Exploring the Nature of Problems

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Problem solving is the process of developing a structured understanding of an issue; the process of formulating the problem and contriving a solution. In today's ill-structured, turbulent, and information-laden business environment, solving the right problem is of crucial importance and often of strategic significance. Instead of defining a typology of problems, the purpose of this paper is to explore the problem space defined by two dimensions, i.e. content complexity and process management complexity. Gaining a better understanding of the problem space can be useful in framing the problem domain associated with the issue under consideration.

An operational research (OR) intervention involves the application of scientific methods to assist an organized group in solving their problems. (Mitchell, 1993) The success of such intervention relies on identifying the right solution for the right problem. Selecting the most suitable method or technique is crucial because, as emphasized by Eden and Sims (1979), the choice of the model implicitly contains the description of the problem. According to Ackoff (1974), our failures are more often due to solving the wrong problem rather than obtaining the wrong solution to the right problem. Solving the wrong problems not only fails to address the actual issues but also unwittingly undermines our ability to solve the right problems. (King, 1993) In today's business environment, which is characterized as ill-structured, turbulent, and information-laden (Szendrey, 2021), solving the right problem is of crucial importance and often holds strategic significance.

The definition provided by Eden and Sims (1979) characterizes a problem as a situation in which someone wants a change from the current state but lacks clarity on how to accomplish that desired change. However, the term 'problem' is used in the literature to denote significantly different meanings. Therefore, it is important to outline the various archetypes that exemplify its possible uses in order to illustrate these differences.

Tame Problems

Issues that can be formulated and for which solutions can be found are referred to as ‘puzzles’ and ‘problems’ by Pidd (2009) or ‘tame problems’ by Rittel and Webber (1973). At the core of a puzzle (Pidd, 2009) lies an issue that needs to be sorted out. Both the issue and the corresponding solution are entirely clear: there is a single correct formulation and a single correct solution to the puzzle. Although, puzzles can be difficult, with various approaches to attacking them, they are solvable, and the correctness of the solution can be demonstrated. The nature of the organizational world is such that issues and options are never entirely clear. Therefore, puzzles are not the domain in which operational researchers aim to model.

An issue that has more than one correct solution is termed a ‘problem’ by Pidd (2009) or a ‘tame problem’ by Rittel and Webber (1973). At the heart of such a problem is an issue that needs to be solved. The issue is sufficiently straightforward and relatively unambiguous, allowing for agreement to be reached on the formulation of the core issue. However, depending on how the issue is interpreted and the types of approaches applied, solving the problem may result in several equally valid solutions, and the correctness of each solution can be demonstrated. Rittel and Webber (1973) also use the term ‘benign’ to describe these ‘tame’ problems, which appear to be definable, understandable, and consensual. Furthermore, they emphasize that even before solving a tame problem, its mission is clear.

Tame problems can be solved in isolation using traditional analytic methods that involve ‘static’ analysis, where factors such as delay or non-linear relationships do not need to be considered. (Roth and Senge, 1996) Ackoff (1979a) distinguishes three steps in the process of analysis: (1) taking apart the issue to be understood, (2) trying to understand how these parts work, and (3) assembling our understanding of the parts to understand the whole. This approach raises a fundamental question: How can we acquire an understanding of the parts and the relationships between them? To acquire an understanding of the parts, further division is necessary until the indivisible, fundamental constituents, are reached. Regarding the relationships between these parts, they are elementary, i.e. cause-and-effect. Roth and Senge (1996) argue that the integration of these parts is possible because there are no significant dynamic interconnections between them. Even different actors can solve distinct parts as long as they share common values and goals.

OR proved adept in solving these well-defined problems in the 1960s (Williams, 2009). However, such well-defined issues are fairly rare in the complex reality of organizations. Operational researchers are often called upon to deal with situations where there is a great deal of ambiguity regarding what is happening, what needs to be addressed, what the valid options are, how to validate solutions, and even how to approach the situation. Moreover, once a solution is obtained, it may be difficult, if not impossible, to determine whether it is a correct one or how good it is.

Messes

Issues are typically part of complex systems that interact with each other and change over time. The English language lacks a suitable word for the 'system of problems'. Therefore, Ackoff (1974, 1979a, 1979b) refers to such sets of interrelated problems as 'messes', recognizing that dealing with the relationships between the problems is often as important as dealing with the problems themselves. A mess, due to the extreme ambiguity associated with it, can only be formulated with a range of partial and potentially overlapping or conflicting definitions and descriptions. Consequently, there can be a number of equally valid solutions, and it is impossible to know *ex ante* whether a solution exists at all. A problem is an abstraction derived from the mess through analysis and interpretation. "Problems are still photographs clipped out of motion pictures — abstractions extracted from experience by analysis — they are related to experience as atoms are to tables. We experience neither atoms nor problems; they are conceptual constructs, not objects of experience." (Ackoff, 1981: 22)

Traditional analytical techniques are not appropriate when dealing with messes because messes are complex systems of problems, and their essential properties may be lost when taken apart (Ackoff, 1979a). Gummesson (2007: 229) further emphasizes the importance of context, stating, "Pick one or two factors from a context and insulate them and you regress to the mechanical idea that if you study all the details you can screw them together like they were parts of an engine – and there is the whole!" The interactions between the component problems and the context cannot be ignored; therefore, this situation calls for systems thinking. According to Checkland (1987), the most important characteristic of systems thinking is the acknowledgment that the whole entity possesses properties that have no meaning in terms of the component parts and, consequently, cannot be derived from them. These properties are known as emergent properties. However, this does not imply the unrealistic task of dealing with every problem and all of their connections simultaneously. (Gummesson, 2007)

Ackoff (1979a) outlines three steps in the process of systems thinking: (1) conceptualizing an issue to be understood as a part of one or more larger wholes, rather than as a whole to be taken apart, (2) seeking an understanding of the larger containing system, and (3) explaining the system to be understood in terms of its role or function within the containing system. Therefore, instead of breaking messes into parts, it is necessary to examine patterns of interacting parts. This is why Pidd (2009) uses the term 'taming' the mess instead of solving it. Furthermore, one of the biggest mistakes when dealing with a mess is to isolate part of the mess, treat it as an independent problem, and try to solve it as a puzzle, disregarding its interconnectedness with other aspects of the mess. (Pidd, 2003)

Wicked Problems

It is important to note that up to this point, the discussion has focused on the 'issues themselves', treating them as if they are isolated from their social context(s). Issues that are significantly influenced by complex underlying social realities are referred to as '**wicked problems**' by Rittel and Webber (1973). They identify ten distinguishing properties of wicked problems: (a) wicked problems lack a definitive formulation, (b) wicked problems have no stopping rule, (c) solutions to wicked problems are categorized as good or bad, rather than true or false (d) there is no immediate or ultimate test for a solution to a wicked problem, (e) every solution to a wicked problem is a 'one-shot operation'; because there is no opportunity to learn through trial-and-error, every attempt counts significantly, (f) wicked problems do not have an enumerable (or exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan, (g) every wicked problem is essentially unique, (h) every wicked problem can be considered to be a symptom of another problem, (i) the existence of a discrepancy representing a wicked problem can be explained in numerous ways, and thus the choice of explanation determines the nature of the problem's resolution, and (j) the planner has no right to be wrong. These properties highlight the complex and challenging nature of wicked problems.

According to Rittel and Webber (1973), tackling a wicked problem is an argumentative process through which an image of the problem and its solution gradually emerges. This process should involve dialogue among participants who genuinely listen to one another and build trust. The formulation of a wicked problem itself presents a challenge because specifying the problem inherently determines both the approach taken to tackle it and the conceivable solutions. In the case of wicked problems, the solution is often a 'good enough' solution. Consequently, wicked problems are never truly solved in the traditional sense; at best, they are re-solved over and over again. Treating a wicked problem as if it were tame, attempting to prematurely tame a wicked problem, or refusing to acknowledge the inherent wickedness of social problems is morally objectionable. Similarly, King (1993) argues that treating a wicked problem as if it were a tame one is potentially catastrophic and, therefore, fundamentally irresponsible.

Wicked Messes

Roth and Senge (1996) delve deeper into the topic and summarize the types of problems using two dimensions, i.e. 'dynamic complexity' and 'behavioral complexity'. Dynamic complexity refers to the extent to which the relationship between a cause and the resulting effects is distant in time and space. In situations of low dynamic complexity, it is usually straightforward to link causes with problems, and these problems can be considered unchanging. However, in situations of high dynamic complexity, it is difficult (or even impossible) to determine the causes of the majority of the problems. Behavioral complexity, on the other hand, refers to the extent of diversity in the aspirations, mental models, and values of individuals. In situations of low behavioral complexity, individuals share common underlying values, aspirations, and mental models, which can serve as a basis for developing a shared perspective and aligned problem solving. However, in situations of high behavioral complexity, it is even difficult to persuade individuals to agree on how to tackle the problem due to profound conflicts in assumptions, beliefs, values, and perspectives.

When both dynamic and behavioral complexity are low, the resulting issues are referred to as tame problems, as defined earlier based on Rittel and Webber (1973). When dynamic complexity is high and behavioral complexity is low, the resulting issues are referred to as messes. However, there is some discrepancy compared to the definition given by Ackoff (1974, 1979a) as he does not rule out high behavioral complexity in messes. For example, in a paper (Ackoff, 1981), he describes a problem in a manufacturing company confronted with fluctuations in the demand for its products. Addressing the problem through cyclical recruitment and dismissal led to low morale among the workforce, thus highlighting the behavioral complexity of the problem. However, since Ackoff focuses on the embeddedness of issues within large and complex sets of interacting problems, the term 'messes' was adopted in this sense to make all delineations clear.

When dynamic complexity is low and behavioral complexity is high, the resulting issues are referred to as wicked problems. Again, there is some discrepancy compared to the definition given by Rittel and Webber (1973) as they do not rule out high dynamic complexity in wicked problems. For example, they discuss the problem of highway site selection, which includes public policy considerations as well as complex engineering challenges. However, since Rittel and Webber focus on the social context of problems, the term 'wicked problems' was adopted in this sense to enable clarity of delineations.

Finally, when both dynamic and behavioral complexity are high, the resulting issues are termed 'wicked messes' by Roth and Senge (1996). Wicked messes can be described as systems of interlinked problems that are tackled by different groups with different understandings (and often misunderstandings), divergent assumptions, polarized beliefs, and possibly contradicting values. Addressing this type of problems is important for three reasons: (a) high dynamic and behavioral complexity characterizes the most pressing social problems, both within organizations and society (b) such problems often go unrecognized or underestimated, and (c) the conceptual context, tools, and methods for addressing such problems are largely under-developed or non-existent.

Furthermore, Roth and Senge highlight that the research traditions dealing with dynamic complexity and behavioral complexity have remained isolated from each other. However, treating these problems as either messes with purely technical solutions or wicked problems with purely behavioral solutions is misleading. In other words, relying solely on collecting the appropriate data and conducting proper analysis or solely on improving communication and building trust among different groups is not sufficient. Moreover, researchers who rise to the challenge of tackling wicked messes will face significant challenges in communicating their accomplishments through scientific outlets due to the difficulty or impossibility of demonstrating the validity of their solutions.

According to Eden (1992), the overall aim of problem solving is to establish ‘order’, which encompasses a sense of direction that brings comfort to the problem owner(s). Therefore, Eden (1987) argues that the concept of ‘problem-finishing’ is a more suitable approach for tackling wicked messes instead of traditional ‘problem-solving’. Problem-finishing entails four overlapping foci when working on a problem: (1) compiling a portfolio of solutions, (2) constructing the problem by explaining the situation, (3) making sense of what has been said, and (4) defining the (representation of the) issue.

Dealing with Content Complexity and Process Management Complexity

To gain a deeper understanding of the nature of problems, I explore the problem space defined by two dimensions, i.e. ‘content complexity’ and ‘process management complexity’, as depicted in Figure 1.1. Instead of solely focusing on dynamic complexity, which Roth and Senge (1996) describe as the extent to which the relationship between a cause and the resulting effects are distant in time and space, I introduce the concept of content complexity. Content complexity refers to the extent to which a problem is structured, ambiguous, and embedded into a set of interacting problems. Meanwhile, process management complexity aligns with Roth and Senge’s (ibid) notion of behavioral complexity. Process management complexity refers to the extent to which there is diversity in the aspirations, mental frameworks, and values of individuals. The time dimension emphasizes the importance of considering that circumstances may change during problem solving and ensuring that the results remain viable in light of these changes. Depending on the established time horizon for working on the problem, these changes can have significant implications.

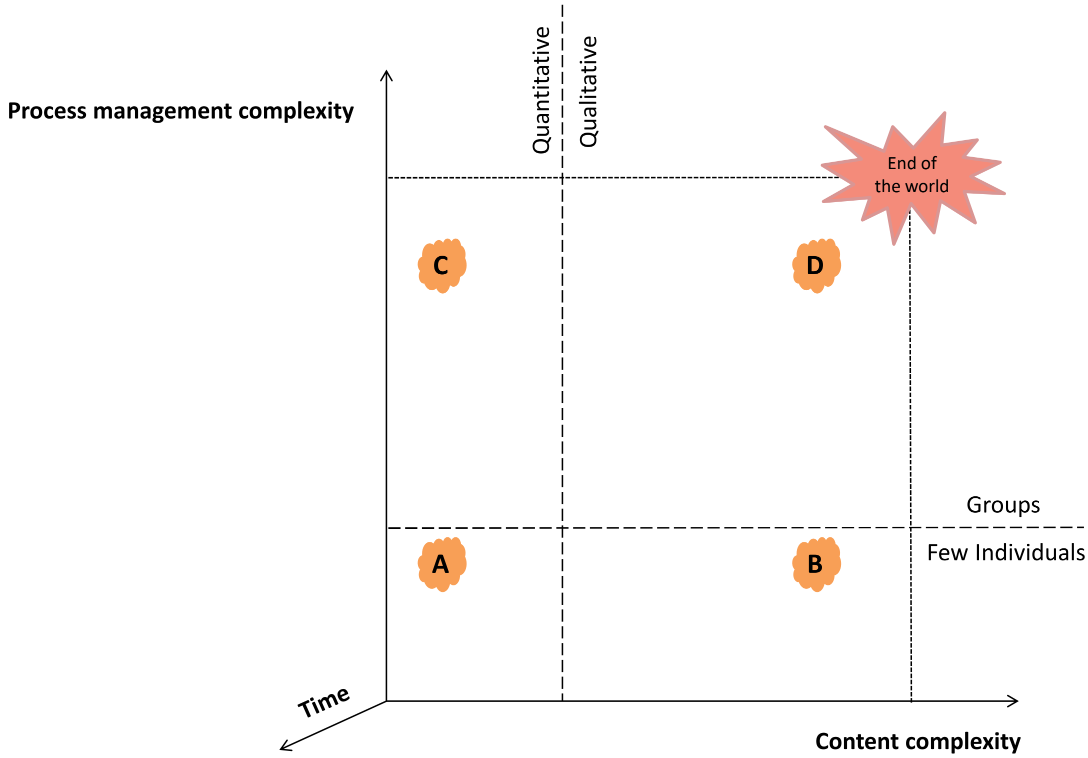

Figure 1.1 Problem space

In the problem space described above, **Problem A** is characterized as a well-structured, relatively unambiguous, and sufficiently straightforward issue. The process of problem solving involves a small group of individuals who possess similar knowledge, skills, and experience. They share common values, aspirations, and mental frameworks, which serve as the foundation for developing a shared perspective on the issue. As a result, agreement can be reached regarding the formulation of the core issues for which solutions can be found. The emphasis is on quantitative data representation, the optimization aspect of the supporting techniques, and the algorithmic approach to problem solving.

Problem B represents an unstructured and vague issue, which contains subjective aspects and is embedded in a large and complex set of interacting problems. Similar to Problem A, the process of problem solving involves a small group of individuals who share common values, aspirations, and mental frameworks. The focus is on the problem, which can only be formulated with a range of partial and potentially overlapping or conflicting definitions and descriptions. This also means that there can be a number of equally valid solutions, and it is impossible to know *ex ante* whether a solution exists at all. These problems resist mathematical formalization and require a non-quantitative approach. Consequently, the pursuit of optimality has to be sacrificed for a sound approach. The emphasis is on qualitative data representation, non-algorithmic reasoning, and the utilization of subjective aspects and heuristic methods.

Problem C, like Problem A, is characterized as a well-structured, relatively unambiguous, and sufficiently straightforward issue. However, the individuals involved in solving the problem are typically pulled from different hierarchical levels and/or from different functional areas within the organization. There can be a profound conflict between their values, assumptions, and beliefs, which can lead to a struggle in developing common aims, agreeing on priorities, and reaching a shared perspective on the issue under consideration. The process of problem solving is dominated by negotiation among the members of the group and the development of a shared understanding of the issue.

Based on the previous discussion, challenges become more pronounced when either the content complexity or process management complexity increases. In the case of **Problem D**, when both content complexity and process management complexity are high, the challenges can become overwhelming. Content complexity requires advanced analytical and systems thinking skills, whereas process management complexity necessitates strong interpersonal and facilitation skills. However, these skill sets diverge from one another. Therefore, during the process of problem solving, it is important to place equal attention on dealing with the complex problem itself and facilitating the groups involved in the process.

IN CONCLUSION, within the problem space defined by content complexity and process management complexity, the emphasis is on finding a balance between dealing with the problem and facilitating the stakeholders. This iterative process concludes when an agreement is reached, and there is a commitment to take action.

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