

Soft Operational Research Techniques: Current and Future Uses

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Abstract

This paper summarises the aim that Soft Operational Research (O.R.) techniques have in practice, and details the philosophy of a number of well known and commonly used techniques such as Soft Systems Methodology (SSM) and Strategic Options Development Analysis (SODA). It aims to propose the future for Soft O.R. and its methods particularly for practitioners and to aid in building awareness.

Introduction

Soft Operational Research (O.R.) methods are crucial when many stakeholder views have to be taken into account and when the problem that you are being faced with is complex in nature¹. They can be used as a tool to help understand the issues at hand and provide a range of reasonable solutions in how to overcome them. This paper will attempt to build a general picture of Soft O.R. methods based on relevant literature, and what Soft O.R. offers to problem structuring. It will firstly discuss the general nature of Soft O.R. and its presence in problem structuring and then discuss two of the key methods in more depth:

- Strategic Options Development Analysis (SODA)
- Soft Systems Methodology (SSM)

For each method, the underpinning philosophies and framework shall be discussed. Other methods will also be highlighted and discussed to provide further depth and awareness. These methods will include:

- Drama Theory
- Scenario Planning/Analysis
- Causal Mapping
- Theory of Constraints
- Benefits Modelling/Analysis

Soft O.R./Problem Structuring Methods

Problems faced by many organisations are typically unstructured, complex and involve multiple perspectives and interests. In order to manage such issues, Soft O.R. methods are crucial in the initial stages of project planning to help overcome them.

Defining Soft O.R. /Problem Structuring Methods

According to Wooley and Pidd², there are a range of ideas that constitute a problem and problem solving. Soft O.R. methods provide decision makers with systematic help in identifying an agreed framework for their problem³. White⁴ and Rosenhead⁵ indicated that, 'Soft O.R. methods are characterised as a family of methods for supporting group decisions of diverse composition within a complex environment to agree a problem focus and make commitments to a series of actions. These definitions can start to provide a clear view into what problem structuring and Soft O.R. actually is, but also the reason for their existence. Rosenhead⁶ also mentions that it provides a framework for problem solving whereas others have found that it is particularly useful for groups of stakeholders, not only individuals, which highlights the idea of multiple perspectives and conflicting interests⁷.

Going back to previous studies⁸, they define the action of problem structuring using Soft O.R. methods as the process where initial conditions are translated into a set of defined problems, issues, and questions to allow scientific research action. Even 30 years later, researchers have built on this definition by saying 'Soft O.R. methods are a collection of participatory modelling approaches that aim to support the diverse collection of actors in addressing a problematic situation of shared concern'⁹. Therefore, this modern definition highlights the contemporary importance of stakeholders in problem structuring compared to that of the past. More modern definitions bring multiple stakeholders and methods into account even when still trying to tackle that 'messy' problem.

Purpose of Soft O.R. /Problem Structuring Methods

Soft O.R. methods have become widely accepted as a significant new direction for operational research and systems movement¹⁰. They mainly help define where the problems actually lie and attempt to provide a clear view of how to overcome them. Therefore, Soft O.R. methods are valuable in the modern day's problem intervention.

However, Soft O.R. methods are more than just about helping to define a problem, they can also help people make decisions, reduce complexity and ensure elements of the

decision making process are not ignored¹¹. The need to structure problems has arisen from three areas¹²:

- We are tackling different types of problem situations
- We have different understandings towards those problems
- We have different assumptions in our interventions

These areas are the key drivers behind why Soft O.R. methods are necessary. Within these three areas, there are multiple actors to take into account behavioural complexity and the fact that people have different aims and objectives in a problem situation¹³. Soft O.R. Methods can aid in overcoming these issues. They can act as a tool to define problems and allow them to be overcome. Many Soft O.R. methods generally share a collective view in understanding a problem situation and aid in gaining as much information as possible about that situation.

Soft O.R. methods are seen as complex interventions that seek action at many levels; both individually and systematically¹⁴. This view into the purpose of problem structuring and Soft O.R. shows that they are about being action orientated. Therefore, Soft O.R. and problem structuring should be used under the assumption that they do not just help define the problem, but provide a pathway to act on it. Soft O.R. methods have also been indicated to be a form of intervention which can provide attention to both the process and the content of inter-organisational collaboration and can report the experience of their application¹⁵. Building on this, a key aim of problem structuring can be drawn¹⁶:

“Soft O.R./Problem structuring methods (PSMs) aim to build shared understanding in a group of decision makers. This shared understanding is used as a basis for them to negotiate an agreed action plan that they are prepared to help implement”

Having problems that are complex in nature and where multiple stakeholders are involved creates a need for Soft OA. The methods can get people involved with the issue and don't only try to gain an objective definition of the problem, but emphasize the importance of each individual's perception of a problem¹⁷. Interesting features of the problem structuring process usually involve scenario creation, organising group workshops to bring people together, and facilitation to help create group discussions and improvements. To accurately define a problem, it must not come from one person, but must be a shared view.

Future for Soft O.R./Problem Structuring Methods

How Soft O.R. will develop in the future is unknown. It is clear however that methods will always exist to deal with multiple stakeholders, and not only individuals or distinct

problems¹⁸. Rosenhead¹⁹ mentions that when applying ‘Hard O.R.’ methods (quantitative methods) to certain problems, they are often both practically infeasible and undesirable and that more and more users will start to switch towards the softer skill set of problem structuring and option choosing. Eden and Ackermann²⁰ also mention that the future of Soft O.R. must become more transparent and a trans-disciplinary approach is required with methods which can bring together social psychology, psychology, maths, strategic management, logic, computer science.

Westcombe²¹ believed that the future of Soft O.R. would incorporate larger stakeholder groups, workshops will be able to happen at different times and different places e.g. virtually, and that the key craft skills of the facilitator may well be transferred across practitioners. Other perspectives also felt that problem structuring and Soft O.R. methods are becoming more software supported²². They mention that methods are becoming more technologically advanced and users are moving away from traditional pen and paper, post-it notes etc, to make facilitation easier.

Within government in particular, there is more desire to move towards short project timeframes, with tight economical constraints. In light of this, the benefit of using Soft O.R. is that it can provide a useful tool for using in short time frames and to capture stakeholder views. More Soft O.R. practitioners are starting to “mix and match” elements of the key techniques on their own for example; using rich pictures to first understand the problem situation, but then may move on to typical SODA techniques such as cognitive mapping and decision analysis. Due to the short time constraints of projects and the limited funds available to seek a solution, practitioners even within government are becoming more flexible with Soft O.R. Hence using a multi-methodology approach (particularly mixing Soft O.R. techniques) is seen as a key focus for where the future of Soft O.R. lies.

Strategic Options Development Analysis (SODA)

SODA (Strategic Options Development Analysis) is one of the more popular Soft O.R. methods. It is essentially a way of making sense of a complex problem through the eyes of a client group²³. As a problem structuring method, SODA aims to channel the co-operation of a variety of stakeholders into addressing a problem.

Philosophy of SODA

Westcombe²⁴ mentions that SODA is used for designing problem solving interventions through mapping stakeholder views. He found that the key philosophy of SODA is about structuring a problem through stakeholder involvement. SODA elicits information from

members of a group using individual interviews and the ideas are captured on cognitive maps²⁵.

The method itself is about helping people to refine their thinking about a particular problem and mainly to achieve understanding and agreement between the members involved in the issue under discussion²⁶. What makes SODA unique is that it is simple to use, it is facilitator dependent and it deals with complex situations by managing complexity rather than reducing it²⁷. Therefore, the central aim of SODA is as follows²⁸:

“SODA is about reaching consensus and commitment to action. It is not wholly about reaching the ‘right answer’, but to enable the client group to develop a mutual problem definition so that they can move to action.”

Eden²⁹ highlighted that a SODA intervention is successful only when consensus rather than compromise, and commitment rather than agreement have been reached. Rosenhead and Mingers³⁰ found that an O.R. consultant would be interested in employing a SODA approach to problems only when; they are interested in face to face problem solving groups, facilitation and when the consultant is interested in researching and analysing a problem through workshops.

Framework of SODA

The theoretical perspective of SODA is explicitly subjectivist in nature and it assumes that organisations are made up of individuals who are constantly striving to make sense of their world³¹. It requires that groups are created in a way that ensures that an adequate number of individual perspectives are brought to the problem³².

As part of SODA, cognitive mapping and facilitation are two key concepts that must be carried out. Several members of a group must be interviewed and the information given must be captured through cognitive maps. Therefore, a facilitator must interview the respondents, create the maps and gain as much information out of the respondents as possible to create more value in the process. To summarise the SODA framework, Westcombe³³ found that SODA makes use of mapping techniques, involves facilitators to design and conduct the workshop process, and can make use of single or networked software projecting the information onto a shared public screen. According to those who designed SODA, the key steps involved include: Key stakeholders are invited to a purposeful workshop and interviewed, individual cognitive maps are then produced, merged to produce a strategic map, and this is then analysed³⁴. Usually a workshop is then held to review the strategic map and to determine appropriate actions for the client based on the findings. According to Rosenhead and Mingers³⁵, SODA has its foundation

in 'subjectivism' and each member of the client group is held to have their own subjective view of the real problem.

Soft Systems Methodology (SSM)

Soft Systems Methodology (SSM) is also one of the most widely used Soft OA methods. It follows the logic that every problem is like a system that needs to be understood. Checkland³⁶ felt that these systems (problems) could be better understood if compared to reality in a model which could structure a debate focused on the differences, and could later identify where changes need to be made.

Philosophy of SSM

The philosophy behind SSM is that it uses systems thinking; which involves the realisation that many of the things dealt with in ones daily existence can be considered as systems i.e. designed to achieve a purpose³⁷. SSM uses systems concepts as a means of learning and understanding when there may be a situation that some may see as problematic³⁸. This method takes the problem structuring away from the 'Hard O.R.' side and therefore is more aligned to human activity systems. Rosenhead and Mingers³⁹ found that SSM is a learning system for complex, problematic human situations and is aimed at improving the problem situation for those involved and to identify areas for change.

SSM recognises that the process of human interaction is just as important as the data involved or even the outcome of an organisational problem⁴⁰. It is a notional view of perceived systems being based on a person or group's perception of a particular issue for example; one may say 'terrorism' while another may say 'freedom fighter'⁴¹. This form of problem structuring acts as a technique to structure the questioning of a problem, and the way it should be approached⁴². It acts as a learning system, a system of enquiry, and helps the user to pay attention to the activities within the problem situation and take a systematic view to understand it⁴³. To be clear about what is being discussed, the goal of SSM is⁴⁴:

*“To come to an accommodation between different,
and often conflicting, views and interests of participants in a process of debate and
learning to generally make sense of the world surrounding the problem.”*

To summarise the philosophy behind SSM, it gives an approach for taking a complex human situation/problem and expressing its core constituent systems in a standard way that is transparent and involves the whole client group⁴⁵. Therefore, it can capture the key elements of a problem, while taking into account a variety of stakeholder perspectives.

Framework of SSM

Early literature suggests that SSM should adopt a ‘7 step process’. However, the application, or even success of carrying out this method does not have to be carried out in any detailed sequential order, but rather generally follow the key steps of the learning cycle below:

1. Learn about the problem situation (including the social and political aspects)
2. Create some relevant models of purposeful activity (to learn more about the problem situation)
3. Discuss the situation using the models (to find accommodations about the actions needed)
4. Take action based on the accommodations reached (and look to begin the cycle again)

The mindset adopted when using SSM should be focussed towards learning for action, not problem solving. Some of the techniques used to carry out this process include:

- **Rich pictures** – Creating a diagrammatic representation of the problem situation for analysis
- **PQR Formula (Three consecutive letters meaning What/How/Why)** – Fully understanding the key deliverable and stakeholder perspectives
- **Customers, Actors, Transformation, World-view, Owners, Environment (CATWOE)** – Picks up loose information and a situational perspective (Customer, Actors, Transformation, Worldview, Owner, Environment)
- **Root definitions** - Includes the PQR and CATWOE incorporated to create an accurate description of the problem situation to develop actions
- **Conceptual/activity modelling** – Activity model is created in the form of a map from the PQR and stakeholder perspectives – to identify appropriate actions
- **3 E’s** – Assesses the transformation process; efficiency, efficacy, and effectiveness – Are things operating the way you had previously planned, then you would start to begin the process again

By following these key processes within the framework of SSM, it can help the user fully understand the problem situation and move forward. Often with problems, there is no sole answer which is correct. SSM does not provide an answer, but rather provides a tool to learn about the problem, design an appropriate way forward and then understand how it should be delivered. With most projects, there will always be several perspectives; those from the project team and from the problem owners e.g. making a job easier, learning new skills etc. Therefore, fully understanding who the project is for, and what

should actually be delivered is very important. SSM helps clarify - even to the client - the best way to proceed with a project and deliver the required output.

Drama Theory

Drama Theory is a socially interactive oft O.R. method where actors take roles within the problem situation and help decipher the problem based on interactions between various points of view. It looks at the social construction of real situations and incorporating the multiple perspectives that participants have to form some analysis and to also overcome differences in opinion⁴⁶. Drama Theory proposes an overall model of conflict and resolution where; a drama unfolds as a series of episodes in which some of the parties interact⁴⁷. Their actions influence the outcome of each episode and what happens next, but within each episode, there is a scene setting, a climax and a larger scale drama as a whole⁴⁸. Throughout the episodes, characters occasionally act on a common interest to achieve common goals, but resolution only occurs on reaching an outcome that exhausts both rationality and emotion and there are no opportunities to make the situation better through further transformations and episodes⁴⁹.

The principle of this method is to analyse real situations, and create interplay of rational choice, emotion and argument of the various characters involved in the problem to come to a reasonable resolution⁵⁰. Often, Drama Theory uses Confrontational analysis as a mathematical underpinning of structuring situation and identifying dilemmas for different characters; as it follows the adoptions of game theory⁵¹. Stakeholders using this method act out a short drama in relation to the problem situation, with the overall aim of trying to identify how people interact, what arguments tend to arise, and to help understand the situation as a whole.

Scenario Planning/Analysis

Scenario planning is a method for learning about the future by understanding the nature and impact of the most uncertain and important driving forces affecting our future⁵². With this method, you can use stories or scenarios to find out more about near, medium and long term futures. It is a group process that uses techniques in workshops and the transfer of knowledge to understand the nature and impact of those driving forces that will affect the organisation or a particular problem – which are most uncertain and have the most impact⁵³. With this method, it is important to gain a deeper understanding of the central issue important to the future⁵⁴.

Scenario planning involves having strategic conversations where key points diverge and scenarios or stories are developed about how the future might unfold under certain circumstances⁵⁵. Based on Scenario literature, there are five crucial steps to follow⁵⁶:

1. **Identify the focal issue or decision** – Agree on the issue that needs addressed
2. **Identify the primary driving forces** – Social, political, economical, technological etc
3. **Identify the predetermined elements of the driving forces** – Elements completely outside of one's control and will play out in any future
4. **Identify the critical uncertainties** – Elements left once predetermined elements have been identified e.g. Globalisation, Recession. Simplify the list of critical uncertainties (usually into a two dimensional matrix) for logical futures to be explored.
5. **Flesh out scenarios** – Revisit the driving forces and become the characters in the scenarios. The idea is to look use the defined forces in the matrix to shape discussions about what the world would look like and how it would impact on the organisation.

The result should be possible future scenarios that assist the organisation to plan for a wide variety of future outcomes, facilitating a more thorough planning process⁵⁷. It is a useful method because the future is unpredictable and unlike traditional forecasting, it allows decision makers to question modern assumptions and foresee decisions that may have been missed or denied⁵⁸. Scenarios can be run on a range of problems to understand various situational elements of the problem.

Theory of Constraints

Theory of Constraints is one of the most recently developed Soft O.R. techniques. It aims to overcome the fact that any organisation has a constraint, or a number of constraints, that dominate the entire system and the secret to success lies with managing these constraints, and managing the system as it interacts with the constraints, to get the best out of the whole system⁵⁹. According to Goldratt⁶⁰, there are a number of key steps involved based on the fact that goal achievement is limited to at least one constraint:

1. Identify the constraint
2. Figure out how to exploit the constraint
3. Subordinate all other processes to above decision
4. Elevate the constraint

This method is more suitably used towards problems in manufacturing and supply chain, although there is potential scope to use this method outside of this remit. With this method, a project may involve implementing new software into an organisation and the constraint may be resistant to change. Therefore it tries to find a way of tackling such messy problems.

Benefits Modelling/Analysis

Benefits Modelling/Analysis or Mapping as it is occasionally called, is a method for formulating complex and multi-factorial issues which have evolved from the roots of Multi-Criteria Decision Analysis (MCDA). It offers a facilitated option in the assessment of a particular problem⁶¹. The method itself is purposefully used to model a problem. Mathieson⁶² also expertly mentions that the central idea behind this method is the systematic formulation of a Benefits Map, representing casual relationships between areas of investment and value criteria. The map can then break down the problem in terms of the benefits associated and it can be easily communicated to the client.

Pidd⁶³ mentions that Multi Criteria Decision Making (an overarching term for what Benefits Analysis aims to achieve), is an approach that seeks to find ways of expressing differing preferences within a common framework and acts as a thorough assessment of a problem situation. Generally, the Benefits Map identifies benefits metrics to help formulate strategies and also analyse threats and counter measures.

Causal Mapping

Some analytical techniques are occasionally inadequate in dealing with causal interrelationships among various individual and social concepts but Causal Mapping is a technique that allows you to cope with these types of interrelationships and capture them⁶⁴. Causal Mapping is a technique that can be used to visually display behaviours, outcomes and what causes them to interlink⁶⁵. Generally, a Causal Map is an illustration using boxes and arrows of relationships⁶⁶. It is helpful in uncovering streams and multiple paths to specific outcomes⁶⁷.

The aim of this method is to visually show how various factors in relation to a problem influence each other to understand the problem as a whole, and to systematically understand their impact and formulate goals⁶⁸. Causal Maps are widely employed in problem structuring interventions by showing a rich representation of ideas, and the networks involved⁶⁹. It is also useful to use because it illustrates how factors fit together, captures complexity and is a simplistic way of showing influential behaviour⁷⁰.

Soft O.R. Method - Summary Matrix

To summarise this paper, the matrix below highlights each of the key Soft O.R. methods discussed in comparison to some key metrics that are required to use the methods successfully in the future:

	Software supported	Facilitation required	Mapping essential	Workshop essential	Multiple stakeholders required	Specific problem focus	Brainstorming needed
SODA	√	√	√	√	√		√
SSM	√	√	√		√	√	√
Drama Theory		√		√		√	
Scenario planning	√	√		√	√	√	√
Theory of Constraints			√			√	√
Benefits Analysis		√	√	√		√	√
Causal Mapping	√		√	√		√	√

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