

## **Response to Anonymous Referee #2**

With the recent emergence of index insurance papers and the myriad approaches and hazards available, a review paper is warranted. The title indicates a focus on multi-hazards and food insecurity, however the manuscript moves far beyond these topics. Significant amounts of information spanning hazard type, variables, approaches, etc., are presented, which turns out to be overwhelming instead of comprehensive. Arguably the manuscript would benefit from a greater focus; presently it has too much breadth and lacks depth. In its current form, it is unclear how readers can benefit from this contribution. A reformatting of the presentation with a clearer emphasis and concrete take-aways could lead to a valuable contribution. Additional suggestions are presented below:

**Response:** We thank the Anonymous Referee #2 for his/her comments on our manuscript. We will improve our manuscript by focusing on food security and reformatting the manuscript. Moreover, we will address each of the suggestions in order to improve it, so it can be accepted for publication.

Questions at the end of the Introduction section are very relevant, but also very broad. Perhaps focusing specifically on multi-hazards and food insecurity can help to focus the questions further (and presumably the manuscript as a whole.) Related, it's not well motivated why other sectors (e.g. energy) are included here. Unless they specifically relate to energy used in food production? Or tradeoffs between hydropower and allocations to agriculture? More specificity is strongly suggested to tighten the analysis and findings.

**Response:** Thank for your comment. We believe that our work should undergo substantial improvements if we focus on multi-hazard and food insecurity. We have enough material to focus on this aspect. We understand that trade-offs between other sectors it's a great suggestion for future work, so we will discuss it briefly in the conclusions and future work.

Table 1: Are these Themes developed by authors or follow a commonly accepted methodology? More description is required on what centrality and density really mean and how best to be interpreted. Also, what is the reference for the numerical scale? 0-10? Finally, some clusters are described in numerous Themes. For example, Basic includes four clusters in the text, but only two in the figure.

**Response:** We thank you for your comment. We obtained these themes followed the keyword clustering algorithm proposed by Cobo et al. (2011) and we determined it using the package bibliometrix in R Environment. Cobo et al. based their metrics in the concept of centrality and density of co-word analysis developed by Callon et al (1991). The method is a practical application of the Fuzzy Set Theory Field and does not have a specific scale. The values are relative do the number of papers analyzed, number of citation in the documents and the number of clusters generated by the co-word analysis. We will describe more clearly how these metrics – density and centrality – are calculated and how to better interpret them.

The Hazard Identification section feels like a really long list, and it's unclear what the goal is in this section. Is it to essentially list the papers that go with each hazard? That could be doable in a large Table (perhaps appendix.) The descriptions of the hazards are basic enough that most readers should be familiar (and arguably aren't learning new information), perhaps with the exception of SPI or similar, but even then, most are likely to already know. It's of course necessary to identify the top hazards (e.g. Fig 3), but the text in its current form does not add much. The authors are encouraged to consider either simplifying (e.g. a Table as suggested) or taking a deeper dive into the details of hazard aspects identified and targeted in each paper.

**Response:** We thank you for your comment. We agree with your comment and we believe that the manuscript will benefit by reducing the description of the hazard calculation in a table and proposing an in-depth discussion of index selection, impacts on design and decision-making. We learned from the literature review that the risk communication is much appreciated and farmers tend to be willing to purchase a policy when they understand risk.

The Vulnerability Analysis section appears to be a mix of discussing assets, variables, and modeling approaches. Perhaps the authors could consider an alternative presentation approach such as combining parts with the Hazard Identification section (e.g. have subheadings by hazard type that also includes assets at risk and relevant variables.) This could partially address the comment above. The description of modeling approaches does not appear to fit in this section, and is probably a stand-alone section.

**Response:** The vulnerability analysis is an important step for our review and conceptual framework. We agree with Referee #2's comments. We will clarify our choice by explaining what vulnerability concept we have adopted in our work. Therefore, some of the language, e.g., the words 'assets' and 'assets at risk' will be substituted for a formal and clear definition of vulnerability and then how we approached the literature review.

While the Financial Methods section relays the large number of design approaches, target outcomes, etc. It is unclear what the reader is supposed to take away from this section. Simply that there are many types? Or if a particular type sounds most appealing or relevant to their needs, then they can refer to the papers cited? Certainly some aspects are appealing, such as those that describe the pros and cons of a particular approach. The authors are encouraged to include more pros and cons to give the reader a more firm understanding and perhaps guidance for their own work.

**Response:** We thank you for your comment. We will improve the discussion on what are advantages and disadvantages of the models and potential implications in decision-making. We will make sure that at the end of the section the readers are able to select the methods according to different multi-hazard scenarios.

For the Conclusions, it may be a stretch to claim that a large number of papers (ag and crop insurance) leads to a 'high impact on index insurance'. It does mean the topic is perhaps more well studied than others, but I believe the impact is still

very small. Also, I'm not sure this manuscript really points to the 'gaps in the field', and if it does, then this needs to come across much more strongly. Conclusions that point directly to multi-hazard and food insecurity should be front and center in this section. I suggest expanding this section.

**Response:** We thank you for your comment. We agree with the referee comment. We need to clarify that the impact was calculated using Cobo's metrics of density and centrality and it means that crop insurance theme has a high impact in the literature that we collected in the systematic review. However, overall, index insurance has a lot of potential and we agree that field in general has a lot of room for improvements. We found two main gaps in the field. The first one is that only a few studies approached multi-hazard insurance design and second, the ones that approached did not further described how to perform an exploratory multi-risk hazard analysis for index insurance. This is particularly challenging in countries such as Brazil, which are vulnerable to multiple climate hazards. We will expand this section and will shed more light on food insecurity and multi-hazard.

The Reviewer acknowledges that review papers are challenging to write. The authors are encouraged to highlight their motivation for assembling the manuscript, more clearly focus the topics, and articulate precisely what they want readers to glean from this contribution.

**Response:** We once again thank the reviewer for carefully reading our manuscript and being so insightful. We intend to address all the questions, particularly; we will focus more in the implications of multi-hazard risks in food security. We believe that manuscript will largely benefit from the revision.

#### **References:**

Cobo, M., López-Herrera, A., Herrera-Viedma, E., and Herrera, F.: An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the Fuzzy Sets Theory field, *Journal of Informetrics*, 5, 146–166, <https://doi.org/10.1016/j.joi.2010.10.002>, 2011.

Callon, M., Courtial, J. P., & Laville, F.: Co-word analysis as a tool for describing the network of interactions between basic and technological research—the case of polymer chemistry, *Scientometrics*, 22, 155–205, 1991