"Solutions" are not the answer

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Academics and policy-makers often frame their work by defining "problems" and
proposing "solutions." While this approach is effective in closed systems, where
problems can be clearly defined, we critique its application to open systems,
where such clarity is not possible. We highlight how narrowly framed "solutions"
can lead to unintended consequences and policy incoherence when applied to
open systems, and advocate for a rhetorical shift from "problems and solutions"
to "challenges and responses." This reframing acknowledges the dialectical nature
of interacting with open systems and encourages decision-makers to engage
in a continuous and evolving praxis, where challenges are addressed iteratively,
rather than problems being solved once and for all. We argue that this approach
is more realistic, avoiding the pitfalls of short-term solutionism by promoting a
more holistic and ongoing engagement with complex, open systems.

KEYWORDS

solutions, polycrisis, climate change, wicked problems, infinite games, management

1 Introduction

> *Regard life not as several isolated problems, but comprehensively, as a whole, with a mind
> that is not suffocated by the search for solutions.* (Krishnamurti 1996, p. 52)

The twin concepts of "problem" and "solution" are widely used across academic and
policy-making domains. Broadly speaking, these concepts operate by first defining a problem
through the identification of a situation that needs to be dealt with, and then proposing a
solution to the problem which aims to alter the situation such that the well-defined problem
is no longer undesirable. This rhetoric can be seen widely across policy areas in various guises
such as those of 'remedies' (in law) or 'fixing market failures' (in economics), as well as in the
rise of "nature-based solutions" as a means to tackle sustainability issues (Seddon, 2022).

In many practical applications, this mode of solutionist thinking works incredibly well.
Each of us is no doubt better off living in a world where smallpox has been eradicated, where
civilian GPS technology makes it possible to geolocate ourselves instantly anywhere in the
world, or where a plumber can quickly identify and replace a faulty valve in a leaking tap. In
cases where a narrowly defined problem can be identified, and a solution to fix the problem
crafted, the concepts work exceedingly well.

One feature of these 'solvable' problems is that they exist in a closed system, or at least,
a system that can be treated as closed. Closed systems are those which are isolated from
their environment and can thus be analysed without having to consider external influences
(von Bertalanffy, 1971, p. 38). Since closed systems can be boxed off from the rest of
reality, we are able to identify a clear problem and evaluate the effectiveness of solutions
with relative ease. Rittel and Webber identify this mode of thinking as the "physical

science and engineering thoughtway" (Rittel and Webber, 1973, p. 165), and Berman describes it as part of the "economic mode of reasoning," which she argues has become the dominant way in contemporary policy-makers make decisions (Berman, 2022, p. 5–17). Debates following this logic often centre around finding the best solution which solves the problem as neatly and efficiently as possible, usually on the understanding that the problem can then be dispensed with and forgotten.

2 The challenge of open systems

It is evident, however, that things are not always so simple. A solution may look promising, but upon implementation, it may become apparent that it only addresses part of the problem, or triggers unforeseen consequences which lead to additional problems. When it comes to addressing social issues in particular, problems may transcend a single domain, and instead exist at many different levels at the same time. For instance, decarbonising an economy requires addressing the physical challenge of sustainable power generation, the social challenge of re-training the fossil-fuel industry workforce, the behavioral change of consumers to new products, and the economic challenge of financing new infrastructure, to mention just a few (Hickel, 2021, p. 1108).

In short, some problems just have no solutions. At least, no one-shot solutions. The world is complex, full of uncertainties, and increasingly interconnected. Extracting a clear and isolated 'problem' to 'solve' can be difficult. In many cases, problems are wicked in the sense that they offer confusing information, require input from multiple decision-makers with conflicting values, and touch on many parts of a wider system (Churchman, 1967). Attempting to tackle these kinds of problems through the lens of crafting a solution is difficult, not least because defining the problem in the first place is a big challenge. These kinds of problems are inherently stratified along several dimensions, which interact in ways that produce emergent and difficult to predict effects (Sayer, 2000, p. 12). Approaching them with a solution-oriented logic risks seeing only a reductive definition of the problem. Crafting a solution to a partially-defined problem leads to only some aspects of the actual issue being 'solved'. Indeed, such mistakes are known as Type III errors; the "*unintentional error of solving the wrong problems precisely*" (Mitroff and Silvers, 2009, p. 5).

Such "solutions" are, in fact, even worse than they first appear. The word *solution* derives from *solve*, which in turn is derived from *solvere* in Latin. *Solvere* means to 'loosen, unfasten'. When faced with a knot of interacting factors that constitute a problem, we might consider solutions as ways to pull and reconfigure these threads in an attempt to smooth out the knot. Of course, these threads do not exist in isolation, so pulling on them can create tension elsewhere, causing side effects that may uncover or exacerbate other problems. Hence, a solution to a closed-system problem existing in an open system context may end up creating only more problems.

So, what is stopping us from expanding the problem and looking for ambitious solutions to match? One trouble is that more holistic framings of the problem might entail combining multiple somewhat contradictory views. A conciliatory synthesis of these views may be elusive or even impossible. Absent such a synthesis, solutions offered for each different framing of the problem might then be contradictory, leaving us in a double bind—a situation where no single solution can tackle each of the problem's conflicting demands (Bateson, 2000, p. 276–283). Of course, acknowledging this complexity makes finding a solution even more difficult. The temptation is to avoid doing so. Sometimes, we know that our problem definition is too narrow but keep it narrow anyway. In doing so, we commit the "*intentional error of solving the wrong problems*," or Type IV errors (Mitroff and Silvers, 2009, p. 5).

Given the above, we should think of narrowly framed solutions in open-system domains as offering "at best, […] short-term relief" and as coming with a significant risk of unintended consequences (Price, 2023, p. 786). Narrow solutionism can lead to policy incoherence, where multiple solutions are tried, yet each re-arranges the web of intersecting threads in a way incompatible with, and detrimental to, the goals of the others (Loghmani Khouzani et al., 2022). Successive framings of narrow, closed-system problems can lead to a proliferation of technical "solutions" that fail to recognise the complexities of the issue at hand, complexities that may span spatiotemporal boundaries, multiple dimensions, institutions, actors, and stakeholders. Such solutions could be considered as Type III errors if policy-makers genuinely misunderstand the complexity of the problem domain. Alternatively, they could be classified as Type IV errors if policy-makers recognised their solutions were too narrow, but proceeded regardless for political expediency or other reasons.

3 Discussion

Solutions work best when we are sure that we fully understand a problem that exists in a closed system. Of course, many well-scoped problems exist, especially in engineering-like domains where it may be possible to fully define a system, and even enumerate its possible states. Yet the most pressing social-ecological problems of today; climate change, rising inequality, geopolitical strife, sustainable resource management, misinformation, etc., are both deeply interconnected and not reducible to clearly defined 'problems'. This situation has been termed the "polycrisis"—a set of intersecting crises that are systematically linked by a set of positive and negative feedback loops (Albert, 2024, p. 18).

We have argued that solutions are inappropriate for these kinds of open or very large systems. Yet, when we face problems in such domains—especially ones as urgent as those constituting the polycrisis—we still need to do something. Of course, the answer cannot be analysis paralysis. Instead, when faced with a problem in an open system, we should acknowledge that any given solution is likely to lead to secondary effects which will also require our attention, rather than making the problem go away entirely. Such contexts include most social and ecological problems, where there are few opportunities to neatly define a closed system boundary.

Instead of thinking about "problems and solutions," we should prefer to use "challenges and responses." A challenge, like a problem, is a set of factors present in the world which we would like to change. Unlike a problem, however, a challenge calls for a response rather than a solution.

A response, like a solution, is a way of resolving some of the factors which constitute a challenge. Thus, like a solution, a response is incomplete, but explicitly acknowledges its incompleteness by not framing itself as a one-time answer. Rather, a response is part of an ongoing engagement with the challenge in question. It does not pretend to address fully the challenge but attempts to move the decision-maker iteratively towards resolving, managing, adapting to, or dialoguing with the challenge, in an open system and ever-changing context. Further, we understand that each response is likely to create more challenges, which will, in a somewhat dialectical way, necessitate their own responses in the future. Some of these responses may even undo previous responses, as it is belatedly understood that they were not helpful. This 'evolution' of the response occurs in a manner coherent with an evolving understanding of the domain in question.

This leads us to consider the use of the term 'solution' in sustainability settings, particularly when it comes to nature-based solutions. We observe that most nature-based solutions are not pure "solutions" in the sense we have used the term. Rather, they incorporate elements of holism, adaptability, and most importantly, responsiveness to changing circumstances. In a recent review article, Seddon (2022) writes how nature-based solutions are aimed at "address[ing] societal *challenges*" (emphasis ours), notes their intersectionality in the sense that their successful implementation must involve navigating "institutional, socioeconomic, and cultural factors," explicitly warns against "top-down governance structures," and stresses the importance of monitoring the outcomes of nature-based solutions over the long term as to engage in adaptive management of their implementation. In practice, therefore, we see that nature-based solutions operate far more like nature-based "responses," in our terminology.

Nevertheless, we believe that language matters. How a question is framed is important to how we react to it. Giving a false hope that there is a 'solution' to complex, wicked, open system challenges could disillusion people when those 'solutions' fail, sometimes in spectacular and unforeseen ways, or other times in unseen ways that become apparent only long after the problem was considered resolved.

Thus, for open system domains of which sustainability is without a doubt a part, we would encourage the use of challenge-response framings, preferably to that of problems and solutions. The former sees decision-making not as a one-shot, top-down process, but rather as an ongoing back-and-forth process. It allows the concept of time back into our thinking by re-framing decisions about how to navigate the world as an infinite, rather than a finite game (Carse, 1986), a dance, a praxis which is "*not all or nothing—not 'revolution or bust'—but a [continuous struggle] to realise the best possible future that is within 'our' power*" (Albert, 2024, p. 6). In this vein, we consider the notion of challenges and responses to have an empowering role; one which can help motivate and direct policy-makers' responses to contemporary issues, particularly in relation to open system domains such as sustainability.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

TD: Conceptualization, Writing – original draft, Writing – review & editing. TL-K: Conceptualization, Writing – review & editing. BF: Conceptualization, Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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