

REVIEWER'S REPORT

I have now read the manuscript titled: "Assessing flood risk: identifying indicators and indices for period-specific flood measures". In my opinion, the article has many significant drawbacks that undermine its clarity and overall quality.

General comments:

- The aim is not clear
- There are many inconsistencies in the presentation of the method and results
- Significant references are missing
- Critical view is missing from discussion and conclusions

Specific comments:

Title: The title does not represent the content. This is a "Review of indicators and indices for flood risk assessment".

Abstract: The problem with review papers is that they have to be very well-focused (clearly delimited) and to have a specific purpose. Neither of the two is clear in the manuscript in my opinion. In the abstract, the gap that the authors are "bridging" (line 14) is not clear neither are the findings.

Introduction: This is a very good place to make some things clear. What do you mean with floods? Is this only river flood or also flash flood (or dynamic flooding) or even coastal flood? What do you mean by "flood periods"? This becomes clear in page 19 (too late).

Introduction: what do you mean by "alternative approaches" in line 32? What are their advantages and disadvantages? You can get some ideas/refer to this publication:

Papathoma_Köhle?M;Vulnerability.curves.vs.vulnerability.indicators;application.of.an.indicator_based.methodology.for.debris_flow.hazards?Nat;Hazards.Earth.Syst;Sci;?727337-7356?https://doi.org/10.1016/j.nhess.2017.08.022

Introduction: (lines 38-40). Is this your own definition? These criteria (measurable, observable etc.) can be found in the book of Birkman Measuring Vulnerability to natural hazards. In my opinion, a quality check of your indicators through this criteria would be beneficial for the paper (see previous publication of Papathoma-Köhle). What is also missing is the definition of (vulnerability) indicators from Birkman. The reference is here:

Birkmann?J;Indicators.and.criteria.for.measuring.vulnerability;Theoretical.bases.and.requirements;In;J.Birkmann.(Ed);Measuring.Vulnerability.to.Natural.Hazards;Towards.disaster.resilient.societies.(S;113);UNU.Press;8662

Moreover, valuable information on indicators can be found here:

OECD; Handbook on Constructing Composite Indicators; Methodology and User Guide; (OECD Publications? Paris? 8664);

Introduction: you refer to the ambiguity among risk factors (line 95) that you do not really discuss in the manuscript. You should definitely refer to this paper—they do exactly that:

<https://link.springer.com/article/10.1007/s11069-024-06643-9>

Introduction: you focus on AHP. Why? What about other methods? What is better in AHP? Maybe saying “participatory methods” in general would be better. A reference about AHP should be added for the readers that do not know what it is.

Material and method: you explain in the conclusions why you limit the review to these years (2017 to 2022). The reason you give is limited resources which is not good enough to explain this limitation. What about recent papers (2023?). What has this with resources to do?

Material and methods: the title of 2.2 is wordy and not to the point.

Material and methods: (line 129) “an assessment was conducted”, which assessment? How? Which method did you use? Not clear.

Results: (line 140) you already wrote a lot about definitions in the introduction. Maybe you should move some text here and use the introduction to set the scene.

Results: Definitions from the UNDRR (2017) are totally missing! Here is the reference:

<https://www.undrr.org/drr-glossary/terminology>

Results: there is no critical view of the definitions. E.g. definitions of risk Ologunorisa and Maskrey—why are they different? Are they?

Results: vulnerability (lines 167-169): “damage curves for physical assets and indices for human well-being”. I do not agree. There are plenty of studies using indices for physical assets e.g.

Papathoma-Köhle, M., Schlögl, M. & Fuchs, S. Vulnerability indicators for natural hazards: an innovative selection and weighting approach. *Sci.Rep* **9**, 15026 (2019). <https://doi.org/10.1038/s41598-019-50257-2>

Results: Vulnerability: a discussion on the different vulnerability dimensions is needed here.

Results: Susceptibility/sensitivity. According to line 123 there are three factors of risk (vulnerability exposure and hazard) and vulnerability incorporates susceptibility/sensitivity and adaptive capacity. If this is part of vulnerability why is it in a separate subchapter, and where is adaptive capacity.

Table 1. the table would be better with a column providing the reference of each paper and a column showing the aim of each paper. The first column is not clear (what is this about?-I think it is about the aim of the study but it is not clear). An interesting piece of information would be to indicate whether the study is quantitative or qualitative and what is the risk metric.

3.3 Indices and indicators: what are the differences? The authors have to explain (we get an explanation in the figure caption-Fig 1). Yet, although according to the figure caption the indices are left, in the text they are called indicators (lines 229-230).

Figure 1: on the right side we can see the risk factors. However, the risk factors according to line 23 are 3 (hazard, vulnerability, exposure). Now they are five. Susceptibility is supposed to be part of the vulnerability (lines 28). What about the “flood potential”? What is the difference to hazard? Where is the definition of flood potential in the “definition analysis” part?

Figure 1: Are these indices from specific publications or have you developed them yourselves? It is not clear.

Table 3. Is imperviousness an indicator? Is it measurable and observable? (see comment about quality criteria above). I think imperviousness is actually the result of a number of indicators (e.g. building material, building height, position of openings etc.).

Table 8. What is direct and inverse proportion? I do not agree that population density has a neutral effect during the response phase (by the way, I think that “phase” is a better word than period). Evacuation possibilities and methods are related to the population density. I also do not agree that the number of households is neutral in the pre-flood phase. It is very relevant for the total authorities and how they are going to prepare.

Table 9 and table 10: why the socio-economic index has now less indicators than before?

Table 9 is for the hazard, table 10 is for the exposure. What about vulnerability?

Discussion: parts of the discussion talk about the methodology. New information is coming in but there is no critical view of the findings which is what the discussion would be about. Also, limitations could be discussed here and not in the conclusions.

Discussion: according to the abstract, there should be some recommendations at the end, but there are not.

Conclusions: “the paper seeks to understand the ambiguity among risk factors”. I do not think that it does that. There is not enough discussion on this matter.

Conclusions (lines 461-462): “it was necessary to build a clear concept”-it is also not clear what is this concluding clear concept that has been developed. Lines 466-467: “the exhaustive definitional review”-it is not exhaustive since the terminology of the UNDRR is missing. Lines 474-476: “By focusing on...nature of flood risk”. This is not

something new. There are plenty of studies focusing separately on hazard, vulnerability and (less) exposure. Finally, the last paragraph is about participatory methods and stakeholders, a topic that it is not adequately approached in the manuscript.