Acting on SDG synergies and trade-offs requires policy-focused systems tools

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5th International Workshop on Archetypes in Sustainability Research

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System archetypes

Limits to Success

Drifting Goals

Fixes That Fail

Escalation

Growth and Underinvestment

Source: Kim (1992) *Pegasus Communications*
SYSTEM ARCHETYPES

Loss of crop diversity

Source: BBC (Adapted from Khoury et al. (2014) *PNAS*)

Average change in the calories consumed from key crops worldwide (1961-2009)

<table>
<thead>
<tr>
<th>% change</th>
<th>Soybean</th>
<th>Sunflower</th>
<th>Palm oil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+284</td>
<td>+246</td>
<td>+173</td>
</tr>
<tr>
<td>-38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-45</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-45</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-52</td>
<td></td>
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</tr>
</tbody>
</table>

Source: BBC (Adapted from Khoury et al. (2014) *PNAS*)

Success to the Successful

S : + causality
O : - causality
System archetypes
each functioning system is successful in its own way, but all misfunctioning systems resemble one another.
Acting on Sustainable Development Goal (SDG) synergies and trade-offs requires policy-focused systems tools

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https://eartharxiv.org/repository/view/3136/
A STATIC VIEW ON TRADE-OFFS AND SYNERGIES

SDG interactions

Source: Kroll et al. (2019) Palgrave Communications
A DYNAMIC VIEW ON TRADE-OFFS AND SYNERGIES

SDG interactions

Pressure from industries to lower the emissions target

Emissions target gap

Transition to renewable energy

Emissions

Source: Moallemi et al. (forthcoming)
# System archetypes in the SDG context

<table>
<thead>
<tr>
<th>Driver</th>
<th>Interaction archetype</th>
<th>Description</th>
<th>Potential behaviour</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perverse side-effect</td>
<td><strong>Fixes That Fail</strong></td>
<td>SDG interventions end up with opposite effects due to delayed trade-offs with other goals</td>
<td>Slowing progress despite increasing efforts</td>
<td>(32)</td>
</tr>
<tr>
<td></td>
<td><strong>Band-Aid Solutions</strong></td>
<td>Band-aid solutions with short-term moderate impacts diminish the need for transformative SDG interventions</td>
<td>Slowing progress due to declining presence of long-term interventions</td>
<td>(33)</td>
</tr>
<tr>
<td></td>
<td><strong>Eroding Ambitions</strong></td>
<td>Long-term interventions with time-delayed response create uncertainty about SDG achievement and justify lower ambition</td>
<td>Increasing progress, but towards low-ambition goals that can be easily achieved</td>
<td>(34)</td>
</tr>
<tr>
<td>Time-delayed response</td>
<td><strong>Downplayed Problems</strong></td>
<td>The ignorance of trade-offs which are seemingly insignificant due to their time-delayed response but will eventually overshadow all synergistic interactions and can halt or reverse progress</td>
<td>Initial progress due to synergistic interactions, followed by rapid decline from the prevailing effects of downplayed trade-offs</td>
<td>(35)</td>
</tr>
<tr>
<td></td>
<td><strong>Escalating Tensions</strong></td>
<td>Increasing temporary interventions with path dependency result in unsatisfactory progress in conflicting goals</td>
<td>An overall decline in progress in all goals, despite increasing efforts</td>
<td>(36)</td>
</tr>
</tbody>
</table>
Fixes that fail
Fixes that fail

Tian et al. (2020) *Nature*

Yao et al. (2019) *NCC*
Downplayed problems
Archetypes as a practical tool

**Step 1: Data collection**
- Collect instances of events related to the SDGs

**Step 2: Database construction**
- Detail and document events in chronological order with their causal relationships

**Step 3: Archetype recognition**
- Distil archetypes from event trajectories and their interactions documented in the constructed database

**Step 4: Evaluation and triangulation**
- Triangulate the identified archetypes by other sources/experts and modify them if needed
Are archetypes enough?

“If we are taught how to recognize a set of system archetypes, will we be able to improve our intuition about complex dynamics enough to render simulation unnecessary?” (Sterman, 2000)
SOCIAL TIPPING POINTS

Escalation

Source: Eker & Wilson (2022) IIASA.
Role of simulation modelling

Role of simulation modelling

Conclusions

• Archetypes are useful tools to conceptualize misfunctioning systems that resemble each other, such as the trade-offs between SDGs.

• Archetype recognition requires empirical evidence.

• Archetype use requires support from empirical methods such as simulation modelling to analyze complex systems.
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