Thank you very much for your extensive review of our paper including comments and suggestions. A major revision of the paper has been carried out to take account of all the comments. We believe, during the process, the paper has been significantly improved.

We have sequentially addressed all of the points raised by the referee in each section of the paper along with the general and technical comments. The major changes include reformulation of abstract, inclusion of discussion, and correction of the presentation of maps. The revised maps are added in the last section of this document.

Major changes:

1. **Abstract**

Seismic risk assessment involves combination of the exposure model, seismic hazard, and structural vulnerability. The risk analysis is necessary to mitigate the potential losses resulting from future earthquakes and supplement scientific risk management. It is indispensable to interpret risk in terms of social and economic consequences due to hazardous events like earthquakes in order to assist systematic evaluation and management of risk. There is an interrelationship between hazards, physical risk, and the social characteristics of populations. Therefore, based on existing studies focusing on each of these aspects, this paper presents the integrated seismic risk assessment along the subdivisional administrative units of Nepal using 2011 census data. The administrative unit, provinces, are subdivided into districts and each district into municipalities and Village Development Committee (VDCs). The districts, municipalities, and VDCs were considered as our study units. In this study, the physical or seismic risk was evaluated from the exposure and vulnerability model of the country whereas, the social vulnerability was assessed using Social Vulnerability Index (SoVI) methods. To formulate the physical risk, the assets used were five types of buildings under the exposure model. This model was combined with the physical vulnerability functions of the building and the hazard curves of the country. The result of the physical risk has been presented as Annual Average Loss (AAL). Similarly, 54 variables among 92 social vulnerability variables were reduced to seven weighted parameters using Principal Component Analysis (PCA). The scores of a total of 45 parameters were used to evaluate the SoVI index, which was further combined with the physical risk to evaluate integrated risk. The results showed that populated cities like Kathmandu and Janakpur have a highly integrated risk index. Similarly, the terai region bordering neighbor India and some parts of the central hilly region are highly vulnerable, while most parts of the mountainous region in the central and eastern regions are least vulnerable. The results from the present study can be utilized as a part of a comprehensive risk management framework at the district level to recuperate and recover from earthquakes.

2. Discussion

The findings of this study can be briefly summarized into three parts: evaluation of social vulnerability index, physical risk assessment, and integration of the social vulnerability and physical risk. The objective of the social vulnerability assessment is to quantify the vulnerability in Nepal in terms of SoVI scores considering socio-economic parameters at the local level. As mentioned in the previous section, based on z-scores, the total SoVI scores were classified into five quintiles from very low (< -1.5 standard deviation) to very high (> 1.5 standard deviations) vulnerability. The total SoVI scores were calculated by summing all principal components. The results of social vulnerability show that the most socially vulnerable places are located in the Far-Western, eastern Terai region, and western Terai region of Nepal. Our findings exhibit differences in social vulnerability in areas located in the same ecological region. The main reason behind this could be the pre-existing conditions like infrastructures, education, economy, etc. The population in the Far-Western region and the eastern Terai region are mostly minorities, Dalits, and marginalized groups who are behind in education and development (Gautam, 2017). As for Mountainous and hilly areas in the Far-West region, the geographical terrain has affected the development path of these areas. Aksha et. al (2019) and Gautam (2017) also found a similar vulnerability in their respective studies. However, Aksha et. al (2019) classified Kathmandu valley as a high vulnerability class, while Gautam (2017) classified it as a very low class. Our result agreed with the latter case. This variability in the result is due to differences in variables and hazards considered during the analyses. Moreover, more recent data for SoVI will depict the more exact status of society and its vulnerability to disaster. This study uses Census data from 2011. The most recent census was held in 2021 however, data from 2011 were considered due to the unavailability of recent comprehensive data. More recent data can be used in the future study, once the Nepal census 2021 is published and made available.

The objective of physical risk assessment is to evaluate the physical risk index using a probabilistic approach. As in Burton (2016), the Classical PSHA risk-based calculator was used to assess loss exceedance curves, risk maps, and average annual loss. There are several studies that show a varying range of seismic hazard analyses of Nepal. According to Stevens, et al. (2018), in the large part of Nepal the accelerations in the range of 0.4g-0.6g and 1.0g-3.0g may be expected for 10% and

2% probability of exceedance over 50 years period respectively. Chaulagain (2015) evaluated the estimated peak ground accelerations (PGA in g) at 10% and 2% probability of exceedance in 50 years in the range of 0.22-0.5 and 0.42-0.85g, respectively. Thapa and Guoxin (2013) estimated the PGA (in g) at 10% and 2% probability of exceedance in 50 years in the range of 0.21–0.62 g and 0.38–1.1 g, respectively. In this study, a probabilistic approach and region-specific steps were used to evaluate the seismic hazard curves as in Chaulagian, et al. (2015).

The probabilistic method of estimating seismic hazards used in the study utilizes the Poisson model. Although earthquakes are assumed to occur randomly in space and time, this model assumes that earthquakes make a stochastically independent sequence of events in space and time (Anagnos and Kiremidjian, 1988). Despite this erratic characteristic, the Poisson model is widely used due to its simplicity in the formulation and smaller range of parameters to be estimated. Moreover, the recent research (Schiappapietra and Douglas, 2020; Weatherill et al., 2015) in seismic risk assessment have incorporated spatially-correlated distribution not only to estimate simultaneous intensity measure levels at locations during a specific earthquake, but also to quantify the correlation between locations. The present studies have suggested modelling of spatial correlation of earthquake ground motion since attenuation of ground motion is not only period-dependent, but also regionally dependent. However, in our study, we have used conventional method of probabilistic seismic risk assessment. Nonetheless, a certain standard approach is necessary to evaluate comparable estimates of seismic hazards.

The authors are aware of the fact that numerous estimations such as casualties, non-structural damage, business interruption loss, and loss to critical infrastructure may improve the indicator of physical risk. However, only economic losses to buildings were utilized in this study as an initiation for this type of research for Nepal. The results of physical risk and average annual loss estimates, were rescaled using the MIN-MAX method as mentioned in previous sections. The rescaling is necessary to integrate social vulnerability with physical risk although the rescaling of the estimates may have resulted from spatial information loss of physical damage results. This study presents the integrated risk due to earthquakes in sub-divisions administrative units of Nepal i.e., districts and VDCs. The mapping of the spatial distribution of average annual losses and social vulnerability is very useful, but it doesn’t reflect the true effect of components inducing seismic risk at a particular location. This can be due to the compounding nature of the spatial risk as to the areas of medium to high levels of social vulnerability compound moderate levels of physical risk to generate high levels of integrated risk. There is a higher degree of seismic risk and integrated risk in Kathmandu valley whereas, the medium level of social vulnerability in the eastern Terai region is compounded with the high level of physical risk to create a higher level of integrated risk which can be seen in Figure 11. In light of the limitations of this study, it is clear that robust procedures and methods should be used in future analyses of integrated risk assessment. Although this study is accompanied by certain shortcomings, it is within the context that the inclusion of a higher number of factors that contribute to the mitigation of earthquake risk provides better approaches in the development of policy and plans to reduce overall seismic risk.

3. Title changes:

2.2 Earthquake risk assessment to Parameters of Earthquake Risk Assessment

3.1.1 Data and SoVI Modification is changed to Social Vulnerability Indicators.

3.1.2 Principal component analysis changed to Calculation of SoVI (Social Vulnerability Index) by Principal Component Analysis (PCA)

3.2 Seismic Risk Assessment changed to Evaluation of Physical Risk Assessment

4.1 Social vulnerability index (SoVI) changed to Results of Social Vulnerability Analysis

4.2 Seismic Risk Assessment changed to Results of Seismic Risk Assessment

4.3 Integrated Risk Assessment to Results of Integrated risk assessment

General Comments

→ We agree that there are grammatical errors within the text, we have tried to correct them to the fullest. The words “methods” and “method” that were mentioned in the paper have been substituted. We have added a big section called “Discussion” prior to conclusion. The detailed comparison of the study with past studies has been carried out. In addition, we have also included limitations and steps to overcome these setbacks.

Abstract

→The abstract has been reformulated. All of the points are addressed in the reformulated version of abstract.

Introduction

→The introduction has been organized as per suggestions mentioned above. Comment 2.1: The national and global aspects of earthquakes have been separated. Comment 2.2: The text "lack of seismic mapping" has been replaced with "lack of social data for analysis and mapping." Comment 2.3 The sentence has been paraphrased. Comment 2.4 The OpenQuake reference has been cited. Comment 2.5 The administrative division of Nepal has been introduced. Comment 2.6 As mentioned, we have rewritten the section according to the comments.

Theory and Background

→**Comment 3.1**: Reformulated sentence as per suggestion: "Besides the hazard component, there are other social parameters that determine the impact of natural hazards such as socioeconomic status, geographical features, ethnicity (minority), renter, gender, and age (Burton and Silva, 2016)." **Comment 3.2**: We have removed the subjective statement "There have always been stories of…" **Comment 3.3 and 3.4**: Reformulated as per suggestion. Comment 3.5: Included in discussion part.

Materials and methods

→**Comment 4.1**: Reformulated the first sentence to: "This study assesses seismic risk by combining it with the human dimensions within the hazard zone similar to that in Burton and Silva (2016). This approach is an integrated seismic risk assessment." **Comment 4.2.2 & 4.2.3**: Table 2 provides the list of all the variables used for social vulnerability assessment. Out of 45 variables, district-wise indicators were represented by 22 variables and each sub-section (municipality and VDCs) was assumed to have uniform value. Among these 45 variables, seven of them were weighted combination of multiple variables as shown in Table 2. These weighted variables were obtained from 54 variables mentioned in Table 3. Therefore, altogether 92 variables (45-7+54) were considered for SoVI index. **Comment 4.2.5**: Figure 1 has been moved to the introduction as a part of background information and study area description and the background information in this section has been moved to the theory part.

Comment 4.2.8: Yes, we have rechecked and we obtained the test value of 0.000, as shown below. Similarly, we found some other studies with same cases. For example, the study by Yogamalar and Samuel (2018)[1].

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.888
Bartlett's Test of Sphericity	Approx. Chi-Square	258644.625
	df	1035
	Sig.	.000

Comment 4.2.11: Reformulated statement: "As presented in the paper Tate (2012), SoVI scores were used in the form of standard deviations (z-scores) or quintiles to emphasize their relative value." All other comments of section 4.2 and 4.3 have been addressed in accordance to the suggestions. Some important changes are: **Comment 4.3.12:** Reformulated statement: "In this study, the building description and data from Census 2011 were used to develop the exposure model without considering the industrial or commercial buildings. In other words, only residential buildings were considered for the exposure model. The exposure models used in the study are part of seismic risk assessment with uncertainties, although present studies like Kalakonas et al. (2020) and Gomez Zapata et al. (2022) have pointed how the epistemic uncertainties embedded in exposure models are propagated throughout the computation of seismic risk. We have considered five types of residential buildings —……" It is also mentioned in "Discussion" section that "The authors are aware of the fact that numerous estimations such as casualties, non-structural damage, business interruption loss, and loss to critical infrastructure may improve the indicator of physical risk. However, only economic losses to buildings were utilized in this study as an initiation for this type of research for Nepal." **Comment 4.3.15:** Fragility Function has also been added:

[1] Yogamalar, I., & Samuel, A. A. (2018). Classification of shared values for educational research. *International Journal of Human Resource Studies*, *8*(2), 47. DOI: 10.5296/ijhrs.v8i2.12818

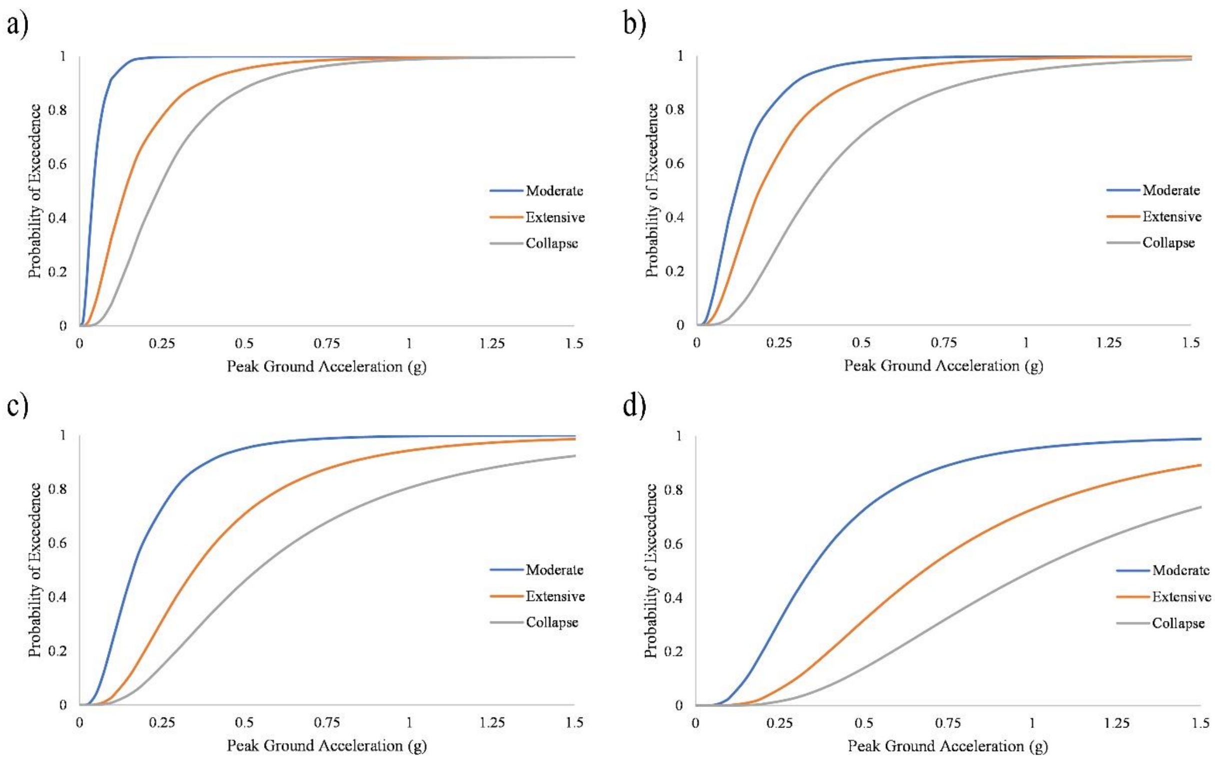

Figure: Fragility curves for a) adobe b) mud mortar c) cement bonded d) wooden buildings

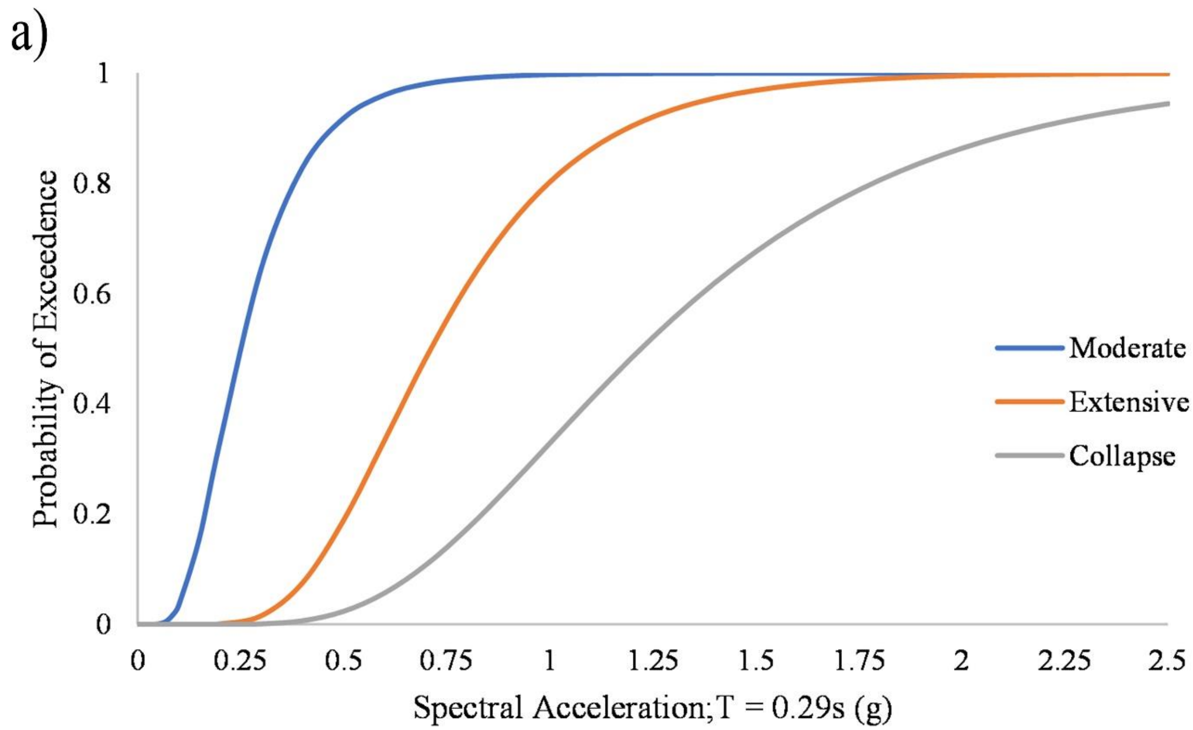

Figure: Fragility curves for RCC buildings

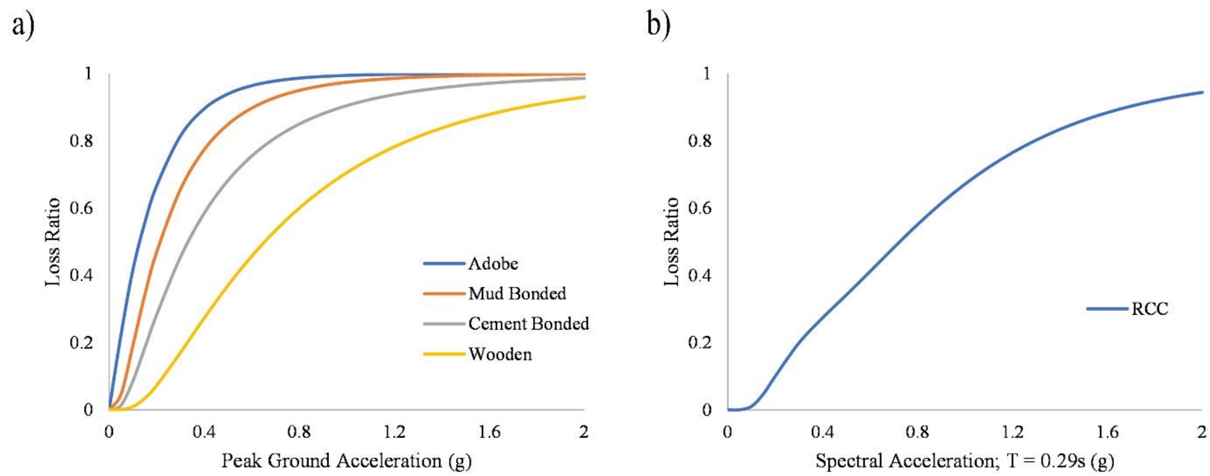

Figure: Vulnerability curves a) adobe, mud mortar, cement bonded, and wooden buildings b) RCC buildings

<u>Comment 4.4</u>: The section Integrated Risk Assessment has been reformulated as: “A total risk index was constructed by combining the social vulnerability index and estimates of average annual loss in rescaled metrics. The framework or workflow of the integrated risk assessment is shown in Figure 5. The first step in Figure 5, seismic hazard, was evaluated using the Probabilistic approach. The geographic features represent exposure modelling for residential buildings and their physical vulnerability. Combining these parameters, seismic risks were evaluated in terms of Average Annual Loss (AAL) which was further recomputed by using the Min-Max rescaling method. The physical vulnerability and exposure model interacts with the social and economic parameters or overall capacity of the population to sustain hazards (Burton and Silva, 2016). The social features define socio-economic parameters related to the demographic population to prepare for, react to, and recuperate from damaging events (Burton and Silva, 2016). The integrated risk is the combination of physical risk and a set of contextual and social vulnerability conditions (Carreño et al., 2012). In this regard, the paper evaluates the integrated risk grounded on direct factors or physical risk and socio-economic factors.”

Results, Discussions, and Conclusions

We have reorganized results sections with different titles as mentioned above. A new section “Discussion” has also been added. The figures and results without further elaboration have been included in “Results” section whereas, the explanation, limitations, and suggestions have been included in “Discussion” section. Similarly, we have also modified “Conclusions” section as per the comments.

Figures:

Addressing Comment 4.2.5 (Figure1), 4.3.8 (Figure 3), 4.3.17 (Figure 4), C_7 (Figure 6), following changes are made.

- "_" are removed on legends.
- Borders of India and China are added.
- The font size of coordinates is reduced.
- Historical Earthquake data are added in figure 4.
- Numbers are made consecutive in figure 4.
- Captions are changed as per suggestions.

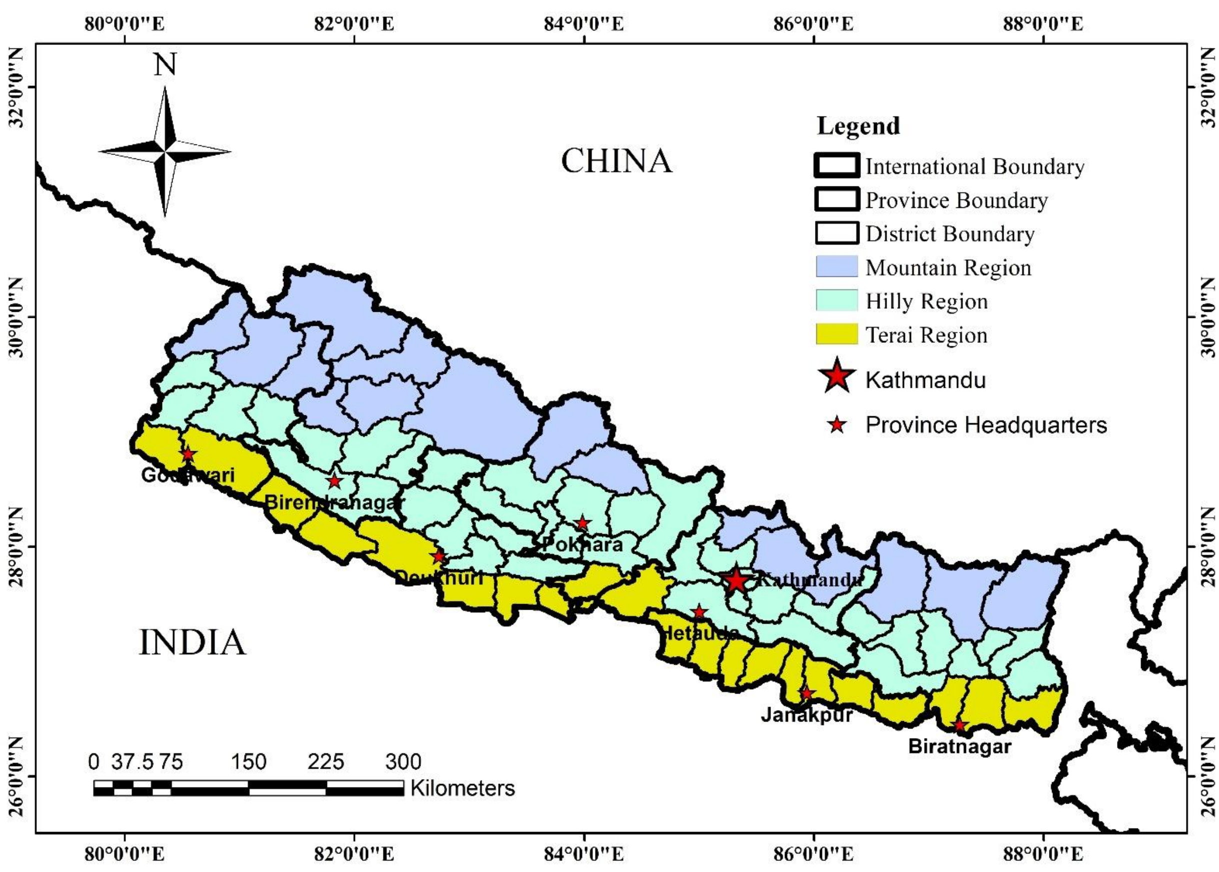

Figure 1: Administrative Map of Nepal showing 3983 VDCs and municipalities, 75 districts, seven provinces with their headquarters, and three geographical regions

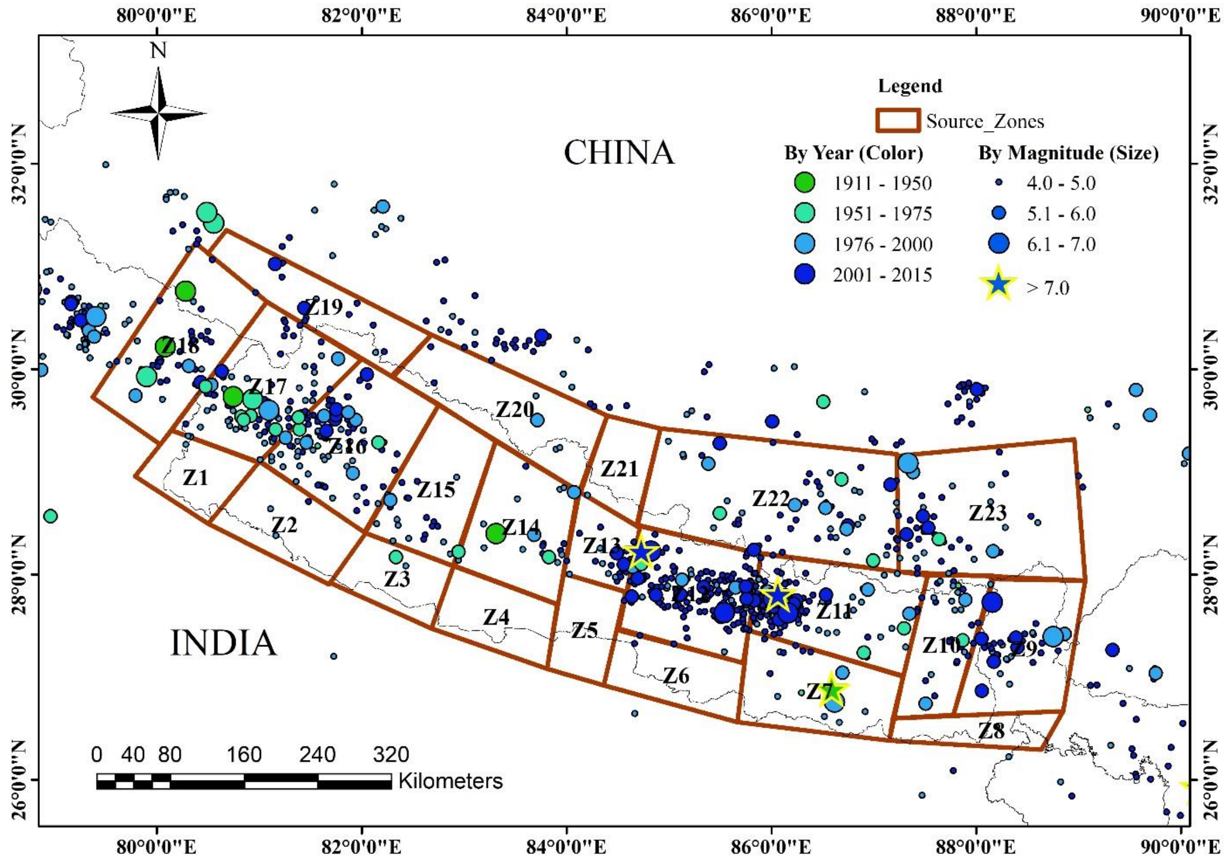

Figure 2: Seismic Source Zones along with spatial distribution of earthquakes in Nepal (Thapa and Guoxin, 2013).

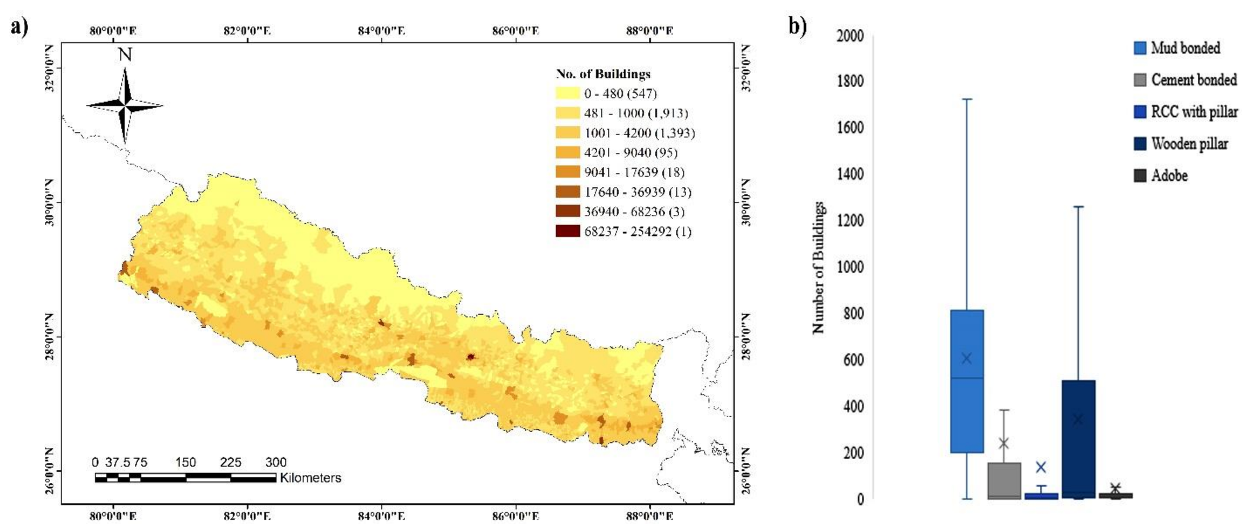

Figure 3: a) Spatial distribution of total buildings in Nepal b) Box and Whisker plot describing the distribution of each building types

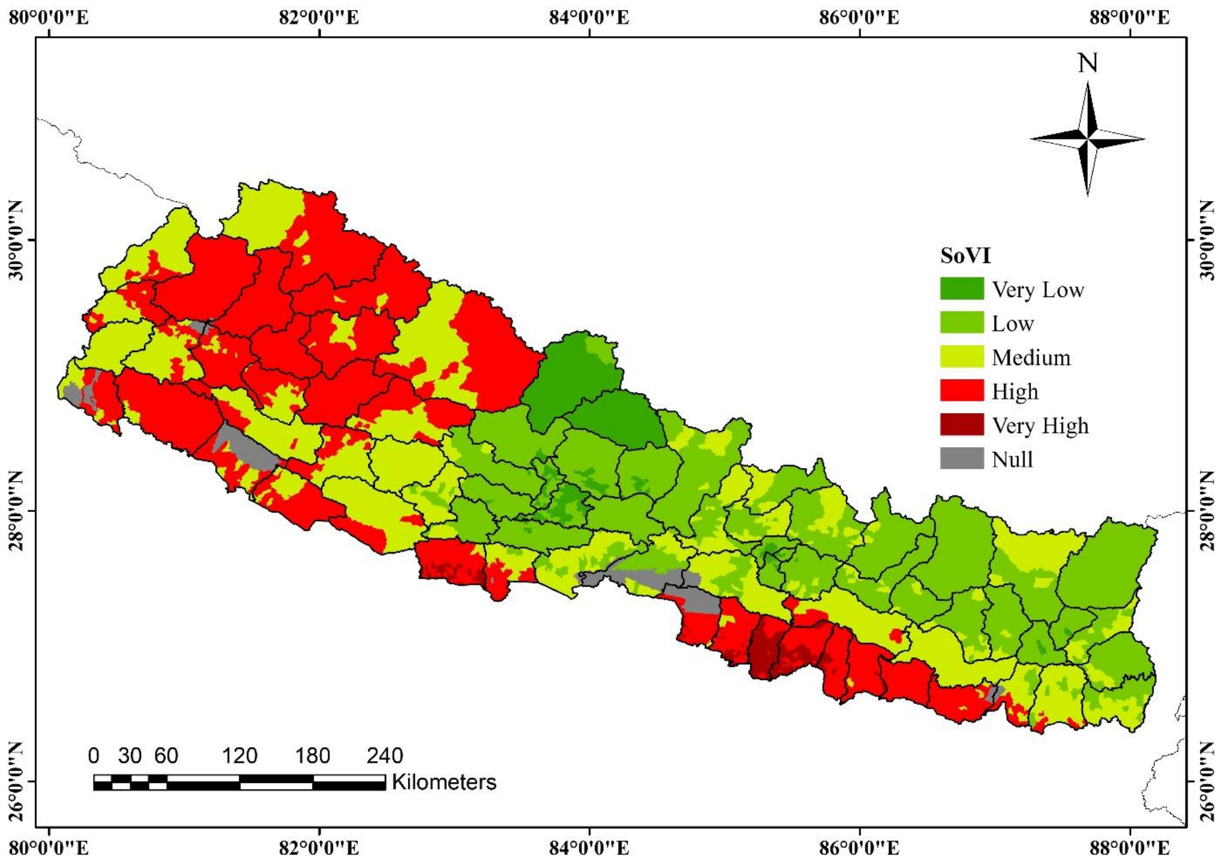

Figure 4: Spatial distribution of Social Vulnerability Index in districts and VDCs of Nepal.

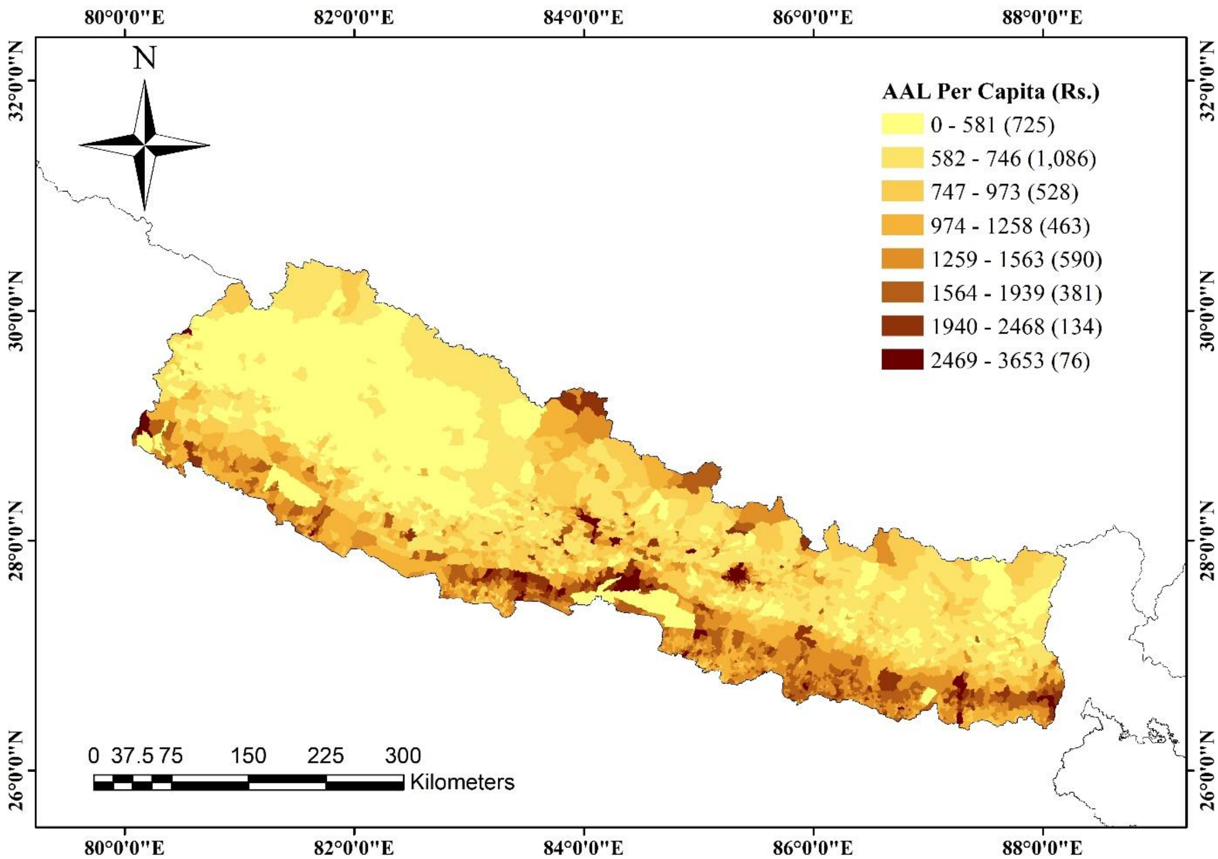

Figure 5: Average Annual Loss per capita, as calculated from OpenQuake, for Nepal.

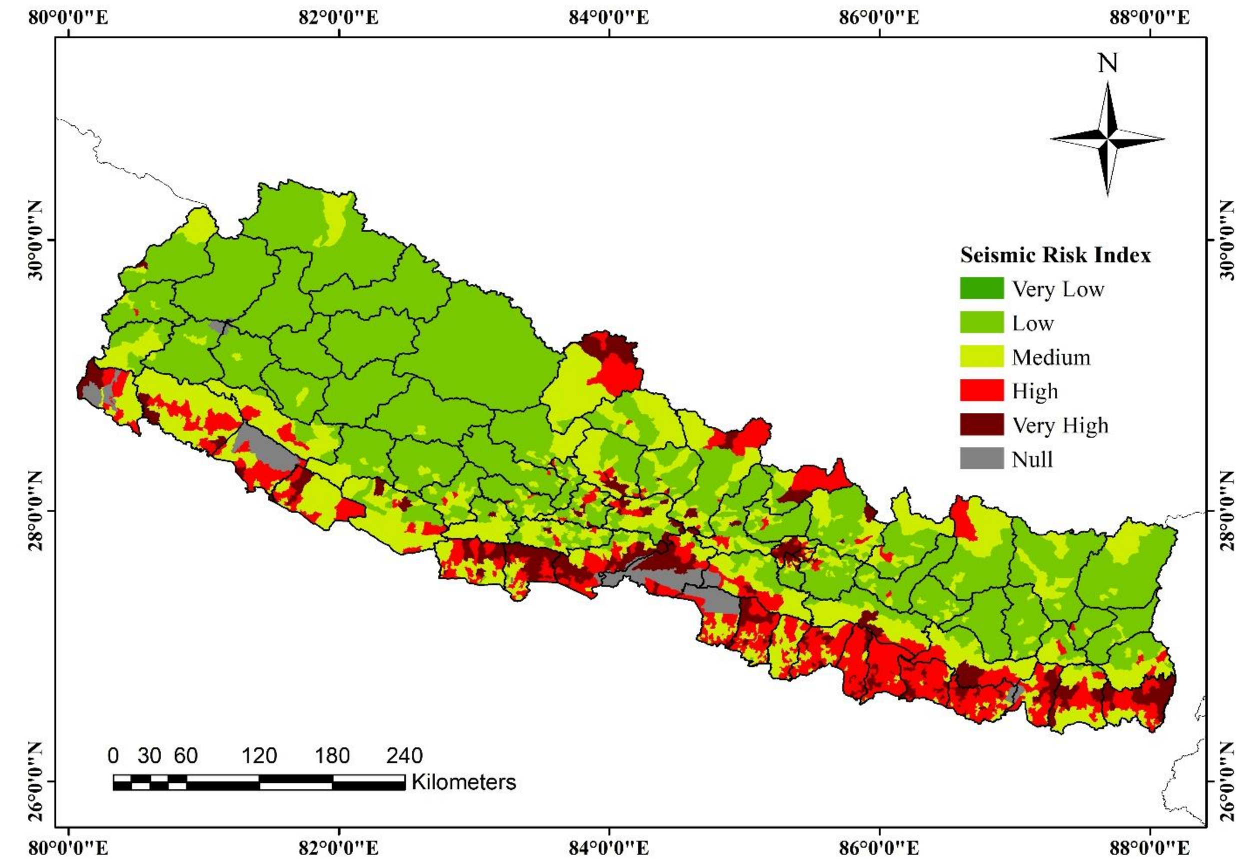

Figure 6: Spatial distribution of Seismic Risk Index in Nepal.

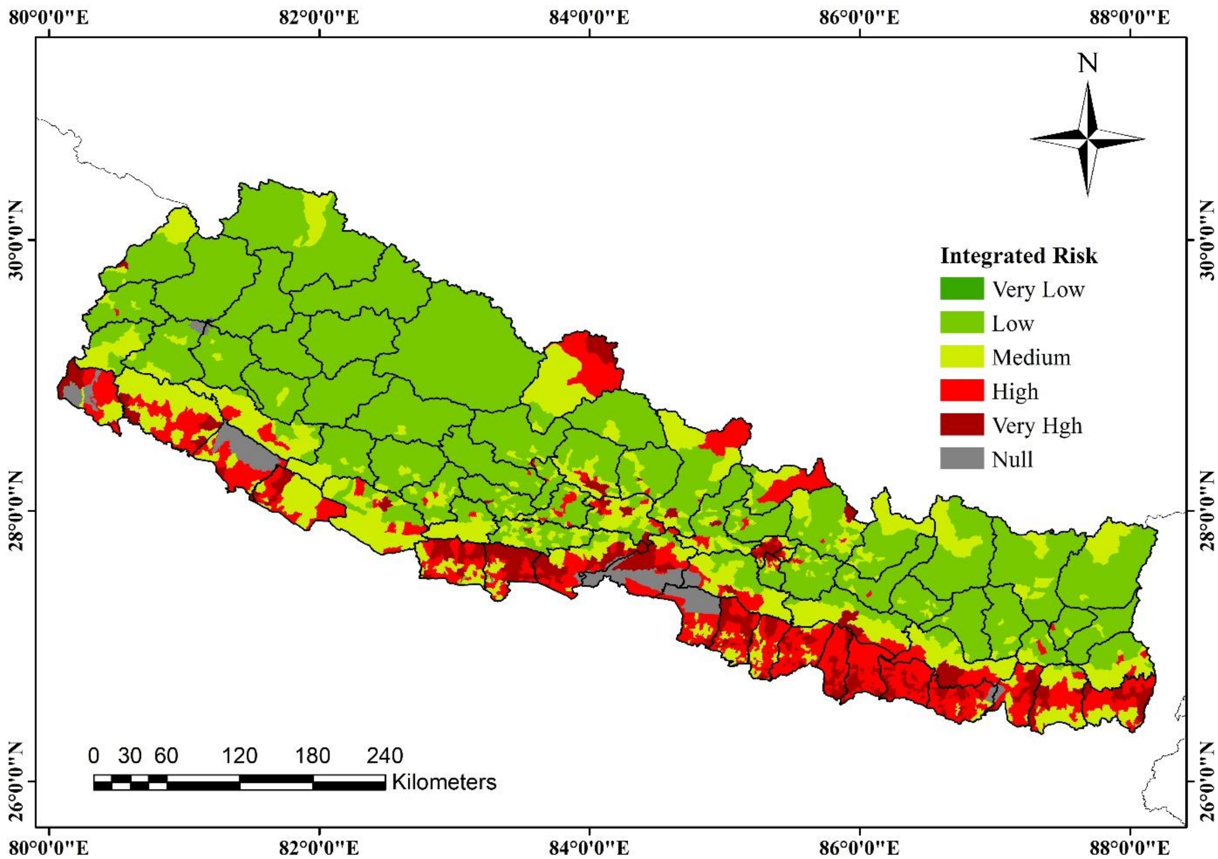

Figure 7: Spatial distribution of Integrated Risk Index in districts and VDCs of Nepal.

References

Abdi, H. and Williams, L. J.: Principal component analysis, 2, 433–459, https://doi.org/10.1002/wics.101, 2010.

Aksha, S. K., Juran, L., Resler, L. M., and Zhang, Y.: An Analysis of Social Vulnerability to Natural Hazards in Nepal Using a Modified Social Vulnerability Index, 10, 103–116, https://doi.org/10.1007/s13753-018-0192-7, 2019.

Alizadeh, M., Alizadeh, E., Asadollahpour Kotenaee, S., Shahabi, H., Beiranvand Pour, A., Panahi, M., bin Ahmad, B., and Saro, L.: Social Vulnerability Assessment Using Artificial Neural Network (ANN) Model for Earthquake Hazard in Tabriz City, Iran, Sustainability, 10, 3376, https://doi.org/10.3390/su10103376, 2018.

Anagnos, T. and Kiremidjian, A. S.: A review of earthquake occurrence models for seismic hazard analysis, 3, 3–11, https://doi.org/10.1016/0266-8920(88)90002-1, 1988.

Atkinson, G. M. and Boore, D. M.: Empirical Ground-Motion Relations for Subduction-Zone Earthquakes and Their Application to Cascadia and Other Regions, 93, 1703–1729, https://doi.org/10.1785/0120020156, 2003.

Boore, D. M. and Atkinson, G. M.: Ground-Motion Prediction Equations for the Average Horizontal Component of PGA, PGV, and 5%-Damped PSA at Spectral Periods between 0.01 *s* and 10.0 *s*, 24, 99–138, https://doi.org/10.1193/1.2830434, 2008.

Borden, K. A., Schmidtlein, M. C., Emrich, C. T., Piegorsch, W. W., and Cutter, S. L.: Vulnerability of U.S. Cities to Environmental Hazards, 4, https://doi.org/10.2202/1547-7355.1279, 2007.

Burby, R. J., Steinberg, L. J., and Basolo, V.: The tenure trap: The vulnerability of renters to joint natural and technological disasters, 39, 32–58, https://doi.org/10.1177/1078087403253053, 2003.

Burton, C. G. and Silva, V.: Assessing Integrated Earthquake Risk in OpenQuake with an Application to Mainland Portugal, 32, 1383–1403, https://doi.org/10.1193/120814EQS209M, 2016.

Campbell, K. W. and Bozorgnia, Y.: NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 *s*, 24, 139–171, https://doi.org/10.1193/1.2857546, 2008.

Carreño, M. L., Cardona, O. D., and Barbat, A. H.: New methodology for urban seismic risk assessment from a holistic perspective, 10, 547–565, https://doi.org/10.1007/s10518-011-9302-2, 2012.

Cattell, R. B.: The Scree Test For The Number Of Factors, 1, 245–276, https://doi.org/10.1207/s15327906mbr0102_10, 1966.

Central Bureau of Statistic (CBS): National Population and Housing Census 2011 (National Report), 2012.

Central Bureau of Statistic (CBS): Population Monograph of Nepal Volume I (Population Dynamics), 2014a.

Central Bureau of Statistic (CBS): Population Monograph of Nepal Volume III (Economical Demography), 2014b.

Chaulagain, H., Rodrigues, H., Silva, V., Spacone, E., and Varum, H.: Seismic risk assessment and hazard mapping in Nepal, 78, 583–602, https://doi.org/10.1007/s11069-015-1734-6, 2015.

Chaulagain, H., Rodrigues, H., Silva, V., Spacone, E., and Varum, H.: Earthquake loss estimation for the Kathmandu Valley, 14, 59–88, https://doi.org/10.1007/s10518-015-9811-5, 2016.

Chiou, B.-J. and Youngs, R. R.: An NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra, 24, 173–215, https://doi.org/10.1193/1.2894832, 2008.

Cornell, C. A.: Engineering seismic risk analysis, 58, 1583–1606, https://doi.org/10.1785/BSSA0580051583, 1968.

Cota, A. A., Longman, R. S., Holden, R. R., Fekken, G. C., and Xinaris, S.: Interpolating 95Th Percentile Eigenvalues from Random Data: An Empirical Example, 53, 585–596, https://doi.org/10.1177/0013164493053003001, 1993.

Cutter, S. L. and Finch, C.: Temporal and Spatial Changes in Social Vulnerability to Natural Hazards, in: Planning for Climate Change, vol. 105, Routledge, 129–137, https://doi.org/10.4324/9781351201117-16, 2018.

Cutter, S. L., Boruff, B. J., and Shirley, W. L.: Social Vulnerability to Environmental Hazards, 84, 242–261, https://doi.org/10.1111/1540-6237.8402002, 2003.

Department of Health Services: Annual Report Department of Health Services 2070/71 (2013/2014), 2013.

Dixit, A.: Floods and Vulnerability: Need to Rethink Flood Management, in: Flood Problem and Management in South Asia, Springer Netherlands, Dordrecht, 155–179, https://doi.org/10.1007/978-94-017-0137-2_8, 2003.

Fang, C., Spencer Jr, B. F., Xu, J., Tan, P., and Zhou, F.: Optimization of damped outrigger systems subject to stochastic excitation, 191, 280–291, 2019.

Fekete, A.: Validation of a social vulnerability index in context to river-floods in Germany, 9, 393–403, https://doi.org/10.5194/nhess-9-393-2009, 2009.

Fernandez, J., Mattingly, S., Bendimerad, F., and Cardona, O. D.: Application of indicators in urban and megacities disaster risk management: a case study of metro Manila, Earthquakes and Megacities Initiative (EMI), 2006.

Franklin, S.: Science as Culture, Cultures of Science, 24, 163–184, https://doi.org/10.1146/annurev.an.24.100195.001115, 1995.

Frigerio, I., Ventura, S., Strigaro, D., Mattavelli, M., de Amicis, M., Mugnano, S., and Boffi, M.: A GIS-based approach to identify the spatial variability of social vulnerability to seismic hazard in Italy, 74, 12–22, https://doi.org/10.1016/j.apgeog.2016.06.014, 2016.

Gautam, D.: Assessment of social vulnerability to natural hazards in Nepal, 17, 2313–2320, https://doi.org/10.5194/nhess-17-2313-2017, 2017.

Glorfeld, L. W.: An Improvement on Horn's Parallel Analysis Methodology for Selecting the Correct Number of Factors to Retain, 55, 377–393, https://doi.org/10.1177/0013164495055003002, 1995.

Gómez Zapata, J. C., Pittore, M., Cotton, F., Lilienkamp, H., Shinde, S., Aguirre, P., and Santa María, H.: Epistemic uncertainty of probabilistic building exposure compositions in scenario-based earthquake loss models, 20, 2401–2438, https://doi.org/10.1007/s10518-021-01312-9, 2022.

Government of Nepal National Planning Commission and UNDP: Nepal Human Development Report 2014, 2014.

Guo, X. and Kapucu, N.: Assessing social vulnerability to earthquake disaster using rough analytic hierarchy process method: A case study of Hanzhong City, China, 125, 104625, https://doi.org/10.1016/j.ssci.2020.104625, 2020.

Hewitt, K.: Preventable disasters. Addressing social vulnerability, institutional risk and civil ethics, 3, 43–52, 2007.

Horn, J. L.: A rationale and test for the number of factors in factor analysis, Psychometrika, 30, 179–185, https://doi.org/10.1007/BF02289447, 1965.

Humphreys, L. G. and Montanelli Jr., R. G.: An Investigation of the Parallel Analysis Criterion for Determining the Number of Common Factors, 10, 193–205, https://doi.org/10.1207/s15327906mbr1002_5, 1975.

IBM Support: Kaiser-Meyer-Olkin measure for identity correlation matrix, https://www.ibm.com/support/pages/kaiser-meyer-olkin-measure-identity-correlation-matrix, 2020.

Jolliffe, I. T.: Principal Component Analysis, Second., Springer, 2002.

Kaiser, H. F.: The Application of Electronic Computers to Factor Analysis, 20, 141–151, https://doi.org/10.1177/001316446002000116, 1960.

Kaiser, H. F.: A second generation little jiffy, Psychometrika, 35, 401–415, https://doi.org/10.1007/BF02291817, 1970.

Kalakonas, P., Silva, V., Mouyiannou, A., and Rao, A.: Exploring the impact of epistemic uncertainty on a regional probabilistic seismic risk assessment model, 104, 997–1020, https://doi.org/10.1007/s11069-020-04201-7, 2020.

Khazai, B. and Bendimerad, F.: Risk and resiliency indicators, 3, 2011.

Mainali, J. and Pricope, N. G.: Mapping the need for adaptation: assessing drought vulnerability using the livelihood vulnerability index approach in a mid-hill region of Nepal, 11, 607–622, https://doi.org/10.1080/17565529.2018.1521329, 2019.

Malakar, Y.: Community-Based Rainfall Observation for Landslide Monitoring in Western Nepal, in: Landslide Science for a Safer Geoenvironment, Springer International Publishing, Cham, 757–763, https://doi.org/10.1007/978-3-319-05050-8_117, 2014.

Martins, L., Silva, V., Crowley, H., and Cavalieri, F.: Vulnerability modellers toolkit, an open-source platform for vulnerability analysis, 19, 5691–5709, https://doi.org/10.1007/s10518-021-01187-w, 2021.

Mileti, D.: Disasters by Design: A reassessment of natural hazards in the United States, Joseph Henry Press, Washington, D.C., https://doi.org/10.17226/5782, 1999.

Mishra, S. R., Khanal, P., Karki, D. K., Kallestrup, P., and Enemark, U.: National health insurance policy in Nepal: challenges for implementation, 8, 28763, https://doi.org/10.3402/gha.v8.28763, 2015.

Mori, T., Shigefuji, M., Bijukchhen, S., Kanno, T., and Takai, N.: Ground motion prediction equation for the Kathmandu Valley, Nepal based on strong motion records during the 2015 Gorkha Nepal earthquake sequence, 135, 106208, https://doi.org/10.1016/j.soildyn.2020.106208, 2020.

Pachauri, R. K., Allen, M. R., Barros, V. R., Broome, J., Cramer, W., Christ, R., Church, J. A., Clarke, L., Dahe, Q., and Dasgupta, P.: Climate change 2014: synthesis report. Contribution of Working Groups I, II and III to the fifth assessment report of the Intergovernmental Panel on Climate Change, Ipcc, 2014.

Pagani, M., Monelli, D., Weatherill, G., Danciu, L., Crowley, H., Silva, V., Henshaw, P., Butler, L., Nastasi, M., Panzeri, L., Simionato, M., and Vigano, D.: OpenQuake Engine: An Open Hazard (and Risk) Software for the Global Earthquake Model, 85, 692–702, https://doi.org/10.1785/0220130087, 2014.

Pandey, M. R., Tandukar, R. P., Avouac, J. P., Vergne, J., and Héritier, T.: Seismotectonics of the Nepal Himalaya from a local seismic network, 17, 703–712, https://doi.org/10.1016/S1367-9120(99)00034-6, 1999.

Pandey, M. R., Chitrakar, G. R., Kafle, B., Sapkota, S. N., Rajaure, S. N., and Gautam, U. P.: Seismic hazard map of Nepal, 2002.

Pherali, T.: Education: Cultural Reproduction, Revolution and Peacebuilding in Conflict-Affected Societies, in: The Palgrave Handbook of Disciplinary and Regional Approaches to Peace, Palgrave Macmillan UK, London, 193–205, https://doi.org/10.1007/978-1-137-40761-0_15, 2016.

Rahman, N., Ansary, M. A., and Islam, I.: GIS based mapping of vulnerability to earthquake and fire hazard in Dhaka city, Bangladesh, 13, 291–300, https://doi.org/10.1016/j.ijdrr.2015.07.003, 2015.

Ramadan, O. M. O., Mehanny, S. S. F., and Mostafa, A.: Revisiting the 5% accidental eccentricity provision in seismic design codes for multi-story buildings, in: Proceedings of the 14th World Conference Earthquake Engineering, 2008.

Schiappapietra, E. and Douglas, J.: Modelling the spatial correlation of earthquake ground motion: Insights from the literature, data from the 2016–2017 Central Italy earthquake sequence and ground-motion simulations, 203, 103139, https://doi.org/10.1016/j.earscirev.2020.103139, 2020.

Schmidtlein, M. C., Shafer, J. M., Berry, M., and Cutter, S. L.: Modeled earthquake losses and social vulnerability in Charleston, South Carolina, 31, 269–281, https://doi.org/10.1016/j.apgeog.2010.06.001, 2011.

Sharma, P., Guha-Khasnobis, B., and Khanal, D. R.: Nepal human development report 2014, 2014.

Shrestha, A.: Vulnerability assessment of weather disasters in Syangja District, Nepal: A case study in Putalibazaar Municipality, 2005.

Stevens, V. L., Shrestha, S. N., and Maharjan, D. K.: Probabilistic Seismic Hazard Assessment of Nepal, 108, 3488–3510, https://doi.org/10.1785/0120180022, 2018.

Tate, E.: Social vulnerability indices: a comparative assessment using uncertainty and sensitivity analysis, 63, 325–347, https://doi.org/10.1007/s11069-012-0152-2, 2012.

Thapa, D. R. and Guoxin, W.: Probabilistic seismic hazard analysis in Nepal, 12, 577–586, https://doi.org/10.1007/s11803-013-0191-z, 2013.

Thompson, B. and Daniel, L. G.: Factor Analytic Evidence for the Construct Validity of Scores: A Historical Overview and Some Guidelines, 56, 197–208, https://doi.org/10.1177/0013164496056002001, 1996.

Ulak, N.: Nepal's Earthquake-2015: Its Impact on Various Sectors, 7, 58–86, https://doi.org/10.3126/gaze.v7i0.15120, 2016.

UNISDR, U.: Terminology on disaster risk reduction, 2009.

Velicer, W. F., Eaton, C. A., and Fava, J. L.: Construct Explication through Factor or Component Analysis: A Review and Evaluation of Alternative Procedures for Determining the Number of Factors or Components, in: Problems and Solutions in Human Assessment, Springer US, Boston, MA, 41–71, https://doi.org/10.1007/978-1-4615-4397-8_3, 2000.

Vivek, P., Singh, S. N., Mishra, S., and Donavan, D. T.: Parallel Analysis Engine to Aid in Determining Number of Factors to Retain using R, 2017.

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, 13, 957–981, https://doi.org/10.1007/s10518-015-9730-5, 2015.

Youngs, R. R., Chiou, S.-J., Silva, W. J., and Humphrey, J. R.: Strong Ground Motion Attenuation Relationships for Subduction Zone Earthquakes, 68, 58–73, https://doi.org/10.1785/gssrl.68.1.58, 1997.

Zwick, W. R. and Velicer, W. F.: Comparison of five rules for determining the number of components to retain., 99, 432–442, https://doi.org/10.1037/0033-2909.99.3.432, 1986.