Review of: "Sustainable entrepreneurial ecosystems in developing economies: A conceptualisation of complex adaptive systems approach"

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Potential competing interests: No potential competing interests to declare.

My review focuses on the CAS aspects of the paper. I have an interest in different systems/complexity frameworks as research perspectives and as possible sources of theory. I have only modest background in the ecosystems field(s), so you can bare this in mind when interpreting my comments. I hope you find my comments constructive and encouraging. The manuscript seems to have its place but I suggest that its CAS angle is motivated more clearly. Good luck going forward!

There are three sets of comments: about CAS, the term complexity, and clarity.

CAS

The general idea of interpreting ecosystems as CAS is probably sound. It is possible that using CAS instead of some pre-existing (domain-specific) theory (as far as those exist) allows seeing things that have otherwise been overlooked. So I support the idea of connecting domain knowledge to CAS theory.

I think the article should be very clear *why* you want to interpret ecosystems as CAS. What is the added value? How is CAS different to something else? Even though I'm already on-board with using the CAS perspective, as a reader I still need to know what your angle on it is to fully understand the paper. Other readers who are more skeptical about introducing new theory to this domain could be put off even more. Currently, I saw some signs of justification – I believe this was part of it:

“This would help move past studying attributes of components and provide a framework that can be used for studies that connect micro- and macro-level research in entrepreneurship (Roundy et al., 2018).” (Section 3.1)

If the idea is that CAS is a theory that emphasizes connectivity, while prior literatrue has de-emphasized connectivity, then this could be more clearly stated and mentioned already in the introduction. Elsewhere you emphasized co-evolution, so perhaps this was the central idea.

Whichever way you justify CAS, it is a framework that leads to high uncertainty (as I think you acknowledged somehwere). CAS specialists say that there is no general theory of CAS (Miller and Page 2007; Holland 2014), which at least I have

understood to mean that we cannot make generalizable predictions about CAS behavior. CAS does however offer a set of concepts to work with (agent, adaptation, nested systems, attractor…). Taking concepts and applying them seems to be more your angle. But what can be achieved with using CAS concepts if CAS are fundamentally unpredictable? One possibility is that CAS is used as a counter-argument to other views that try to make strong predictions about ecosystems. Is there a more 'productive' use of CAS that allows to construct new knowledge rather than just challenge old knowledge? Lots of CAS specialists seem to be modellers, specifically agent-based modellers. This is one possible use of CAS theory. Sometimes you see more narrative interpretations of CAS (Kuhmonen 2017).

Whatever use for CAS you want to argue, make it clear. In my view, there can be tension between aiming to 'understand' how ecosystems (or any other social systems) work and using theory that emphasizes unpredictability. This tension might be worth acknowledging somehow.

Last minor point:

"Adaptability refers to the ability of a system to alter itself in response to changes in its environment so as to preserve its own existence and operation."

Sometimes adaptation is phrased as agents changing their 'decision-making rules'. It may be a pretty modelling-oriented way of speaking, but it can be a useful and more precise description of what adaptation is. So agents end up doing *different things* for *different reasons*. This is really significant, so consider if you want to use this type of phrasing.

Holland (2014) Complexity: a very short introduction. Oxford Uni Press.

Kuhmonen (2017) Exposing the attractors of evolving complex adaptive systems by utilising futures images: Milestones of the food sustainability journey. Technological Forecasting & Social Change, 114. http://dx.doi.org/10.1016/j.techfore.2016.08.015

Miller and Page (2007) Complex Adaptive Systems: An Introduction to Computational Models of Social Life. Princeton Uni Press.

Complexity

Complexity does not have a strict academic definition, but it is associated with various properties (as I think you mention) and it usually (maybe always) means some type of *uncertainty*. At the same time, it's also a colloquial term that is not always meant in a technical way. Often the term is not used very clearly in academic context, but I think it's worth being a bit careful when using it. For example:

"Complexity introduces the possibility of disorder in the ecosystem e.g., friction can occur when a component tries to secure its identity in competition with others at the same scale, yet the competitive process can destabilise other scales

within the system on which it depends."

In this sentence complexity is the "actor" that does something. If you say that complexity does something, then I think it would be important to know what complexity is (in this context). It would be useful to say more specifically what types of things could cause the disorder you mention, e.g.: agent interaction. At one point I think you mentioned properties associated with complexity, but they are a bit removed from this sentence. This sentence can work also without any reference to "complexity".

In general, the word complexity is very vague and is often better replaced with "uncertainty" or some more specific property, or some list of example properties. This just helps make an academic article more clear and precise.

Clarity

In Section 3.1 there is a sequence where different properties of CAS are explained, e.g.

"Complex components describe the interactions between diverse actors and elements"

It took me a while to understand these sentences. It may be more clear if you don't use 'describe', and instead just say "[concept] means XYZ in ecosystem context".

I didn't understand what the function of the bolded propositions in 4.1-4.4 are. This could be explained in the beginning of S4.

I think the discussion section is actually conclusion material, while in the conclusions you have content that could well make up a discussion. Following my CAS comments, part of the discussion could be some reflection on what you think the potential and limitations of the CAS framework seems to be based on having done this work.

There were some sentences in the text that I didn't understand. My general suggestion for more clear phrasing throughout the manuscript is to keep sentences short and avoid passive form. These are the sentences I didn't understand:

"When mapping (e.g., at a national level) is inadequate to understand real life issues, detailed boundaries can be determined to explore actors' processes within the boundaries, to understand how the links between ecosystem actors impact ecosystem outcomes (Phillips & Ritala, 2019)" (Introduction)

"Research suggests that the recognition and implementation of sustainable development opportunities are more complex for the entrepreneur than the recognition of non-sustainable opportunities (Volkmann et al., 2021)" (Introduction)

“Self-organization describes the emergent outcomes a system exhibits when structured in such a way that it can be organized into a number of interacting subsystems” (3.1)

“In complex adaptive systems, the localized context of the actions of individual elements in a system is recognized as a key aspect of how system behaviour unfolds and requires different models for each level if entities and interactions of different kind emerge at each level (O’Sullivan, 2009a)” (3.1)

“Adaptive tensions, influenced by entrepreneurs' intentions, location factors, and institutional arrangements, shape sustainable entrepreneurial ecosystems based on local conditions.” (5)