turning this plethora of ideas into action.

A series of major workshops was organised, facilitated by Checkland and two senior managers. The first, with the flip charts and a mission statement derived from them as input, addressed the question of “technology development”. Following a period of discussion, the meeting split into small groups. Each was asked, after seeing some examples by Checkland, to form a clear definition of a ‘core purpose’ for MF, and sets of activities that would enable this purpose to be achieved. (In effect these were root definitions (RDs) and CMs, although the language of SSM was not actually used.) The next step was for the groups to make comparisons, using an SSM format, between their models and the actual situation in order to identify potential issues.

A second workshop was undertaken, but whereas the emphasis in the first had been technology and its development, in the second it was service provision. The format was similar to the first, with three groups considering different aspects of the service role—technical advisor to operations, designer of plant, and enabler for strategic decisions. Again, comparisons were made with the current situation and issues noted. The results of the workshop were recorded in a 45-page booklet which pointed up the need for structural, procedural and attitudinal changes.

A new phase now began concerned with how these general conceptions could be realised in practice. Three further workshops were held consisting only of MF senior managers, some of whom had not participated in earlier ones. The first was spent examining in detail how current practices compared to the new ideas. RDs and CMs were used extensively to tease out the implications of possible changes. The second workshop was pivotal. Intense discussions generated a new model that encapsulated a more radical yet implementable approach to business service provision. This saw a move from a rather aloof internal

provider of technical expertise to an approach involving joint developments with user departments with the focus on the final (external) customer. For MF this was a radical departure in self-image.

The final workshop concentrated on defining the outline of a new organisational structure. Possibilities were tested using SSM’s comparing phase—23 crucial activities were defined from the models developed at the preceding workshops, and different structures were tested against these in terms of technology development, service provision, and strategy—a major task. Once decisions had been made, there followed the major process, lasting eight months, of rolling it out in a consultative and involving way to MF’s 500 staff.

This application of SSM is notable both in terms of the size of organization involved, and also in terms of its mode of use, which was as a facilitation device structuring work carried out by the participants themselves rather than as a methodology applied from outside.

### *3.1.2. Developing models to support a claim for damages (Ackerman et al., 1997; Williams et al., 1995)*

The Canadian-based company Bombardier had contracted, through a subsidiary, to develop and supply the shuttle wagons to take cars and buses through the Channel Tunnel linking France and Britain by rail. Bombardier was pursuing a legal claim against the tunnel’s builders, Trans Manche Link, based on the delay and disruption which, it alleged, it had suffered as a result of both TML’s frequent introduction of revised specifications, and delay in approving design documents. This had necessitated extra design work, wasted design work, and surges in design activity with consequential extra costs.

Many of the extra delay and disruption costs incurred by Bombardier were due to ‘knock-on’ effects—for example design work being carried out in ignorance of the specification of related parts, leading to the need to redesign, producing further upset to the design schedule. The task undertaken by a team from the University of Strathclyde was to develop models capable of quantifying the resulting delay and disruption which would carry conviction in a court of law.

SD suggested itself as a natural modelling language for representing the multiple interlocking feedback cycles which characterised the problem situation. However the information that was needed to construct a relevant SD model was distributed over the members of the very substantial management team. Not only that—individual managers had different perceptions on how the various factors interacted. SODA was used initially as a knowledge acquisition process. Cognitive maps were elicited from each member of the client team, and then merged. This group map was then debated, corrected and elaborated at a series of workshop sessions attended by lawyers working on the claim as well as the client team.

The validated SODA map served as the raw material for developing a SD model. Specifically, the 98 feedback loops embedded in the SODA model were used to generate an influence diagram, an intermediate step towards a full-blown SD model. As the team moved from influence diagram to SD model, the SODA model remained in play both as an accessible knowledge repository for the project, and as a medium for communication between analysts and clients.

The resulting SD model was calibrated against historically observed behaviour, and then used to emulate what would have happened if actions that were the subject of the legal claim had not taken place. In the event, the legal action was settled out of court. Bombardier attributes the advantageous nature of the settlement of the case to the effectiveness of the model-based argumentation they were able to deploy. Following on from this project Bombardier has continued to fund a programme of collaboration with the University of Strathclyde.

### 3.1.3. *Supporting a tenants co-operative (Thunhurst and Ritchie, 1992; Thunhurst et al., 1992)*

This is an account, not of a single project, but of an extended engagement over a number of years. With the run-down of the British coal industry following the defeat of the 1984–1985 coal strike, many pits were closed and communities left without their previous economic base. One of these was Thurnscoe, a mining village in South Yorkshire. The houses in which the residents (overwhelmingly

miners, ex-miners or widows of miners) lived were owned by British Coal. When British Coal decided to sell up, the tenants organised to secure their homes for themselves. They formed themselves into a co-operative and bought the 361 houses with a £1.75m mortgage, thus becoming the largest co-ownership housing co-operative in Britain.

Although housing management was to be carried out initially by an established housing association, the Thurnscoe Tenants Housing Co-operative was determined to become the effective managers of the properties at the earliest opportunity. Their collective relevant managerial experience was in effect zero. One of the instruments for realising their aim was to be the Community Operational Research Unit which was just then being established (with the support of the British Operational Research Society) at the nearby Northern College in Barnsley.

The Community OR Unit worked primarily but not exclusively with the co-operative's Committee. Analysis was carried out on the case for acquiring a micro-computer (these were early days); the comparative merits of a 'crash programme' of training and early take-over of responsibility by the Co-operative versus a 'slow but steady approach'; the viability of establishing a community repairs business utilising local talent; carrying out a survey of the estate's demography and housing quality; and so on. Work was carried out with, rather than for, the Co-operative, commonly in workshops facilitated by the unit. Factors, criteria, uncertainties, stakeholders were captured and recorded on flip charts. Elements of PSMs, and of other approaches such as decision analysis, were used as and where they might be helpful.

Certain interlocking issues emerged repeatedly, and will serve to illustrate the type of work that was carried out. The housing stock was in generally poor but uneven condition. Thus an early decision was needed on whether the purchase should include currently vacant properties—some of them possibly unfit for habitation and so a financial liability. Other interrelated concerns which became the focus of debate included a sales policy to sitting tenants (market price? discounted price? never?); the possibility of selling houses to generate funds for maintenance or improvement of the

others; policy in relation to rent arrears; ways of increasing the involvement of tenants in the running of the Co-operative; and possible extension of the Co-operative into the management of other local facilities. These were worked over in different combinations in a number of workshops. Elements of different PSMs were used, often in short cut versions, to establish relationships, surface uncertainties, conduct stakeholder analysis, etc.

PSMs were not the only methods to be used. For example, spreadsheet financial models were developed to explore the effects of different rent levels on the scale and rate of possible updating of the properties, in a series of ‘what if...?’ analyses. There were also innovative methods developed ‘on the hoof’. The outputs of these models was displayed in a flip-chart format which committee members felt comfortable with from their experience of PSMs and other soft approaches.

The extended experience of working with the Thurnscoe Tenants Housing Co-operative demonstrates that working even with clients initially inexperienced in interfacing with analytic methods can be of great value in generating confidence and the ability to manage their own affairs. PSMs can be deployed creatively as part of an eclectic repertoire including relatively ‘hard’ methods.

#### *3.1.4. Developing an IT strategy for a supermarket chain (Ormerod, 1995)*

At the time that this study was carried out, Sainsbury’s was the largest UK supermarket chain in terms of profits, and generally acknowledged as the market leader. Believing that innovation in IT had played a major role in their success to date, they engaged management consultants to develop a new information systems strategy. The project had top level sponsorship—its four-strong steering committee included the joint managing directors. The project team worked with a task force of 16 senior managers chosen for their relevant business experience, with the commitment that they would be able to devote up to two days per week to the project.

The starting point was Sainsbury’s overall business strategy and the business environment. Cognitive maps (from the SODA approach) were drawn of the individual steering committee mem-

bers’ perceptions of what the company needed to do to remain successful, and these maps were used to transfer this Board-level understanding to the task force. Through a seminar and then a two-day workshop task force members then generated their own map as a means of debating strategy and establishing areas of the business which seemed to present possible new IT systems opportunities.

The next phase was to examine each of these areas in more detail, for which the task force members learned to use SSM. In four cross-functional subgroups over a six week period, SSM was used to identify candidate IT systems for investment. (Help with the method was given if sought.) Other groups were formed of non-task force members, so that in all 30 people were involved in the analysis. They generated a long and varied list of systems, not all involving IT.

The evaluation of these possible systems was conducted using the ‘comparing’ mode of the SCA, which was then taken forward to a more quantitative prioritisation framework akin to a multicriteria assessment scheme. The criteria were identified by the steering group, but the valuation was carried out by the task force, enhanced by some senior additions.

The final stage involved converting the prioritised portfolio of systems into a smaller number of larger projects. This made use of the ‘shaping’ and ‘choosing’ modes of SCA to take account of scheduling requirements, technological dependencies, etc. The agreed system strategy produced by the project was endorsed by the Board and implemented. New systems were developed and introduced over a five year period, and were found to result in substantial, measured benefits.

This case is remarkable, both for its extensive high-level ‘buy-in’ and participation, and for being a good example of multimethodology—the deployment and adaptation of a wide range of PSMs in combination.

#### *3.2. Personal experiences*

Just as with the application of traditional OR methods, many practical PSM interventions are never recorded in the disciplinary literature. This

section will provide some material on applications of PSMs which has not been filtered by the normal requirements of paper-length accounts in refereed journals. This will be attempted by providing brief accounts of a number of the more significant practical projects employing a PSM-influenced approach which one of the authors (JR) undertook during the period 1998–2001. This method of sampling has the advantage that it sweeps up relative failures as well as relative successes. Another advantage, in a rapidly developing field, is that it reports on recent practice. They will also serve as ‘raw material’ for discussion in later sections.

### 3.2.1. *Planning for a street festival (Principal collaborators: T. Horlick-Jones, M. Cushman)*

A major annual street festival in a metropolitan city was threatened by its own success. Dense and growing crowds generated risks of crushing, crime and civil disorder; transport and emergency services were fully stretched; and residents experienced noise and other forms of harassment. How could the festival find a strategic direction, rather than fine-tune existing arrangements?

This engagement has had two main phases. In 1998, following an extended period of ethnographic monitoring (see Hammersley and Atkinson, 1995) we ran two linked workshops with leading representatives of four key players—the police, the local government body most involved, the festival organisers, and a local residents’ organisation. All had contrasting perspectives, and indeed three of them would have preferred the festival not to take place at all (though for different reasons)! At the first workshop a variant of the early stages of SSM was used to surface possible objectives for the festival, and so generate ideas of how it might be changed.

The second workshop took these outputs as its starting point. The ‘comparing’ mode of strategic choice was used to contrast alternative options within a key decision area, namely how to raise more money to stage the festival. The clear output of this phase was a strong agreement that moving to a linear, rather than circular, route for the procession was advantageous on almost all counts—to the surprise of all participants. They took this message back to their constituencies, where inertia

overcame it. (This part of the engagement is described in Horlick-Jones et al., 2001.)

The period of stasis ended in 2000. The reasons for this were (a) serious criminal events at the festival that year, and (b) the arrival of the first popularly elected mayor for the city. The proposal for a linear route was rapidly adopted as the Mayor’s preferred solution, with a Review Group set up to make recommendations, to which we were appointed as advisors. We facilitated a series of workshops, this time with representatives of close to 20 stakeholder organisations drawn from affected local government organisations and other statutory agencies, emergency services, transport bodies, the residents group and the festival organisers. These workshops determined in turn the generic route shapes available; the relevant criteria; and a long-list of candidate routes.

Finally a two-day workshop with around 50 participants (including, for example, the local MEP) arrived at a short-list of routes for detailed technical risk assessment. At none of these workshops was an identifiable PSM used. However the tailor-made systematic methods employed were informed by our experience of PSMs and had similar general characteristics. These included the elicitation of relevant factors from group members; participatory prioritisation to establish a consensual problem focus; and explicitness about multiple objectives without explicit quantification and trade-offs. At the time of writing no decision on route has yet been taken.

### 3.2.2. *Development planning for a Third World country (Principal collaborators: S. Baroni, J. Friend, E. Vila)*

In 1998 Hector Chavez was elected President of Venezuela with a landslide majority. A previously failed military plotter, his mandate was to clean up the corrupt political system of the previous 40 or so years (see Gott, 2000). On December 15, 1999 his proposals for a radical new constitution were approved in a referendum, again overwhelmingly. On January 2, 2000 I flew out to Venezuela to advise, as I thought, on establishing a policy analysis unit for the Ministry of Planning.

This did not happen. On December 15th torrential rains produced catastrophic floods and

mudslides in the coastal state of Vargas, costing tens of thousands of lives and devastating its infrastructure. I became a member of a three-person team advising the Minister on reconstruction strategies. As part of this process we convened a stakeholders conference with representatives from many government ministries and other agencies, academic departments and the private sector. A Vice-Minister of Planning acted as facilitator, using flip-chart-based methods informed by PSM experience. The team delivered a timely and cogently argued report to the Minister, which had no perceptible influence on the course of events.

The other team members, from Cuba and Italy, were close associates of the Minister. Indeed he was a friend of mine of 20 years standing, who had been an academic visitor in my department only a few years previously. He, along with another friend (and ex-student) who was now a senior office-holder in the Ministry of Energy and Mines, had been a member of a group calling itself the Dead Planners Society, which had spent years in opposition preparing ideas for a Chavez government. A key part of their approach was the use of strategic choice (SCA) and robustness analysis to prepare planning decisions. As a result there was a small network of academics/practitioners/politicians knowledgeable about these methods. These included the Minister, who was a close associate of the President and held the senior economics portfolio.

Three months later John Friend, the originator of SCA, held two half-day SCA workshops on the reconstruction of Vargas. Its members were to some extent self-recruited, and targeted discussion onto technical issues (water run-off, severe weather warnings). A week or so later, joined by the original three-person team, a further two SCA workshops were held with more senior figures from key ministries. This time discussion focused on infrastructure issues—railway development, roads to the coast, new airport location. But participants seemed to regard the occasion as a seminar, rather than a decision-making forum. In March 2001 the four of us met again in Caracas. This time the agenda was different. The President had issued a policy statement on Special Economic Zones (ZEEs) which were intended to revitalise areas of

the country performing below their economic potential. We were invited to report on how decision-making might operate within a ZEE, as well as on legal and organisational questions. A pilot SCA workshop was held with personnel from one of the ZEE areas, which seemed more purposeful and successful than any of its predecessors. However no follow-up appears to have resulted. Detailed proposals for capacity building in the use of participatory modelling methods have not been picked up.

Evidently this involvement with top level planning in Venezuela has not lived up to expectations, which were considerable given the apparently auspicious circumstances. Plausibly this was due to incomplete ability to control attendance, failure to set appropriate expectations, and a degree of mismatch of decision-making cultures.

### *3.2.3. Agreeing a local paediatric care strategy (Principal collaborator: Mike Cushman)*

Camden and Islington is a health district in inner London whose central location has resulted in an unusual concentration of major and specialist hospitals. Five of these provide inpatient care for children. However changes in clinical practice have led to a continuing decline in the number of overnight admissions of children, with more emphasis on supporting them in their own homes during treatment. The consequential reduction in consultant positions has in turn led to a growing difficulty in providing cover across the childcare specialisms in each of the hospitals currently offering inpatient services.

The Camden and Islington Health Authority (C&IHA) had for two years been convening a process of discussion about this problem between the institutions involved. At the time of our involvement this had already produced a strong measure of agreement on the need to reduce the number of paediatric inpatient units, and to increase other forms of healthcare provision for children. However this agreement was as yet un-specific, crucially as to how many and which units would close, and also as to the form that the improved outpatient and community-based day-care provision should take. The purpose of the use of PSMs was to try to reach agreement on these

outstanding issues—that is to move from abstract to concrete agreement.

A series of three whole-day workshops at monthly intervals was set up. Membership was worked out with great care by the C&IHA staff, to ensure that key players were present, and that all institutions and relevant disciplines were represented. The institutions with inpatient units were the University College, Royal Free, Whittington and Great Ormond Street Hospitals (the latter tertiary care only), as well as Moorfields Eye Hospital. (UK readers will recognise these as among the leading medical establishments in the country.) Participants held the roles of Medical Director, Director of Clinical Services, Consultant Paediatrician, and Consultant Anaesthetist. Other members, in addition to the C&IHA Director of Public Health and members of her team, included a local GP, officers from the two local Community Health Councils (representing the interests of patients), a senior manager from one of the hospital trusts, and the Deputy Director of Primary Care from the local Community Health Services Trust.

The decision problem which they confronted was complicated by the linkage of decisions about paediatric care to those in a whole range of other areas. One of these was maternity services which, to complicate things further, was undergoing a parallel but independent review. Another factor was the possible (but contested) need for any neonatal intensive care unit to be co-located with a paediatric inpatient unit. There was also the need to sort out whether adolescent services, and tertiary paediatric services, should or should not remain in hospitals where the childrens ward would be closed. In the initial workshop, discussion at first cycled through all these interconnected areas, unable to focus on any one issue without being led away on to others.

The method adopted for use on this problem was strategic choice. This was chosen because of the problem's combination of complexity due to multiple decision areas, and uncertainties—about decisions in related areas, about the design of the outpatient and outreach services which would support the remaining inpatient unit(s), about prospective activity levels under alternative arrangements, etc. To permit a coherent discussion

to take place participants prioritised a problem focus consisting of no more than 3 decision areas. When discussion of this focus led to simplification (by fixing provisionally on certain commitments, or because clarification led to the stripping away of irrelevant complications), then excluded decision areas could be drawn back into a new focus. This fluidity was assisted by the use of the 'Oval' post-its originally developed for SODA.

As uncertainties arose in each workshop, they were recorded. At the end of the session those seen as threatening to prevent progress were assigned to group members, often the representatives of C&IHA, to research before the next workshop. The facilitators met with the C&IHA team several times between workshops, to take stock of the situation and to design the next encounter. Each workshop started with a reconfirmation of the progress made at the previous workshop, and received a report of the work carried out in the interim.

In this way the group moved through a number of processes—'parking' issues non-central to their task, fixing decisions in some other areas that became obvious once clarification had been achieved, postponing discussion of yet other essentially subordinate areas, and establishing definiteness about the design of outpatient and outreach services. This enabled the final two stages to be approached with a shared view of the problem situation.

The first of these stages was to consider and compare systematically a number of alternative health service configurations—each consisting of so many inpatient units, so many 'specialist children's centres' providing a range of non-inpatient services, and a particular level of community services. This produced a clear consensus for a particular configuration. The final stage was to take that configuration, and establish all the feasible combinations of locations for the units it required, eliminating those which would be poor in practical terms (e.g. alignment of service with population distribution) or were judged to be unacceptable politically. These options were now compared against a range of objectives that had been developed during the workshops. An active process of discussion around these assessments led first to a

shortlist, and then to a strong agreement on a particular set of locations for the facilities. This consensus embraced both ‘losers’ and ‘winners’. This high level of agreement appeared to be possible because the outcome resulted in a transparent way from a problem formulation to which everyone had contributed and assented.

This was in many ways a canonical application of the SCA, demonstrating the strengths of its many decision tools—decision graphs, option trees, advantage comparisons etc. At the time of writing the changes to community services are under way, but no decision to move towards implementation of the inpatient restructuring has yet been taken. Despite the high seniority of the participants, that decision lies with others who were not members of the group. However the continuing shift in clinical practice means that postponement can only accentuate the pressures for change, for which the strategy group produced a logically consistent and compelling prescription. Furthermore, the model of care explicated in the workshops is already guiding the new developments in the area.

### 3.3. *Surveys of the use of problem structuring methods*

Two main empirical surveys have been carried out into the practical use of PSMs, although mention is made of softer approaches in several other reports (Abdel-Malek et al., 1999; Clark and Scott, 1995; Fildes and Ranyard, 1997; Fildes et al., 1999; Jeffrey and Seaton, 1995). The first, by Mingers and Taylor (1992), looked specifically at the use of SSM, primarily in the UK although this was later replicated in Australia (Ledington and Donaldson, 1997). Three hundred questionnaires were sent to OR and systems practitioners who were believed to have had some exposure to SSM. The response rate of 47% was high, and 66% of respondents had used SSM at least once. The main findings were:

- SSM had been used for a wide variety of different types of problems, especially organizational restructuring, information systems and performance evaluation.

- Where SSM had not been used it was because of a lack of confidence or knowledge on the respondents’ part rather than a perceived weakness with SSM.
- It was felt that considerable experience or training was necessary to use SSM successfully, and that its language could be off-putting for potential clients.
- Finally, and unexpectedly, a large number of respondents reported using SSM in combination with other methods, which was one of the drivers behind the later development of multimethodology.

The second survey, by Munro and Mingers (2002), looked primarily at the use of multimethodology but in doing so asked about individual methods as well. Again, questionnaires were sent to, mainly UK, OR and systems practitioners. They were first asked about their knowledge and use of 30 different OR methods, both hard and soft, and then about particular combinations that had been used together. The most frequently used methods were (in order): statistical analysis, forecasting, SWOT, mathematical modelling, simulation, project networks, decision analysis, SSM, scenario planning, and influence diagrams. Other PSMs that featured strongly were cognitive mapping/SODA, VSM, SD, and strategic choice. Given the large number of OR practitioners in the survey the prevalence of traditional techniques at the top is not surprising. The survey then moved on to look at combinations of methods. The main findings were:

- Multimethodology—combining different methods within an intervention—is a common occurrence, and perhaps increasingly so. This happens within both the OR and systems communities. Combining methods is generally judged more successful by practitioners (as indicated by scores on the seven-point scale) than the use of single methods.
- The majority of combinations are either of hard or of soft methods. There are relatively few combinations of hard and soft together. The most common (and successful) combinations of PSMs usually involved SSM combined with

Table 1  
Published papers reporting practical applications of PSMs

Application area	Methods/techniques used	Reference
<i>General Organizational</i>		
Mining performance evaluation	SSM + cognitive maps + queueing theory	Pauley and Ormerod (1998)
Evaluating organizational performance	SSM + critical systems	Gregory and Jackson (1992)
Careers management	SSM	Bolton and Gold (1994)
Developing competence profiles	SSM	Brocklesby (1995)
Industrial psychology	SSM	Kennedy (1996)
TQM	SSM + system dynamics	Bennett and Kerr (1996)
Developing R&D strategies	SSM	Nakano et al. (1997)
Organizational planning	SSM	O'Connor (1992)
Designing a Parliamentary briefing system	Cognitive maps	Bennett (1994)
System for organizational learning	Cognitive maps	Lee et al. (1992)
Assisting community groups	Interactive planning + SD	Magidson (1992)
Teaching entrepreneurship	Interactive planning	Robbins (1994)
Modeling the San Francisco Zoo	VSM	Dickover (1994)
Organizational change	VSM	Brocklesby and Cummings (1996)
Modeling a municipal organization	VSM	Rasegard (1991)
Performance improvement in a multibusiness	VSM	Haynes et al. (1997)
Analysis of drugs trade	SD + SSM	Coyle and Alexander (1997)
Organizational restructuring	VSM	Walker (1990)
Litigation/project management	Cognitive map + SD	Ackerman et al. (1997)
Facilities relocation	System dynamics + soft systems	Vos and Akkermans (1996)
Developing business strategy	System dynamics + soft systems	Winch (1993)
<i>Information systems</i>		
Accounting information system	SSM	Ledington (1992)
Analysis of CD-ROM network	SSM	Knowles (1993)
Information systems strategy	VSM	Schuhman (1990)
Capturing process knowledge	SSM + process models	Boardman and Cole (1996)
Building process models	SSM + grounded theory	Platt (1996)
Developing information systems strategy	Interactive planning + SSM + VSM + strategic choice	Ormerod (1996a,b, 1998)
<i>Technology, resources, planning</i>		
New technology and culture conflict	SSM	Kartowisastro and Kijima (1994)
Planning livestock management in Nepal	SSM	Macadam et al. (1995)
Transport planning	SSM	Khisty (1995)
Agrotechnology transfer in Hawaii	SSM	Millspacko et al. (1991)
Natural resource management	SSM + non-equilibrium ecology	Brown and Macleod (1996)
Lake management	SSM + DSS	Gough and Ward (1996)
Energy rationalization	SSM + QQT	Fielden and Jacques (1998)
Integration in transport planning	Cognitive maps	Ulengin and Topcu (1997)
Regional planning in S. Africa	Interactive planning	Strumpfer (1997)
<i>Health services</i>		
Outpatient – clinics	Systems thinking + data analysis, queueing, simulation	Bennett and Worthington (1998)
Problems of disabled users	Systems thinking	Thoren (1996)
Modeling outpatient services	SSM + simulation	Lehane and Paul (1994, 1996)
Nurse management	SSM	Wells (1995)
Contract management in the NHS	SSM	Hindle et al. (1995)
Health-care information system	SSM	Maciaschapula (1995)
Resource planning and allocation	SSM + simulation	Lehane and Hlupic (1995)

(continued on next page)

Table 1 (continued)

Application area	Methods/techniques used	Reference
Employment for those with mental health problems	Critical systems	Midgley and Milne (1995)
Planning hospital organization	Interactive planning	Lartindrake and Curran (1996)
<i>General research</i>		
Qualitative survey research	Cognitive maps	Brown (1992)
CEO's cognitive capacity	Cognitive maps	Calori et al. (1994)
Eliciting knowledge about pesticides	Cognitive maps	Popper et al. (1996)
Automated knowledge discovery	Cognitive maps	Billman and Courtney (1993)

one or two other methods, including simulation, influence diagrams, strategic choice, cognitive mapping, CSH, and interactive planning. There were also combinations not including SSM, especially involving SD, cognitive mapping, influence diagrams, and strategic choice.

- Choices about which methods to use are affected by the knowledge, experience and skills of the particular practitioner, and to some extent the academic or organisational context, as much as by the nature of the problem itself. Many people do not consciously reflect on or articulate their methodological decisions.

Literature reviews provide a different approach to producing an overview of the field. No review of this kind can catch all relevant publications, and the question of what constitutes a genuine application also poses problems for the reviewer. However Table 1 summarises the results of the most thorough survey to date of written-up examples of practical applications of PSMs (Mingers, 2000).

Several things are notable.

- First, simply the number of published examples, given that they are all reported in reputable journals. This must be very much the tip of the iceberg as far as overall usage goes.
- Second, the wide range of application areas and types of problems tackled, although clearly many are of a general organizational or planning nature.
- And third, the predominance of SSM as either a methodology by itself, or as one used in combination with other methods. This confirms

the strong showing of SSM in the previous surveys.

#### 4. Issues for discussion

PSMs are very much a field in active development, and there is a considerable range of practical issues which are currently either under-theorised or unresolved, and on which, therefore, more work is needed. Three of the most significant of these are discussed below.

##### 4.1. Selecting methods

We are currently in the favourable situation of having many different PSMs and related methods to choose from, and a new problem opens up—how to decide which one(s) to use in any particular situation. One of the first frameworks for classifying different methods was Jackson and Keys' (1984) *system of systems methodologies*. This proposed two dimensions for the context of a problem—the degree of agreement among participants, defined as *unitary* (consensus), *pluralistic* (several viewpoints but agreement possible), or *coercive* (disagreements resolved through exercise of power); and the nature of the problem—*simple* or *complex*. This yielded six cells into which OR/systems methods were placed. For example, traditional hard OR was most suitable for simple–unitary contexts, VSM for complex–unitary contexts, and SSM for complex–pluralistic contexts.

Although a step forward, this framework had several limitations (Mingers, 1992a,b). In particular, it assumed that problems could be clearly

identified as being of a particular type; that methods fitted neatly into the cells; and that therefore practitioners just needed to choose an appropriate method to deal with their particular type of problem. It may sometimes be the case that, just as a well-defined problem clearly implies a particular solution technique, so a strongly organised problem *situation* may indicate the method by which it can fruitfully be tackled. Commonly, however, this will not be the case in the ‘messy’ situations that PSMs are appropriate for. It may well be that only after the investigation is underway will the situation attain sufficient definiteness that a method can be selected. Furthermore, since the use of PSMs is a form of ‘organised finding out’, it is quite possible that this process will change the understanding of the problem context. For example, what was initially perceived by the relevant actors to be pluralist in character may, as a result of the intervention be re-perceived as falling elsewhere on the spectrum of degree of agreement.

The next development was that the system of systems methodologies framework was augmented by a method (or rather meta-method) to assist in choosing appropriate method(s) in particular situations: “total systems intervention” (TSI) (Flood and Jackson, 1991; Flood and Romm, 1996). TSI, however, was itself limited as it assumed that generally only one PSM would be used within a single intervention, and that the *whole* method would be used rather than simply a part of it. This limitation was recognised theoretically by Midgley (1989, 1990) and Mingers (1994) but was already a de facto reality in practice, where several practitioners routinely combined parts of methods together (see for example the Sainsbury’s case study above).

This leads to the idea of *multimethodology* (Mingers and Brocklesby, 1997; Mingers and Gill, 1997), that deliberately seek to combine together a range of methods, perhaps both soft and hard, in order to match the richness of the problem situation, and deal effectively with the different stages of a project.<sup>1</sup>

Any real-world problem situation will be a complex mix of the material, the social, and the

personal. Material or physical characteristics could be modelled using traditional OR techniques, but social conventions, politics and power, and personal beliefs and values need quite different, qualitative approaches. Equally, a real project goes through several stages—understanding and appreciating the situation, analysing information, assessing different options, and acting to bring about change. The various methodologies can be more or less useful at these different phases. These are two strong arguments for combining together different PSMs. In use, multimethodology is a creative process of design based on competence in a range of methods. Each project or intervention is seen as a unique situation (although of course having features in common with others) for which a particular combination of methods, or parts of methods, needs to be constructed. This is an ongoing process throughout the project, as events occur and the situation evolves.

#### 4.2. Client relations

The rationale for all varieties of decision support, whether hard or soft, is that they should be used and useful. This evidently requires establishing and maintaining good relations with those who have troublesome decisions to take—we may call them ‘clients’ for short, though there can be many varieties of relations between supporter and supported.

By and large practitioners of hard OR, and those who developed its (mathematical) theory, have presented a relatively straightforward view of its practice issues. Underlying these accounts has been an implicit or explicit view of the decision-maker as an individual confused by the complexity of certain types of decision which he (sic) is confronted by, who will in principle be grateful for objectively based advice, and act on it. Practice issues (that is, those outside the skilled use of technique) are seen as to do with the collection of data without biases, the construction of appropriate measures of effectiveness, the identification of sensitive parameters, the clear and persuasive presentation of results. Both the development of a relevant model and the acceptance of its implications are taken to depend on mutual

<sup>1</sup> Jackson (1999) has also moved nearer this position which he now terms “coherent pluralism”.

understanding and trust between decision-maker and analyst. (For reference, take virtually any OR text from Morse and Kimball, 1951 onwards.)

None of these are invalid when working with PSMs, but their more complex underlying model of decision support has led to greater introspection and subtlety. Rather than a client we have a client-system, whose members interact on the issue of concern but also on others. Rather than a simple eagerness for clarification we may have anxieties, irreducible uncertainties, conflict. Rather than objective data we have information crucially subject to interpretation from different perspectives. And so on.

In this section we will indicate a range of issues that may be of particular concern when using PSMs in an engagement with a client group. The discussion will draw on a range of case studies, including those summarised in Section 3.2.

#### 4.2.1. *Negotiating entry*

There has been a good deal of discussion in the social science literature about the politics of access to research in organisations (see for example Beynon, 1988; Boden, 1994; Schwartzman, 1993), but much less so in writing about decision support. Accounts of practical work often omit the question of how the researchers got to be there in the first place. This is a relevant issue for internal consultants, as well as for external consultants and academic action researchers, but for simplicity this discussion will not deal with the former case.

Even for high-profile researchers unsolicited approaches “out of the blue” are a rather rare starting point for an engagement. Nor is “cold selling” normally a plausible strategy. Anecdotal evidence and personal experience suggest that fruitful involvement most commonly result from previous contacts, introductions brokered by third parties, or relations established in other contexts with organisational gatekeepers. This suggests active networking as a strategy, investing in a wide range of relationships which can be exploited opportunistically in the medium- to long-term (Horlick-Jones and Rosenhead, 2002).

A feature of PSMs is that, because of their ability to handle multiple perspectives, they are more appropriate than are traditional OR methods

for use in interorganisational problems. The question of access here takes on another dimension. Contacts with one of the organisational actors may give entry to the problem forum—but that entry point may itself occasion doubts among other stakeholders as to the impartiality of the facilitation that may follow. In the street festival case (see Section 3.2) considerable attention had to be given to the network of mutual obligations among the organisations in order to sequence approaches to them in a way which converted introduction by one into acceptance by all. In the paediatric care strategy case, post-workshop feedback revealed some sensitivity to the close inter-workshop working relationship between the facilitators and the Health Authority team members.

#### 4.2.2. *Workshop arrangements and processes*

PSMs have their greatest advantage in multi-actor situations, and their characteristic mode of operation is the workshop, in which representatives of stakeholding groups interact. Commonly fragmented information and knowledge need to be brought into conjunction and socialised, as a background to the negotiation of a common problem formulation and commitment to its implications. The PSM practitioner(s) must provide an environment in which this can happen effectively. The way in which the workshop is established and its processes managed can be crucial to the success of the engagement.

The practitioner operates in the workshop in the role of disinterested facilitator, enabling so far as is possible the participants to have their voices heard. This involves managing the contributions of the over voluble and the over reticent, and making it feel safe for all to express their views as fully and openly as possible. It is not enough, therefore for the facilitator to be skilled in the particular method(s) being used. She/he needs to be sensitive to the potential fears and anxieties of participants, to inequalities of communicative competence, to the mood of the group, and to the internal and external power relations which may inhibit free expression. (For fuller treatments of facilitation, see Phillips and Phillips, 1993; Ackermann, 1996; Vennix, 1996.)

PSM practitioners have frequently emphasised the importance of the physical arrangements of the workshop, for example availability of accessible wall surfaces for flip-chart and post-it sessions, comfortable chairs and little obstructive furniture, availability of 'syndicate' rooms and a venue away from the workplace (Eden and Ackerman, 1998; Friend, 2001).

The appropriate selection of workshop members has also been flagged up as an issue. Two of the cases from Section 3.2 exemplify this in contrasting ways. In the paediatric strategy case great care was given over some weeks before the first workshop to the construction of a matrix ensuring that both organisations and specialisms were appropriately represented, and that the individuals concerned were signed up to the method of working. There were no absentees at workshop 1, and with just a few substitutions continuity of representation was maintained in subsequent workshops. By contrast, in the development planning case the calling of workshops was a last minute affair with little time for reflection on the appropriateness or completeness of the invitation list, which in any case bore only a passing resemblance to the attendance list. These features certainly had a major bearing on the effectiveness of the events.

It is not uncommonly the case that workshops are limited in length by external factors. For example in one health service case only two hours was available (the length of a cancelled clinic) and that was constantly interrupted by staff exiting summoned by beepers, since the entire speciality team for the hospital was in the room (Gains and Rosenhead, 1993). In an involvement with crime prevention in a city in the North of England, the time constraint was attention span. Two workshops were held with boys and girls (separately) of the age and indeed groups responsible for much local crime and the fear of crime. Ninety minutes stretched their capacity for even spasmodic concentration. In such cases it must be a matter of judgement whether to accept the restriction or to accept that no workshop can be held.

Even managerial participants are not immune to attention span deficiencies. This is another argument, in addition to those advanced earlier, in

favour of multimethodology. Extended engagements not uncommonly involve a series of workshops at intervals. Some PSMs are composed of a number of stages with distinctive tools and processes, but others are less rich. It can be demotivating for group members to face the repeated application of a method with which they have become familiar. The use of a combination of methods, if appropriate to the subject matter and context, offers an alleviation of this difficulty.

Each workshop constitutes a major expenditure of scarce time by the participants, and merits careful preparation. It should always be a post-workshop responsibility for the facilitator(s) to take stock and discuss next steps with the workshop members entrusted with moving things forward. When there is a series of linked workshops, this process merges with that of planning the follow-on event. Additional information or other inputs may be needed if the next workshop is to avoid simply treading water. It is more common than not that the original design for the sequence will need radical revision as a result of information and interactions generated at the previous workshop.

Attention to detail in the organisation of any workshop is essential. In the crime prevention project a workshop was also held with local pensioner residents. (A fourth one was held with the local police team.) The workshop was held in a (much vandalised) community centre with poor lighting. There was a low platform in front of the wall we selected as most suitable for flip charts. The consequence of the combination of these factors was (i) that the participants felt themselves unable to venture to the wall themselves, instead passing oval post-its to the facilitators; and (ii) that the participants had great difficulty in seeing the writing on the ovals once posted. These are major downsides for a method predicated on participation.

#### 4.2.3. *Beyond the workshop*

The experience within a PSM workshop, when it is working well, is frequently intense and the sense of release and satisfaction when a breakthrough is made can be palpable. Negotiated accommodations arrived at in this way can be

creative escapes from apparently irresolvable tangles.

However this almost cathartic experience is non-transferable to non-participants. Generally only a part of the client system from any organisation involved in the problem situation will be present at the workshop, and those not present may be reluctant to take its outputs on trust. This difficulty surfaced explicitly during the paediatric strategy case, at a report-back meeting to a larger cross-institutional paediatric care forum for the health district. The mood of scepticism was sufficient to generate a semi-serious proposal that the entire exercise be repeated with new participants drawn at random from the forum's membership, in order to explore the reproducibility of the outputs.

For work within a single hierarchically structured organisation, top-down authority may carry the outputs of a PSM-based process towards implementation. In the case of interorganisational work the situation is more complex, and the generation of acceptance among the various organisational constituencies can be problematic. It is clearly advisable for these problems of multiple acceptance to be discussed by the group, and to inform the implementation strategy.

Another dimension of the acceptance and implementation problem is the impact of abrupt and unexpected changes in the external environment. This was a factor at several stages of the street festival case. In Venezuela political volatility was a fact of life—and in fact generated the “48 hour coup” against Chavez one year later. In the paediatric strategy case the momentum to implementation has been affected both by the timing of a general election, and by a drastic restructuring of NHS organisation announced with little apparent premeditation during the election campaign. There is no methodological defence against such shifts in the context. Perhaps they should be regarded by those involved with PSMs as a price of relative success—that they demonstrate that we are dealing with problems at a strategic level which is more vulnerable to such discontinuities. Furthermore the solutions/resolutions generated may, despite the punctuation, live on to form the basis of future cycles of negotiation.

#### 4.3. *Evaluating the success of problem structuring methods*

Whilst it is clear that PSMs are widely used, and that this usage is growing, what is less clear is the extent to which we can actually evaluate how successful PSMs are. Their popularity, and the fact that people use PSMs repetitively, provides prima facie evidence for their efficacy but is it possible to measure their contribution more rigorously, either comparing using a PSM against not, or comparing PSMs with each other?

This turns out to be a difficult question to answer, with a wide spread of views about both its desirability and its feasibility.<sup>2</sup> At one extreme Checkland clearly articulates the view that it is not possible to meaningfully measure the effectiveness of a particular use of a methodology. This is because every instance of use will be unique—inextricably bound both to the problematic situation and to the user(s) of the methodology. He says:

If someone says to me: ‘I have tried the methodology and it works’, I have to reply on the lines: ‘How do you know that better results might not have been obtained by an adhoc approach? . . . If, on the other hand, the assertion is: ‘Your methodology does not work,’ I may reply, ungraciously but with logic, ‘How do you know the poor results were not due simply to your incompetence in using it?’ (Checkland, 1981, p. 241).

What Checkland does allow, in support of SSM, is that it has a high degree of internal rigour, and that it is based on solid theoretical and philosophical grounds—in this case phenomenology.

At the other extreme, Finlay (1998, p. 201) argues that not only should a methodology be evaluated in terms of its underlying theoretical base but it also needs to be validated comparatively through the use of formal (laboratory and

<sup>2</sup> There is also debate about success and validation in the area of more traditional hard OR—(see Landry et al., 1983, 1996; Oral and Kettani, 1993).

field) experiments: “[T]heoretical validity . . . is not sufficient by itself to establish the validity of a GSS [group support system] in use. Experimental validity must also be sought. . . .if experimental validity is not possible then the GSS remains substantially unvalidated.” These views stem from a clash of underlying philosophies that cannot be adequately addressed, let alone resolved, within this paper. Broadly, Finlay is echoing the positivistic approach which is strongly favoured by North Americans in evaluating, in particular, computer-based group support systems (DeSanctis and Gallupe, 1987). This assumes that a particular method can be abstracted from its context of use, and its users, and then compared with other methods in a controlled environment. In contrast, most developers of PSMs (e.g., Eden, 1995, 2000; Checkland, 1989) would ally themselves to an interpretive paradigm and argue that each particular real-world application of a PSM is, in most ways, a unique event that can only be evaluated in its own terms. By attempting to set up controlled laboratory conditions one is essentially trying to control out many of the very factors that are vital in that particular engagement.

Eden (1995) points out that PSMs such as SODA and SSM are very much more sophisticated and rich (“wide-band”) tools than the computer-based GSS systems (“narrow-band”) that do little more than facilitate the process of a meeting by, for example, anonymised voting. Therefore the application of PSMs involves substantial involvement and commitment from the participants/clients and may well lead to significant organizational change in the “negotiated social order”. As such it cannot be simulated by, for example, students undertaking role-play exercises in a laboratory setting. Nor can its success be judged except by the clients themselves who will have experienced both the process and the outcomes. Even then, such judgements will almost inevitably be imprecise and qualitative.

Whilst broadly accepting the interpretivist view, it is still possible to assemble some general evidence about the *perceived* effectiveness of PSMs. In terms of particular examples, Connell (2001) and Ormerod (1996a) have both produced reviews of one of their own interventions. Connell’s project

used SSM in helping to design an information systems for health service users in one of the regions of the UK National Health Service. One of the key features was to bring together many different stakeholders in order to produce a cross-disciplinary patient-centred information systems. The project was felt to be a failure (by Connell at least) because although the SSM process took place it did not result in an implementation of the recommendations. Connell conducted a comprehensive review, generating several frameworks that would be useful more generally in evaluating soft projects, and conducting a questionnaire and interviews. The review concluded that the original project was generally seen as successful in generating insight and a degree of consensus, but not sufficient commitment among the participants to breakdown long-standing disciplinary boundaries.

The second example is one of the few where a practitioner actually returned, several years later, to check on the development and success of a project’s recommendations. The project was the one carried out by Ormerod, and described above, concerned with developing an IT strategy for Sainsbury’s. Five years after the event, the ambitious IT strategy had largely been implemented. Whilst the costs of several of the systems had been underestimated, so too had the benefits and Sainsbury’s management considered the project important both in its outcomes and in the learning gained during the process (Ormerod, 1996a).

Moving now to more general evidence, both the surveys discussed above asked respondents (users or practitioners rather than clients) how successful they believed the methodologies were. In the SSM survey, 64% rated their level of success as “good” or “very good”, and only 6% as “poor” or “very poor”. When asked about the overall practicability of SSM, of the 65 who answered the question 35 gave an unqualified yes, and a further 26 gave a qualified yes, indicating some area of concern. Very few answered negatively.

In the multimethodology survey we asked about the success of both individual methods, and the use of multimethodology. When asked about how respondents rated the success of the methods, interactive planning scored highest followed by influence diagrams and simulation. On a seven-point

scale, the mean success rating for individual PSMs and related methods was generally over five. Success with multimethodology was similarly measured and respondents were also asked how they perceived the client felt about the project. Seventy-eight responses were complete and the mean scores for their own satisfaction and the client's were 5.6 and 5.4 respectively, with a median value of 6. Although a subjective evaluation, it does indicate a high level of personal satisfaction with PSMs.

## 5. Ways forward

It can reasonably be claimed that PSMs have effected a breakout from the well developed but confined arena of technocratic solutions to consensually defined problems occupied by OR's traditional methods. The breakout, though as yet limited, has been consolidated over the past decade or so. This outward movement has brought decision-support modelling in touch with a range of other methods and practices designed to help groups make progress with their problems. We have suggested elsewhere (Mingers and Rosenhead, 2001) that large group methods, development planning methods and community OR are among the areas from which PSMs can learn, and to which PSMs can contribute.

### 5.1. Large group methods

PSMs are designed to promote an engaged and structured conversation, and this limits the size of the group that they can be used with. Beyond about 12–15 participants even the most skilled facilitation cannot prevent the slide into other forms of interaction. Where more people need to take part (e.g., because of specialised or experiential inputs, or due to political considerations) rather elaborate arrangements are needed, based on segregation into a number of medium-sized groups each with different functions. Such uses of PSMs are the exception rather than the rule.

Recent years have seen the proliferation of a range of methods specifically developed for situations where larger numbers of people need to

participate. Known jointly as large group methods, they can accommodate as many as several hundred participants. For a general description, see Pratt et al. (1999) and Bunker and Alban (1997).

Leading methods are open space technology, future search and team syntegrity, each of which has its own particular features. However each of them is designed to allow all participants to have a voice, and to provide opportunities to develop relationships and to establish genuine dialogue, with a view to achieving organisational change. The underlying principle has been described as "getting the whole system in the room". The apparent contradiction between the attempt to encompass the entire system, and the aspiration to real dialogue is managed by working in small unfacilitated groups, but linked through facilitated plenary sessions.

There are evident similarities between these methods and PSMs, as well as some clear differences. (For a discussion, see White, 2002; Bryson and Anderson, 2000.) Both approaches aim to liberate creative thought by bringing together diverse experiences, knowledge bases and perspectives; and both aim to generate collaborative action towards a desired future. The comparative advantage of PSMs is that the mutual accommodations are based on appropriate cause/effect modelling; while that of large scale methods is that they will have the assent of the entire community of stakeholders, not just a small number of representatives. There thus appears to be a potential for both practices to learn and borrow from each other's methods.

### 5.2. Development planning methods

Methods for planning economic and social development in the Third World have been through a paradigm shift which mirrors that of OR. The traditional method was top-down, prescriptive, and focussed largely on economic growth. The more recent alternative sees development planning as a co-operative process involving a plurality of social actors, including crucially the intended beneficiaries, to identify strategies for guiding social change (see Chambers, 1997).

A bewildering array of methods appropriate to this alternative view have been developed. (For general accounts see Pratt and Loizos, 1992; Mikkelsen, 1995.) The most widely used of these, inspired by Chambers, are rapid rural appraisal and its successor participative rural appraisal (PRA). These names are already misleading, as there have been many applications in urban areas, and even in developed countries (including the British health service).

Among the emphases of these methods is the need to synthesise hard and soft data drawn from the widest range of sources; and to triangulate—that is to view the situation from a variety of perspectives. PRA in particular has developed a wide range of methods for eliciting and collating information. These include ranking exercises, in which, for example, locally available materials (seeds, stones) may be used as markers to rate each of a range of alternatives (e.g., crops) on a number of attributes; role playing, which enables participants to surface sensitive aspects of life which might otherwise be hard to discuss; and a variety of types of maps and diagrams (including Venn diagrams) to express spatial distribution, social overlap and so on.

There are evident parallels, in both process terms and in technique, between PSMs and these participatory development planning methods. But there are also clear differences of emphasis. PRA and its family members have an elaborated methodology for eliciting and representing information of remarkable transparency and accessibility—for example illiteracy is no bar to participation. However for evaluating and comparing alternative actions or strategies they depend on individual judgement and group consensus processes, whereas PSMs' model-based approach makes the connection forward from action to consequence. This complementarity of strengths suggests the possibility of either joint use or mutual borrowing (Bendeck, 2001; White and Taket, 1997).

### 5.3. *Community operational research*

The development of PSMs has opened up a wide variety of problem situations that would not previously have been amenable to model-based

support. For example, it is doubtful if any of the issues tackled in the cases summarised in Section 3 could have been approached using traditional methods.

The general characteristics of problems for which PSMs may be helpful have been presented in Section 1. As yet there have been few nominations of particular application areas that in general match these characteristics. Mingers and Rosenhead (2001) have suggested information systems design as one fruitful area. A paper in the current issue (Franco et al., 2004) proposes interorganisational learning among members of organisational partnerships as another.

OR for community groups is an area in which PSMs have already shown their applicability. The tenants' co-operative case in Section 3.1 is one example. In one collection of masters students' projects in Community OR (Bowen, 1995) half of the applications used PSMs.

When the British Operational Research Society set up a Community Operational Research Unit it was decided that its clientele should consist of groups that:

- exist to protect or advance the interests of their members,
- possess scant physical or financial resources,
- have no articulated management hierarchy,
- operate internally through consensus or democracy.

For more on Community OR, see Taket and White (1997) and Ritchie et al. (1994).

It is easy to see why a 'fit' between community OR and PSMs should appear natural. With few resources, many of traditional OR's resource allocation tools are irrelevant. Furthermore the weak are perhaps disproportionately confronted with 'wicked', less well-structured problems; and the bottom-up nature of the PSM approach seems appropriate for the defined clientele. No doubt these are among the reasons for the relatively high penetration of PSMs in this area.

This is not to say that traditional methods have no purchase in community OR. Rosenhead (1993) proposes a four-way breakdown of Community OR projects. Two of these categories—namely

projects concerned with the internal administration of the group, and those where the group needs to produce analyses to persuade external bodies—indicate a potential for traditional forms of analysis. PSMs come into their own where members of the group disagree internally about strategy or direction, and the issue needs to be resolved; or where in a volatile and possibly hostile external world the group needs to position itself and/or devise a negotiating strategy. So while Community OR undoubtedly offers a rich scope for the application of PSMs, it is nevertheless the case that—as Thunhurst (1987) was early to argue—methodological pragmatism should be the order of the day.

## 6. Conclusion

We believe that the record of applications of PSMs as revealed in this overview is substantial. There have been a wide variety of different types of use, both in context and in content, to which the current special issue of this journal adds a further tranche. Although there are methodological difficulties in the way of evaluating the effectiveness of PSM-based interventions, there is a good measure of user satisfaction. And there is an exciting range of possible further developments which appear to be reachable from the solid base that has already been achieved.

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