Using Systems Thinking to Explore Wicked Problems

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A catalyst paper was submitted to the National ALARA conference in Canberra titled 'Systems Thinking for Wicked Problems' to conduct a workshop to explore the use of soft systems methodology (SSM) to address a wicked problem. The authors would like to thank those who participated in the workshop as it turned out to be a rich action research-like exploration.

This paper will first explain what is meant by wicked problems. Second, it will compare Horst Rittel's reasons for identifying 'wicked problems' as opposed to 'tame problems' and Peter Checkland's development of 'soft systems thinking' as opposed to 'hard systems thinking'. It will then describe the process used at the workshop and the outcome of the exploration. The paper will end with some reflections on the use of SSM to deal with wicked problems.

Wicked Problems

The term wicked problems is attributed to Horst Rittel and Melvin Webber (1973) where they described such problems as societal problems that (urban) planners have to deal with. They distinguished these problems from 'tame problems' often dealt with by scientists and engineers that could be defined clearly and solutions found by established processes.

Rittel and Webber (1973: 160-167) attributed ten characteristics to wicked problems:

1. There is no definite formulation of the wicked problem. To understand a wicked problem one has to have some idea about how to solve it. So the problem space and solution space cannot be separated.
2. Wicked problems have no stopping rule. Often it is unclear when the problem has been solved. The planner is often forced to find a solution due to other constraints placed on him/her such as time, money or patience.
3. Solutions to wicked problems are not true-or-false, but good-or-bad. Often wicked problems involve multiple stakeholders and their assessment of the solution could vary based on their interests.
4. There is no immediate and no ultimate test or solution to a wicked problem. Solutions often generate unintended consequences and the full impact of the solution cannot be ascertained until the repercussions are played out.
5. Every solution to a wicked problem is a 'one-shot operation'; because there is no opportunity to learn by trial-and-error, every attempt counts significantly. Wicked problems are not conducive to trial runs to find better solutions.
6. Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan. It is impossible to prove that all solutions for the problem have been found and analyzed.
7. Every wicked problem is essentially unique. There are no classes of wicked problems to apply similar solutions.
8. Every wicked problem is considered to be a symptom of another problem. Therefore, it is best if they are addressed at as high a level as possible to avoid addressing symptoms rather than the problem.
9. The existence of discrepancies representing a wicked problem can be explained in numerous ways. The 'worldviews' of people looking at the problems could be different and, therefore,

stakeholders may have a different understanding of what the problem really is.

10. The planners addressing wicked problems are liable for the consequences of the actions generated by them as these can greatly affect the lives of people who are touched by these actions.

Although Rittell and Webber's 1973 paper is often cited to describe wicked problems, Professor West Churchman (1967) refers to an earlier seminar when Horst Rittel also used the term 'wicked problems', adding that with wicked problems solutions often make the symptoms worse and it is morally wrong to try and tame a wicked problem.

While Rittel associated 'wicked problems' with urban planning, similar problems can be found in many other areas. A recent discussion paper published by the Australian Public Service (APS 2007) cites climate change, obesity, indigenous disadvantage and land degradation as some' wicked problems' that Australia is faced with. Van der Ween (2003) states that even strategy issues faced by organizations such as Walmart and telecommunication companies like KPN possess the characteristics of 'wicked problems'. Barrie and Fourie (2001) have dealt with issues related to property formalization as a wicked problem.

Techniques to address wicked problems

In an interview about methods that are useful to address wicked problems Rittel suggested the use of second-generation design methods to address these. He summarized the characteristics of second-generation design methodology as follows (Rittel 1984: 324-327).

1. Involving a number of participants to discover as much knowledge as possible about the situation as the expertise and ignorance about the problem is distributed. An attempt should be made to develop a maximum amount of participation to gain as much knowledge as it is possible.
2. Using an argumentative structure in planning looking at pros and cons.
3. Looking at each issue as a symptom of another issue to move up the level at which the problem is addressed.
4. Exhibiting transparency in the process of argumentation about the wicked problem as each set of judgments depends on the understanding of the problem at the point where the argument is being made.
5. Using a principle of objectification to reduce the probability of missing something that could become important later on and also to explicitly state the fundamental objectives to stimulate discussion. This raises the probability of bringing out the important issues and generating divergent opinions and positions on them.
6. Controlling the delegated judgment by spelling out all assumptions that are being made.

He also advocated that the planner should take the role of a midwife or a teacher as opposed to someone who plans for others. In other words the planner had a responsibility to show others how they can plan for themselves.

To support the use of second-generation design methods, Rittel also developed a framework for argumentation called IBIS (Issue-based Information System) initially using a paper-based approach but later using computers to support argumentation. Based on these principles Computer Supported Argument Visualization (CSAV) software has been developed to enable stakeholders to address wicked problems. Examples of such CSAV's are Dialogue Mapping (Conklin 2005) and Compendium (Selvin *et al.* 2001).

Using Soft Systems Methodology

SSM which was developed by Peter Checkland and his associates to address ill-structured management problems has been used to address wicked problems (Barry and Fourie 2001) and the Institute of Sustainable Futures at the University of Technology Sydney (Palmer *et al.* 2007). Several accounts of how SSM has been applied to address ill-structured problems can be found in key books written about SSM (Checkland and Scholes 1990, Checkland and Holwell 1998, Wilson 1990). Jackson (2003: 202-207) offers a critique of SSM and its limitations.

SSM (Checkland 1999) was developed for reasons similar to why Rittel felt that a new generation of methods is required to address sets of problems that could not be solved using conventional methods used by scientists and engineers. SSM was developed when Checkland and his associates from Lancaster University found methods used in systems engineering were unsuitable to tackle ill-structured problems often faced by managers. They proposed that human activity systems need to be considered as 'soft systems' as opposed to 'hard systems'. They felt that the process used to resolve such problems needs to be systemic.

Similar to Rittel's view that wicked problems need multiple perspectives and a structured argumentation process, SSM encourages a debate among the stakeholders who have different perspectives of a problem to come up with a 'root definition' that makes the purpose of a system clearer. Rittel's use of the word 'societal systems' has similarities to the term 'human activity systems' used by Checkland.

Soft Systems Methodology at the workshop

At the ALARA conference workshop, a few processes used from SSM (Checkland and Poulter 2006) were utilized to address a wicked problem selected by the participants. Due to limited time it was only possible to scratch the surface of the problem at the workshop.

Figure 1 shows the 'two strand' version of SSM that is often used in practice to explain the methods used at the workshop. Only the first three analytical aspects of the SSM methodology were used: The two-strand-version of SSM is based on the seven-step model that was originally developed by Checkland (1999) but adds social, cultural and political analysis of the issues being addressed.

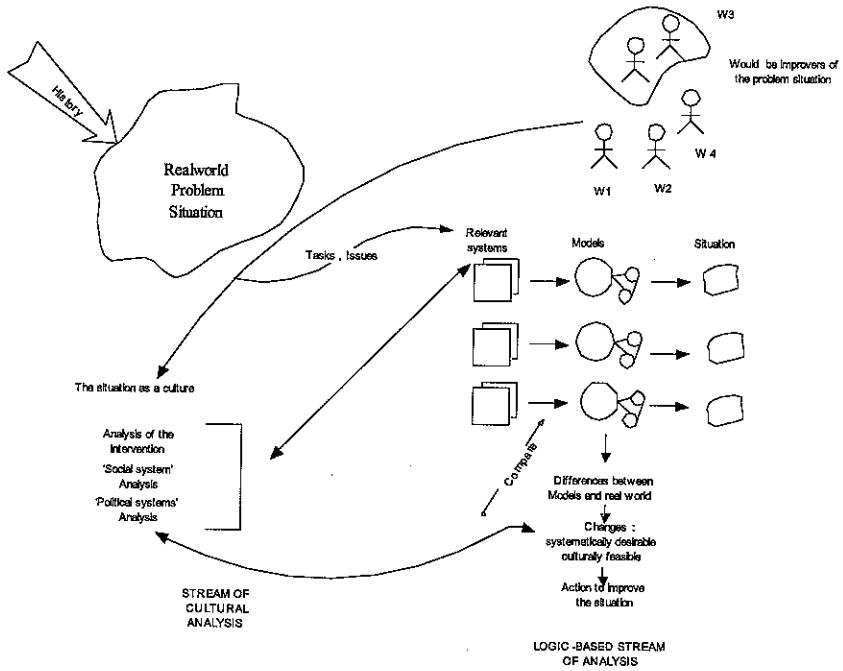

Figure 1. Two-strand version of SSM (Source: Jackson 2003: 189).

The steps used at the workshop were: -

1. A short description of wicked problems was provided and the participants were then asked to choose a 'wicked problem' they would like to address.
2. Using a rich picture: the situation, as the participants experienced it, was captured informally.
3. A social analysis was carried out to get a sense of the social structure of the situation. The elements of the social analysis addressed were formal and informal roles, norms and values.
4. A political analysis was carried out to look at power structures in the situation.

The participants picked 'Caring for the elderly' as the wicked problem to be addressed, as this is an issue of general concern. There were six participants who chose to attend the workshop from the catalyst sessions at the conference. The workshop facilitator knew three of the participants and was aware that at least two of them were very experienced in using action research and systems thinking. The participants divided themselves into two groups after the facilitator explained what the two groups would be doing – one group would construct a rich picture of the situation while the other would conduct a social and political analysis. While the original plan for the workshop was to carry out the activities in sequence, they were carried out in parallel due to time constraints. After the groups had worked independently for nearly thirty minutes they were brought together to see what they might have missed in their analysis of the situation and then went back to work for some more time in their own groups.

The outcomes of the session was a 'rich picture' that started small and became quite informative and complex as participants creating the picture asked more questions of the situation. The social and political analysis took the form of a

'mind map; that showed various issues and their relationships. The conversation between the two groups in-between helped to add more details to the rich picture and the mind map. Due to time constraints, a short reflection session was held to evaluate the workshop.

Reflections

Prior to the conference, a catalyst paper was posted on the ALARA website (www.alara.net.au) and elicited some thoughtful discussions. The authors would like to thank those who responded to the catalyst paper.

Diane Allen linked wicked problems to Argyris and Schon's discussion on interpersonal relations. She also reflected on Acland's analysis of the sources of conflict and the discussion in the 1970's in Kiama about the effects of blue metal quarrying on the surrounding landscape. Margaret O'Connell was reminded of David Beckett's notion of 'hot action' in approaching complex issues and listed the reasons for linking them. Ross Colliver was interested to open up the way in which the multiple stakeholders define the problem differently at the workshop. Among those who posted discussions on the ALARA website, Ross Colliver participated in the workshop and Margaret O'Connell observed the process.

All the participants of the workshop session felt that the process used was beneficial to the discussion of ill-structured or wicked problems to clarify issues from several perspectives. However they felt that the time allocated to the workshop was quite short and more time was needed to fully evaluate the use of SSM. To the extent they used it, it was felt quite effective. One of the reasons why the 'rich pictures' exercise was so successful was the presence of Kate Reckord, who was very interested in using visual tools in her own teaching at the Canberra Institute of Technology. Since Kate was good at drawing she became the person who took

charge of drawing the rich picture and guiding others to add elements to it. The photo shows Kate's enthusiasm. She is the one on the table.

Figure 2. Participants in the 'wicked problems' workshop, 2008 ALARA National Australian Conference, Canberra ACT. Photo by Shankar Sankaran.

Feedback was sought from the participants by email after the workshop and only Pamela Kruse responded to the authors' email. She felt that the method of socio-drama (where people assume roles of stakeholders to portray real-life conflicts) could be very useful to address wicked problems. She felt that doing a rich picture exercise after warming up with a socio-drama session could be a useful addition to the process used at the workshop.

Conclusions

There are several similarities between what Rittel has advocated to address wicked problems and Checkland's use of SSM to deal with ill-structured problems.

As Rittel (1984) observed the definition of wicked problems needs discussion among people who have the required knowledge to contribute to the discussions. The authors would suggest that a careful stakeholder analysis be conducted to determine who will be invited to a discussion on wicked problems. As all stakeholders may not be identified in the first instance a conscious effort should be made to invite additional stakeholders as and when it becomes evident that their contributions are required.

It was not possible to fully evaluate the strengths and weaknesses of using SSM to address wicked problems at the workshop mainly due to time limitations. Also the authors could not get comprehensive feedback after the workshop. However, to the extent it was used, it was found to be useful. It was felt that the presence of Bob Dick and Ross Colliver as participants and the inclusion of Kate Reckord to draw the rich picture might have made it look easy to use SSM. To judge the effectiveness of SSM in addressing wicked problems, a longer workshop with participants who may not be so familiar with participatory processes would be required.

As action researchers, who take on social responsibilities, we need to be aware of various methods and techniques used in addressing societal problems that are often wicked or ill-structured in nature. The workshop has demonstrated briefly that methodologies such as SSM could be useful in addressing wicked problems. The authors would like to encourage ALARA's action research community to collaborate on finding other methods of addressing wicked problems for the social good.

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References

APS, 2007, Tackling wicked problems: A public policy perspective, *Australian Public Service Commission*, Canberra, Available at

http://www.apsc.gov.au/publications07/wickedproblems.htm

Barry, M & Fourie, C 2001, Wicked problems, soft systems and cadastral systems in periods of uncertainty, presented at *The International Conference on Spatial Information for Sustainable Development*, Nairobi, Kenya, 13 pgs.

Checkland, P 1999, *Systems Thinking, Systems Practice: Includes a 30-year Perspective*, Chichester: John Wiley.

Checkland, P & Holwell, S 1998, *Information, Systems and Information Systems*, Chichester: John Wiley.

Checkland, P & Poulter, J 2006, *Learning for Action: A Short Definitive Account of Soft Systems Methodology and for its use for Practitioners, Teachers and Students*, Chichester: John Wiley.

Checkland, P & Scholes, J 1990, *Soft Systems Methodology in Action*, Chichester: John Wiley.

Churchman, CW 1967, Guest editorial: Wicked problems, *Management Science*, 14(4), B 141-2.

Conklin, J 2005, *Dialogue Mapping: Building Shared Understanding of Wicked Problems*, New York: John Wiley.

Jackson, MC 2003, *Systems Thinking: Creative Holism for Managers*, Chichester: John Wiley.

Palmer, J, Smith, T, Willets, J & Mitchell, C 2007, Creativity, ethics and transformation: Key factors in a transdisciplinary application of systems methodology to resolving wicked problems in sustainability, *Proceedings of the 13th ANZSYS conference*, Auckland, New Zealand, 2nd to 5th December, 10 pgs.

Rittel, HWJ 1984, Second generation design methods, in N. Cross (ed.), *Developments in Design Methodology*, Chichester: John Wiley.

Rittel, HW & Webber, MM 1973, Dilemmas in a general theory of planning, *Policy Sciences*, 4, 155-169.

Selvin, A, Shum, BS, Sierhuis, M, Conklin, J, Zimmermann, B, Palus, C, Drath, Horth, D, Domingue, J, Motta, E & Li, G 2001, Compendium: Making, meetings into knowledge events., Presented at *Knowledge Technologies 2001*, March 4-7, Austin, Texas. Available at www.KnowledgeTechnologies.net

Van der Veen, C 2003, Deciding on wicked strategy problems, Presented at *The 23rd SMS Annual International Conference*, November 9-12, Baltimore, Maryland. 23 pgs.

Wilson, A 1990, *Systems, Concepts, Methodologies and Applications*, 2nd edn., Chichester: John Wiley.

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