The paper gathers a large amount of work and develops several ideas, it is thus dense and long. The paper content is relevant for publication in NHESS. However, due to the several comments and disorganized structure of the paper, major revisions are needed to proceed to future steps in publishing this work.

I have several comments that may however require some profound modifications in the manner the paper is structured. If the majority of these comments are not solved in the updated version of this paper, then it should be rejected for publication.

A. General comments

1. I recommend this paper goes through an extensive English edition and proofreading. There are several grammatical errors that must be fixed.
2. The paper claims in several parts that a method is presented. According to my understanding, that is not the case simply because there is no new method presented. The authors make use of local datasets along with already existing approaches and software. Thus, although they provide important results, they should be careful with the manner the word "method" is used. As a major comment, the authors should spend more elaborated comments in an actual discussion.
3. Aligned with the former, I strongly recommend you to present a new big section (same level as the introduction, results, or conclusions) named "discussion" (different from the merged one "results and discussion", which should be split). In this chapter you should present a detailed comparison of your results with existing works, as you have nicely done with Aksha et al, 2019 and moderately (not really clear) with Gautam,2017. Still, other studies are still missing (e.g. the hazard and risk model of the Global Earthquake Model (GEM) from Silva et al, 2020). Therein the authors are expected to write the main drawbacks of their assumptions, how limitations could be overcome in future studies, and what would be needed to achieve more accurate results.
4. The conclusions should be more elaborated and precise. Please consider including bullet points highlighting your main findings.

B. Specific comments

Please note that in the following comments, some references are suggested to be included whilst, others, due to their irrelevance to the overall aim of the paper, are suggested to be removed

1. "Abstract"

1.1. The Abstract should be considerably reformulated. Starting with the particular study case and then the general problem is not a recommended manner to write it.

1.2. Please avoid using acronyms in the Abstract (VDC). Also, that is never defined. Please do it for the first time it is presented anywhere in the text (again, not in the abstract).

1.3. Line 8: "annual loss (seismic risk)" is not an accurate manner to describe the final metric of interest. Please rewrite it.

1.4. Line 9: the expression "the earthquake risk" should be changed to something concrete saying what are the exposed assets of interest in your study.

1.5. Line 10: the expression "compute the risk analysis" is not correct. Better saying "assess the risk to seismic ground shaking of the exposed residential buildings in Nepal". This narrows down the scope of your paper since you are not considering any other type of exposed assets

or other compound and secondary hazardous effects (e.g. ground failure, liquefaction, co-seismic landslides).

1.6. Line 11: Secondary aspects such as the Software (Openquake and ArcGis 10) that you select for your objective are unnecessary details at this very general and early stage of the paper. These details should only be provided later on once you have elaborated more on your ideas.

2. "1. Introduction"

2.1. Line 30: you provide a general detail at the global scale right in between two sentences concerning only Nepal. This is distracting. Please consider deleting or relocating it. The same happens with the content of lines 32-35. You could fix the former issues as follows: since you invest quite a long text in then describing general aspects of the risk assessment practices, and only the local study area is retaken in line 50, I suggest separating the global from the local aspects. In this case, the first part of the introduction should be relocated. Please use a different paragraph when you introduce such a change of setting.

2.2. The ideas that are introduced in line 50 are not clear. Why and how do you justify that the seismic hazard mapping in Nepal is scarce? (You use "lack"). There have been several recent projects done in the same study area, some of them are not old, and you cited them. Thus, please rephrase it.

2.3. Line 59: "risk assessment with proper forecasting measures" is not clear. Perhaps adding some example measures might help to provide clarity on what you exactly are trying to refer to. If these "measures" are the explanation you provide in lines 60-61, then I suggest you deeply reformulate that sentence.

2.4. Line 62: The OpenQuake reference is cited only in line 97, but disregarding its inadequate use in the Abstract (as formerly described), it was also mentioned in line 62. A proper reference is needed there. Subsequently, in line 63 it is only mentioned that the formal analysis you carry out is *"in the districts of Nepal".* The reality is that you do a much more exhaustive analysis of the municipalities. I suggest rewriting it.

2.5. Since some readers might not be familiar with the Nepali administrative division, I suggest you explicitly say right after the first time the word "district" is mentioned what does it exactly mean (i.e. which level of division is it and what is its average area (considering the 75 ones)?)

2.6. The sentence comprised between lines 64 and line 65 "*Studying social vulnerability identifies the sensitive areas and populations that are prone to high risk and are less likely to acclimatize and recover from a natural catastrophe"* is disconnected from the previous paragraph. This is background information that should be provided somewhere else. Also, I do believe the terminology *"natural catastrophe"* is incorrect. Please modify carefully using the correct terms. The same comment applies to "seismic losses" (used twice in the text). Please replace it with something more concrete.

3. "2. Theory and background"

3.1. Please read alone the sentence: "The impact of natural hazards is based on social parameters such as socioeconomic status, geographical features, ethnicity (minority), renter, gender, and age". The manner it is written could be misunderstood in the sense that the listed variables are some of the most important ones, disregarding the hazard component. That should be also clearly said, e.g. beside the hazard component, there are others…). Moreover, that

sentence needs a reference. You could simply consider correctly rewriting this sentence and the former one and use the citation therein provided.

3.2. The sentence "There have always been stories of high-class predation and low-class vulnerability" and the next one "At the same time… society" are prone to open free interpretations. Although I agree with what the authors try to express, since these sentences lack citation and explicit examples, due to the manner they are written, they remain as opinions whose locations are out of context in a "theory and background" section. Please remove them, or better, rewrite them accordingly.

3.3. The text in lines 85 (related to population) and 86 (related to topography) are presented as mere ideas in a disconnected manner from the previous (and nicely written text). Please use connectors or create a smoother manner to connect those ideas with each other.

3.4. Please remove "OpenQuake" from the header 2.2. This is totally irrelevant for a title. Furthermore, I strongly suggest removing the short description of that software from this title. The user's decision about the desired tool to implement is not part of "theory and background", but rather on the "material and method" section.

3.5. The authors should be careful in the manner the first sentence of Section 2.2 is presented. If you note the cited work of Stevens et al., (2018), they say: *"a **large part** of Nepal **is expected** to have **a 10% probability of exceeding shaking** of 0.4g–0.6g and a 2% probability of exceeding shaking of 1.0g–3.0g in any 50 year period".* Please note that it refers that only one portion may experience such ground motions, not all the country. This is totally missing in your sentence. Also, please note that in this context the conditional form is advised (e.g. is expected), whilst you use "is". That is incorrect and unacceptable. Therefore, I also suggest to rephrase these sentences in a more pragmatic manner (e.g. accelerations in the range of XXX may be expected for a 10 % probability of exceedance over 50 years or 475 years return period for certain zones of the study area). The same could be rewritten for the other probability of exceedance. Furthermore, as you certainly know, this type of formulations assume a Poissonian mode, and hence, you might like to highlight that important (and nowadays questionable) assumption herein.

3.6. The authors should state in both sections (3.2.2. and the to-be created Discussion) the implications of not having used any spatial correlation model to model the seismic ground motion fields. Justify your assumption being aware of this limitation, for this aim, please consider citing Weatherill et al, (2015)

4. "3. Materials and methods"

4.1. Line 100: *"potential effects"* is too vague. Please be (way) more precise. You say "This approach", but which approach? You have not even mentioned the method you will follow. You simply mentioned "an integrated approach" and then cite Burton and Silva, 2016. I strongly suggest that you reformulate the paragraph explicitly indicating that you will use an existing method (e.g. Burton and Silva, 2016) to integrate physical vulnerability to seismic ground shaking with other "human" dimensions. Please remove "within the hazard zone" This is simply not clear nor accurate. The sentences you use to cite Carreño, et al, 2012 and Fernandez et al., 2006 are both presented as background information. That is incorrect for the type of title you are describing. Thus, please consider to either moving it to the Introduction, or to rephrase it saying that you will use a method presented by those authors.

4.2. "3.1. Social vulnerability assessment"

4.2.1. The Section "3.1.1 Data and SoVI modification" should be renamed. It is just too vague. Is this input data? For what procedure? Please indicate it in the title. Avoid the use of acronyms here.

4.2.2. Line 120: you say 54. Is this a mistake and do you refer to 45?

4.2.3. Line 116: For the sentence *"Table 2 provides the list of all the variables used for social vulnerability assessment",* please specify whether those variables are a result of your subjective selection among more, or are they all integrally (not removing any) within each dataset employed. This is not clear.

4.2.4. Line 131. The subscript in "Si" is incorrect. Please change it.

4.2.5. Figure 1:

4.2.5.1. The location within the text of this figure is not accurate. Please note it belongs to the section "Data and SoVI modification" within "Materials and method", which is weird. This figure does not really display any important variable of analysis for these sections, but only show the geographical location of some three regions and administrative divisions. Thus I suggest this is included within a more generic title "Context of the study area" or similar. This is not a must, but it is highly advised. In this case, others parts should be relocated therein.

4.2.5.2. If possible, please remove from the legend "_". This is not harmonious.

4.2.5.3. Please add the borders with neighboring countries. The way it is shown it shows Nepal as an island.

4.2.5.4. Please reduce the font size of the coordinates. Having them larger than the actual caption is not aesthetic.

4.2.5.5. For guidance, please consider adding the location of some of the main cities.

4.2.6. Section "3.1.2 Principal component analysis" should be renamed adding for which sub-process this method is planned to be done, otherwise remains unclear.

4.2.7. Line 163: The manner the authors describe old versions of the method is irrelevant to the main Section "Materials and methods". Also, right next to it and to remark a difference with newer approaches, the word "currently" is used while citing outdated references (1993-2000). If that is anyway your intention, please provide current (from this decade) references.

4.2.8. Line 185: "test value of 0.000". Really? 0? Please check it out. Although it is true that the number of decimals in all of the provided numbers should remain equal (please work on this), the cero can be an exception (Although I suspect it is unlikely it is a mere null value).

4.2.9. Line 186: Please provide the reference and full name (Statistical Package for the Social Sciences of SPSS v.21.0.

4.2.10. Line 191: incorrect manner of presenting the citations. Open a parenthesis after "studies" that contains both references.

4.2.11. Once again, the manner some comments provided as background are provided (e.g. SoVI scores are generally expressed as standard deviations (z-scores) or quintiles to emphasize their relative value (Tate, 2012)") within the formal analysis and explained steps is highly distracting. Please rephrase this sentence and all of the ones with similar style. You can say: "Similarly to XXX, we expressed the SoVI scores as YYY…."

4.3. "3.2. Seismic Risk Assessment"

4.3.1. In this paragraph you are mixing up present and past tense without any order, please make sure that during the English proofreading this is harmonized.

4.3.2. Line 202. Please rewrite or delete this sentence "The physical vulnerability function is solely hazard dependent". If you decide to rewrite it, please add a citation, but not in using a "background style" as formerly discussed.

4.3.3. Information contained in lines 207 until the first point of 209 is irrelevant for the subsection. Also, it is badly written and there is no order with the (unnecessary) provided references. They must be ordered following certain selected pattern.

4.3.4. For the section "3.3.1 Source model", please rewrite the information about the former studies of seismic source zonations making a link with the actual existing model you decided to adopt. The way it is presented can be misleading due to the expression "for instance". You can extensively simply this saying something like: Despite there have been several seismic sources for the study area (i.e. ZZZ, UUU, and TTT), we have decided to implement the one of XXX that comprises 23 area source" or something similar. Also, in this section, you should mention the main tectonic setting of the region, the Main Himalayan Thrust, which you neglect in your text.

4.3.5. Line 218: please change the expression "effect on engineering structures". This is not accurate. I do understand what you try to say, but, please be more precise in a written form.

4.3.6. Line 219: specify the type of Earthquake magnitude you are referring to. I suspect it is moment magnitude (Mw), but it can be confusing due to the two types of magnitudes provided in Table 5. Thus, this aspect must be clearly stated therein. The expression "the surface wave of 4.0" is inaccurate, please rewrite it. Be careful with the manner you write such technical details.

4.3.7. Line 220: the list of devastating earthquakes is not necessary here. The information of Table 5 is sufficient. Also, this is repeated information (already provided in line 26 (with a proper reference).

4.3.8. If possible, please modify Figure 3, reducing the fontsize of the coordinates, including neighboring countries, and most importantly, since the authors have decided to not include a single map showing the seismic hazard, at least, this figure containing the zonation should contain some of the most important historical earthquakes (similarly as done Thapa and Guaxin, 2014 and Chaulagain et al, 2015). This way, the reader can realise that despite there are more assets exposed in the southern parts of the country, the historical seismicity is comparatively lower. This type of comment is also missing. Please consider including something similar.

4.3.9. Related to the former, please consider citing the study of Rao et al, 2020 where the extend of likely synthetic ruptures are presented for Nepal (see figure 1 in their study)

4.3.10. The first column of Table 5 is unnecessary because the zones have the same numeration. Please delete it. Also, since this information is exactly the same as the Chaulagain et al, 2015 which in turn took it from Thapa and Guoxin 2013, if you really want to keep this table, you should use a word highlighting that there is no contribution from your side in their elaboration. Such a word can be "taken or reprinted", but I feel that a simple citation is in this case not necessary.

4.3.11. Line 231: The plural form of research will also be “research”. Please change it.

4.3.12. Line 238: I dislike the way the building types are included in the exposure model. Considering that according to the GEM V.2.0 taxonomy, there are other several occupancy types for buildings different from the industrial and commercial (e.g. education, government, assembly, agriculture), that would mean that all of those typologies are implicitly included in your model, which I doubt. If only residential buildings were included, I suggest you explicitly say it. Otherwise, it is not clear.

4.3.13. Line 240: *“most of the regions in Nepal consist of”*. Please change the word “regions” and be more specific (replacing it to “the residential building stock” or similar).

4.3.14. Since the authors are not doing any difference in the loss to damage ratios of the consequence model for each building type, the information contained in Table 7 is not interesting enough to be shown as a table. I suggest to reconfigure such data as simple text.

4.3.15. Line 255: There is an imprecision in the sentence “The fragility function used in this study is shown in Table 6”. What the authors report are the logarithmic mean (μ) and logarithmic standard deviation (σ), not the “fragility functions”. Moreover, the definition of the nomenclature μ and σ is missing. Please include it either in the text or table caption. Moreover, I could not find anywhere where it is explicitly stated the intensity measure(s) that those fragility functions employ. Are they all “working” with PGA, PGV, any other spectral acceleration, or more sophisticated ones? Please clarify.

4.3.16. I highly recommend to include a figure showing the graphical representation of these fragility functions. This will provide clarity because, due to the logarithm values, it is not straightforward for the reader to make out an idea about the differences between the damage states across the 5 building types. Use gridded subplots for this aim.

4.3.17. Figure 4: The subplot (a) must be reformatted. Please avoid using “_” in the legend. The used ranges to define the building counts are inaccurate. Please note how the numbers are not consecutive. This is simply unacceptable. A good practice can be found in one study you have cited: please refer to Figure 3 in Chaulagain et al, 2015 to realise how the numerical ranges must be consecutive. Please avoid using white as a color as well as colors with sharper distinctions. Instead, I strongly suggest to use a graduated color map (similar to Chaulagain et al, 2015). Make sure that the colors employed are “color-blind” friendly.

4.4. “3.3 Integrated risk assessment”

4.4.1. Please introduce the text and then, figure 5. It is weird to have it before their actual formal introduction.

4.4.2. Also, regarding figure 5, I strongly suggest to modify it. It is not self-explanatory. I am aware you have based your figure on the existing Fig. 1 of cited Burton and Silva, (2016), but you should use an expression saying you that you fully relied on theirs to produce yours (i.e. “modified from” or similar). Please note that theirs is indeed self-explanatory because they added a short explanation for the components A, B, C, and D. Please consider doing something similar. Some hints are:

4.4.2.1. For the seismic hazard, it is important to remark it is probabilistic hazard and not scenario-based.

4.4.2.2. For what you call “geographic features” it is important to remark what exactly you refer to. In this sense, although Burton and Silva, (2016) mentioned Exposure and physical vulnerability, you should mention it, but even narrowing down saying “Exposure modelling for residential buildings and their physical vulnerability”.

4.4.2.3. Complementary, a senctence where you raised awareness that your “exposure products” are part of modelling process with uncertainties and not a ground truth. This type of sentence should be include. Please consider including these references: Kalakonas et al, (2020) and Gomez-Zapata et al, (2022) for this aim.

4.4.2.4. Moreover, a statement about the geographical part of the exposure model is missing. Although it is implicitly said to be modeled using administrative boundaries, the implication of using any other type of aggregation areas for risk assessment could have been another alternative. Studies such as: Douglas, 2007, Bal et al, 2010; and Gomez-Zapata et al, 2021 have shown the importance of having compatible with the hazard footprint and attenuation. You could briefly present these issues and references either here or in the discussion section.

4.4.2.5. For the “physical risk” you should clearly show what is/are the metrics (similarly as the aforementioned authors did).

4.4.3. The first three lines of this section are presented as background within a “material and methods” section. This structure is inaccurate and instead, it should be relocated somewhere else (e.g. Introduction). Also, please be aware this is repeated information (see where else you have cited Burton and Silva, (2016)) that the reader has already come across several times. I agree that this citation is highly relevant, but you could anyway consider to reduce the number of times that similar ideas that come out of this reference are mentioned in your paper.

4.5. The sentence *“Here, the seismic losses were recomputed by using the Min-Max rescaling method”* is out of context within the current title. That is something the authors had already correctly presented in Section 3.2 (line 205). If your intention is to mention that the outcomes of the former step are integrated in this one, then you must properly rewrite that sentence.

4.6. Similar issue as described above regarding the sentence “The seismic hazard analysis requires earthquake ruptures and ground motion fields”. It is unnecessary and also out of place. This is something you have already elaborated in sections 3.3.1. 3.2.2. If you still want to keep it, you must properly rewrite it.

5. “Results and discussion”

5.1. “As clearly stated in the beginning of this revision, please separate “results” and “discussion” into two differentiable sections.

5.2. “4.2. Seismic Risk Assessment”.

5.2.1. The authors mentioned since section 3.2 that Chaulagain et al, 2015 also performed a seismic risk assessment for the same study area. Only a short comment on a single similarity is mentioned. However, detailed differences with that study (or others) are not provided. This is key in the reconnaissance of the added value of your results (even without mentioning the nice contribution about social vulnerability). This should be included in the new section “discussion” I am kindly asking for.

5.2.2. Line 308: Although some names of the regions were formerly provided in Fig. 1, this one should be recalled one again. It is easy for the reader forget it. However, some names you cite have never been introduced (i.e. Kathmandu, Butwal). This is one of the reasons of the comment 4.2.5.5 related to Figure 1. Same comment applies for line 238.

5.2.3. Figure 11: The caption is incorrect. It is true that you present the results only highlighting the 75 district boundaries, the results that you are displaying are in reality the ones for the 3983 VDCs and municipalities. Therefore, I strongly recommend that you rewrite the caption. Do not be afraid of including more than 1 line descriptions when they are necessary to be fully understandable to the readers.

6. Conclusions

6.1. Line 351: *"This paper presents a method using…"* (This is related to one of the general comments described above). This is because no original method was outlined. Instead, the authors made use of existing approaches to present some results. Please rewrite it. Be precise.

6.2. The last paragraph of the Conclusion should be moved to this new "discussion" section. Complementary, considering that some preliminary reports of the 2021 Nepal Census are already available by April 2022, the authors are encouraged to discuss (in the future "Discussion" section) how a similar analysis as they performed using outdated information from 2011 could locally or globally vary if such a new census was used instead.

C. Technical corrections

1. Most of the references lack the correct style that is demanded by the Journal. The DOI of the references must be provided in the next revision.
2. Line 54: incorrect use of the parenthesis for the citation "Aksha et al., 2019"
3. Table 1 provides sensitive information but without providing any reference. Please add it to the caption.
4. There are several identical titles (e.g. "3.2 and 4.2"; 3.3 and 4.3). A distinction must be made at least either mentioning the study area or something else (method vs. results).
5. Line 289: please replace the word "total" by "integrated". This is to be consistent with Fig. 5
6. Line 293: please remove or rewrite "The OpenQuake platform present within QGIS was used to develop probabilistic seismic risk models". This suggestion comes from the fact that there is a very similar sentence just before this one. Please avoid redundancy.
7. Figure 6: Please remove "_" from Figure 6. Please ensure that the notation for the building types is identical to the one provided in Table 6. Also, please modify the caption. Saying "QGIS IRMT" is not accurate. IRMT is enough. Since captions should be self-explanatory, please rewrite the full name of this acronym and include its respective citation.
8. Line 304: Please modify "geophysical characteristics". Due to the various use of that word in other related scientific contexts, you should use other wording.
9. Line 366: "SIn": This is wrong. Please correct it.

D. Full references that are suggested to be included in the updated manuscript after this review:

- Bal, I. E., Bommer, J. J., Stafford, P. J., Crowley, H., and Pinho, R.: The Influence of Geographical Resolution of Urban Exposure Data in an Earthquake Loss Model for Istanbul, Earthquake Spectra, 26, 619–634, https://doi.org/10.1193/1.3459127, 2010.

- Chaulagain, H., Silva, V., Rodrigues, H., Spacone, E., and Varum, H.: Earthquake loss estimation for the Kathmandu valley, Second European Conference on Earthquake Engineering and Seismology (2ECEES), 2014

- Contreras, D., Chamorro, A., and Wilkinson, S.: Review article: The spatial dimension in the assessment of urban socio-economic vulnerability related to geohazards, Natural Hazards and Earth System Sciences, 20, 1663–1687, https://doi.org/10.5194/nhess-20-1663-2020, 2020

- Douglas, J., 2007. Physical vulnerability modelling in natural hazard risk assessment. Natural Hazards and Earth System Sciences 7, 283–288. https://doi.org/10.5194/nhess-7-283-2007

- Gomez-Zapata, J. C., Brinckmann, N., Harig, S., Zafrir, R., Pittore, M., Cotton, F., and Babeyko, A.: Variable-resolution building exposure modelling for earthquake and tsunami scenario-based risk assessment. An application case in Lima, Peru, 21, 3599–3628, https://doi.org/10.5194/nhess-21-3599-2021, 2021.

- Gomez-Zapata, J. C., Pittore, M., Cotton, F., Lilienkamp, H., Simantini, S., Aguirre, P., and Hernan, S. M.: Epistemic uncertainty of probabilistic building exposure compositions in scenario-based earthquake loss models, https://doi.org/10.1007/s10518-021-01312-9, 2022.

- Kalakonas, P., Silva, V., Mouyiannou, A., and Rao, A.: Exploring the impact of epistemic uncertainty on a regional probabilistic seismic risk assessment model, Natural Hazards, https://doi.org/10.1007/s11069-020-04201-7, 2020.

- Rao, A., Dutta, D., Kalita, P., Ackerley, N., Silva, V., Raghunandan, M., Ghosh, J., Ghosh, S., Brzev, S., and Dasgupta, K.: Probabilistic seismic risk assessment of India, 36, 345–371, https://doi.org/10.1177/8755293020957374, 2020.

7. Silva, V., Amo-Oduro, D., Calderon, A., Costa, C., Dabbeek, J., Despotaki, V., Martins, L., Pagani, M., Rao, A., Simionato, M., Viganò, D., Yepes-Estrada, C., Acevedo, A., Crowley, H., Horspool, N., Jaiswal, K., Journeay, M., and Pittore, M.: Development of a global seismic risk model, Earthquake Spectra, 8755293019899953, https://doi.org/10.1177/8755293019899953, 2020.

8. Weatherill, G. A., Silva, V., Crowley, H., and Bazzurro, P.: Exploring the impact of spatial correlations and uncertainties for portfolio analysis in probabilistic seismic loss estimation, Bulletin of Earthquake Engineering, 13, 957–981, https://doi.org/10.1007/s10518-015-9730-5, 2015.