

PROBLEMS AND POSSIBLE SOLUTIONS OF POST-DISASTER HOUSING RECONSTRUCTION PROJECTS IN INDIA

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Abstract. Natural disasters occur often around the globe and result in significant loss of life and property. Over the last two decades, there has been a remarkable rise in extreme weather events that have the potential to wreak devastation on the planet. Frequently, disaster-affected regions needed to enhance their capacity for rebuilding, requiring more experienced and competent personnel to oversee the projects. Post-disaster reconstruction (PDR) is a complicated and difficult procedure requiring a variety of distinct and well-coordinated actions. The purpose of this research is to examine the effect of disasters, analyse the problems associated with post-disaster housing reconstruction projects in India, and provide potential solutions. A standardised questionnaire was used to gather data from a purposeful sample as part of a quantitative methodology. The analysed data reveal that institutional procedures, rebuilding techniques, project execution, and stakeholder management all contribute to the effective implementation of post-disaster home reconstruction projects.

Keywords: *Impact of disaster, Indian disasters, natural disaster, post-disaster housing reconstruction.*

INTRODUCTION

Over the last twenty years, 7348 disaster events have been recorded worldwide by EM-DAT, one of the foremost international databases of such events. In total, disasters claimed approximately 1.23 million lives, an average of 60 000 per annum, and affected over 4 billion people (many on more than one occasion). Additionally, disasters led to approximately US\$ 2.97 trillion in economic losses worldwide (Human Cost of Disasters, 2020).

Problems with post-disaster home reconstruction in developing nations have been widely explored. However, there have been few researches on long-term rehabilitation strategies initiated immediately after catastrophes for every vulnerable home. To contribute to the implementation of better reconstruction policies for developing countries, we must focus on vulnerable rural communities and understand the process of residential status transition (i.e. the type of dwellings they occupy) after a disaster, as well as the factors that influence this transition (Kotani, Honda, Imoto, Shakya, & Shrestha, 2020). Given that the building industry uses more raw materials than any other economic sector, the growing pressure on it to function more sustainably is expected; the same is true for reconstruction. In

the end, the extraction of these natural resources, the fabrication of regularly used construction materials, and the impact of the resulting buildings have a devastating effect on the environment. Therefore, it is necessary to use advanced and innovative composite materials for construction that are cost-effective and environmentally friendly (Sanchaniya et. al., 2022a; 2022b; 2022c).

Post-disaster reconstruction (PDR) is one of four recognisable post-disaster phases, including emergency, restoration, rebuilding, and improvement construction. Post-disaster restoration initiatives often face unpredictability (Hayles, 2010; Sun & Xu, 2011) and complexity. (Bello, 2006; Boano & García, 2011) consider one of the most challenging tasks to be dealt with those involved in reconstruction of disaster-affected areas. Despite the relief support from agencies, government, and NGOs on post-disaster development, the number of effectively completed rehabilitation projects has remained low.

The objectives of this research are to investigate the effects of disasters, examine the problems associated with post-disaster housing reconstruction projects, and provide potential solutions. We surveyed 100 specialists – engineers who worked on prior post-disaster house restoration projects – via interviews. In the poll, we inquired about issues that may arise during the rebuilding of homes after a natural catastrophe, and we provide potential solutions to these issues.

The remaining sections of this work are structured as follows: Section 2 covers the literature evaluation and Section 3 gives an overview of the study methodology, data analysis, and findings.

1. LITERATURE REVIEW

1.1. Impact of Disaster

The effects of NDs are categorized as (a) direct and indirect consequences and (b) short-term and long-term implications (Cavallo & Noy, 2011). Direct effects include direct losses such as life and property devastation. Long-term indirect effects include decreased productivity and consumption (Cavallo & Noy, 2011). In addition, the literature separates direct market loss (damages to those goods whose price can be ascertained in the market) (Sangha et al., 2020) and non-market loss (like loss of life and destruction of protected sites, among others) (Rogers et al., 2019). Several years of slower economic development are among the long-term consequences of ND (Botzen et al., 2019; Sanchaniya & Geipele, 2021). The magnitude of loss relies on the susceptibility of individual families and the capacity of local and national agencies to mitigate the effects (Eriksen et al., 2021).

Developing nations with a low per capita income are especially susceptible, since they are home to a disproportionate share of the world's impoverished and have insufficient social safety nets and infrastructure (Yoon, 2012). Within such places, the most vulnerable segments of society are the impoverished and the disadvantaged (Eriksen et al., 2021). The negative impact of NDs on the poor may be minimal in absolute terms when compared to the wealthy, but the impact on the well-being of the poor is sometimes disproportionately greater (Hallegatte & Rozenberg, 2017). Due to NDs, households just over the poverty line are at danger

of falling into poverty, and their return to pre-ND levels might even affect future generations (Skoufias, 2003). If a family encounters many NDs, it may slip into a poverty trap or be forced to relocate as an environmental refugee (Bates, 2002).

Our research focuses on India, a nation that is geographically, socially, and economically diverse. Environmental factors play an important role in infrastructure development through structure and housing information (Kalinka et al., 2020). According to the National Disaster Management Authority, 27 (of the 32) states are susceptible to NDs (NIDM, 2019). According to the same assessment, around 12 % of the landmass is vulnerable to flooding, but droughts endanger 68 % of the cultivable area. In rural regions, harsh weather challenges the food security, means of subsistence, and assets of farmers (Lipper et al., 2014). India has been designated as one of the nation's most susceptible to sea-level rise and intensified river floods (Eckstein & Kreft, 2020).

With 223 occurrences, floods dominated these events, surpassing the average of 163 yearly flood occurrences observed between 2001 and 2020. During India's monsoon season (June to September), a series of devastating floods killed 1282 lives (Centre for Research on the Epidemiology of Disasters, 2021).

1.2. Post-Disaster Housing Reconstruction

In developing nations, post-disaster housing situations intensively examined. Some researchers addressed the provision of temporary shelters shortly after natural catastrophes (Anhorn & Khazai, 2015; Ansary et al., 2010) and the planning for temporary housing after disasters (Johnson, 2007; Félix et al., 2013). Other researchers, however, examined the crucial success aspects of home rebuilding projects during the pre-construction phase (Sospeter et al., 2020). Others emphasised the difficulties of efficient resource management (Chang et al., 2010) and the roles of guidelines (Ahmed, 2011), participatory planning (Davidson et al., 2007; Ganapati & Ganapati, 2009; Kitzbichler, 2011; Tauber, 2015), cooperation among participants (Rahmayati, 2016), governance (Guarnacci, 2012), and construction training (Opdyke et al., 2018) in the permanent housing reconstruction process, as well as proposed practice measures for managing permanent housing reconstruction.

In reconstruction efforts conducted in a paternalistic, philanthropic way or with a community-based approach as a means of attaining long-term sustainability after a natural catastrophe, community plays an important role in planning and development process (Geipele & Auziņš, 2015; Geipele et al., 2021; Puķīte & Geipele, 2017). The Centre for Research on the Epidemiology of Disasters (CRED) in Brussels, Belgium, reports that India is the most impacted nation in South Asia. According to CRED estimates, between 1987 and 1996, catastrophes in India killed 5063 people and impacted 56 563 631 people annually (Jones et al., 2014).

Natural disasters inflict harm to the built environment. The massive devastation of houses and infrastructure is followed by deaths and injuries, the loss of economic sources, and stagnant or reversing local economies. Housing is the most valued social and economic asset and a crucial component of catastrophe loss, especially

in developing nations where disaster-affected populations are susceptible to homelessness and severe humanitarian situations (Jones et al., 2014).

Due to the relevance of post-disaster rebuilding to humanitarian and international development issues, substantial funds from a variety of sources are devoted to it, with a sizeable portion earmarked for permanent housing reconstruction (PHR). PHR is an excellent way of providing safety and security, restoring dignity, and enhancing livelihood circumstances for impacted and/or displaced populations, therefore alleviating their suffering (Yumarni & Amaratunga, 2017). It often follows the provision of emergency shelter, interim shelter, and transitional housing.

After a catastrophe, housing restoration involves the building of new dwellings in addition to the replacement of damaged or destroyed housing stock (Jones et al., 2014). The phases of post-disaster rebuilding are shown in Fig. 1. To support the quick production of safe, habitable, and acceptable disaster-resilient housing and community recovery, there must be an integrated strategy and a coordinated chain of activities and stakeholders in the chaotic, dynamic, and complex reconstruction environment (Sanchaniya et al., 2022; Yumarni & Amaratunga, 2017).

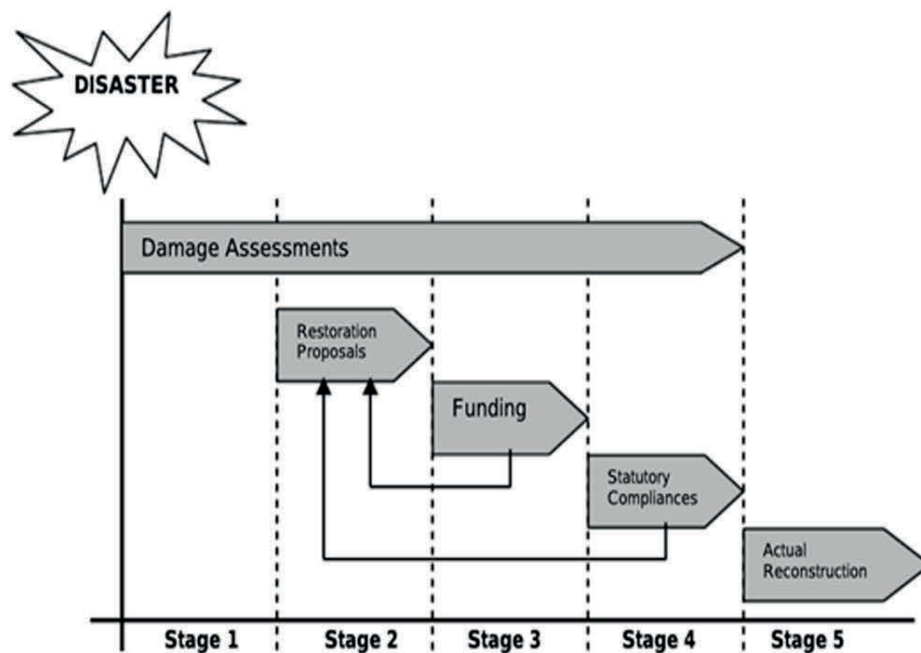


Fig. 1. Post-disaster housing reconstruction process (Masurier & Wilkinson, 2014).

From damage/impact assessments to actual rebuilding execution, reconstruction following catastrophes conceptually progresses through five phases of development (Fig. 1) (Masurier & Wilkinson, 2014).

Damage and impact assessment is the first set of duties after the conclusion of search and rescue and evacuation activities during the first emergency phase. At this stage, information is collected on the effects of the disaster on individuals, communities, and the environment, and recovery activities are planned. The

conclusion of the exercise serves as the foundation for future reconstruction efforts, and it may be reviewed and updated to include new knowledge at later stages; therefore, the longer timescale is shown in Fig. 1. Participation of all parties in the restoration process permits the creation of a comprehensive needs assessment report via damage assessments and surveys. Transmission and aggregation of data, as well as the level of participation and planning among all stakeholders, will enhance the success of this endeavour.

Following the requirements analysis, judgments are made on whether to restore, replace, or destroy damaged homes. The restoration plan summarises the estimated rebuilding requirements and is a prerequisite for financing organisations and/or regulatory bodies. The amount of specificity contained in the proposals will enable financing and other approvals. At the local government level, the proposal for restoration may take the form of hazard and risk studies, which may also include mitigating measures against recurrence. Funds may raise privately, through insurance companies, and via external donor agencies or charitable organisations.

When finance arrangements are continuing or complete, the next step is to apply for resource approvals and construction permits. This step is often laborious, since authorising authorities must guarantee that safety standards are not compromised and that all development ideas have a high degree of resilience. This phase is crucial in terms of both setting the scene for the execution of real rebuilding work and the timeline for the reconstruction process. Statutory application and paperwork processes have a history of delaying rehabilitation projects (Bilau et al., 2018) and may be worsened by the absence of skilled designers and processing officials. This period is often marked by the beginning of disillusionment owing to delays, failures, and disappointed aspirations caused by ineffective disaster assistance services (Scurfield, 2006).

The last phase consists of the rebuilding works' actual execution. This is the regeneration phase of the recovery process during which every part of the community and its surroundings (natural, built, social, and economic contexts) are returned to normality.

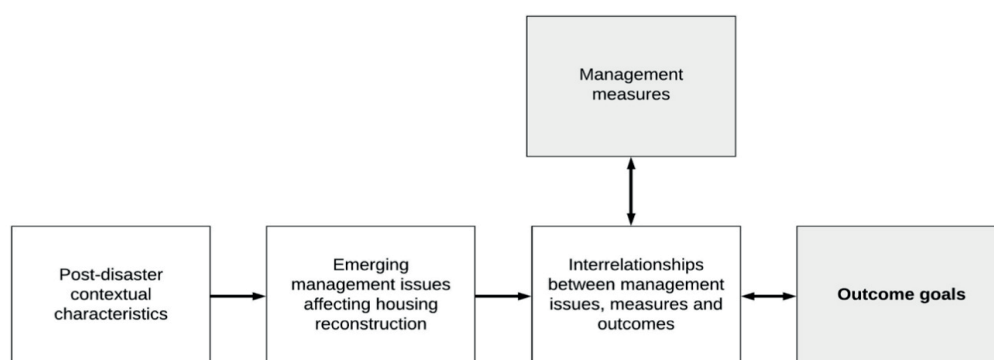


Fig. 2. Conceptual framework for the management of post-disaster housing reconstruction (Bilau et al., 2018).

As depicted in Fig. 2, the framework emphasises the strategic importance of disaster preparedness measures that should be implemented before the next disaster strikes, as well as the cross-cutting nature of capacity building and beneficiary community engagement measures that are essential at all stages of the post-disaster reconstruction process (Jones et al., 2014). The results are limited to developing nations, since practically all of the information is collected from post-disaster housing experiences in developing nations (Bilau et al., 2018).

2. RESEARCH METHODOLOGY

2.1. Research Design

Reviewing the relevant literature, developing a questionnaire, conducting a survey, collecting data, and then testing the hypothesis are the steps in the research process. In this study, the research hypotheses are tested by questionnaire. This study used a sample questionnaire to address the research question. The surveys were sent to respondents through (Google Form) to their company's official email address obtained from the company's website (FMM Directory). Respondents responded to all survey questions by clicking on the email's embedded link, and their responses immediately were recorded on the (Google Form) site. This procedure makes data collecting more efficient and cost- and time-efficient. The survey was carried out in India. In total 100 of the 120 replies gathered were used for analysis.

Using a Likert scale ranging from 1 to 5 (1 = least, 5 = most), respondents were asked to evaluate the impact of each factor on the selection of investment strategies by real estate management organisations.

2.2. Data Analysis

All demographic information was subjected to descriptive analysis to determine the frequency distribution of responders. In addition, it was essential for identifying the characteristics of respondents for analysis. The raw data was transformed into a format that gives information that describes a collection of contextual elements. ANOVA and regression analysis was used to evaluate the hypothesis.

H1: Post-disaster housing rebuilding projects in India have significantly different difficulties in terms of reconstruction. For testing the above hypothesis, the ANOVA test applied.

Table 1. ANOVA Analysis of Difference in Problems Faced in Reconstruction for Post-disaster Housing Reconstruction Projects in India

Parameters	Sum of squares	df	Mean square	<i>F</i>	Sig.
Between groups	3.432	1	1.564	6.754	0.000
Within groups	112.256	118	0.432		
Total	115.688	119			

Table 1 demonstrates that the F value of the ANOVA analysis is 6.754 and $p = 0.000$, which is statistically significant, i.e. less than 0.05 with a 95 % confidence interval. Therefore, the null hypothesis is rejected and it is determined that post-disaster housing rebuilding projects in India confront significantly different issues during reconstruction.

H2: The success of post-disaster housing rebuilding projects in India are significantly impacted by the difficulties encountered in reconstruction. For evaluating the aforementioned hypothesis, regression used.

Table 2. Model Summary

Model	R	R square	Adjusted R square	Std. error
1	0.867 ^a	0.743	0.712	0.67871
a. Predictors: (Constant), problems faced in reconstruction				

Table 3. ANOVA Analysis of Significant Impact of Problems Faced in Reconstruction for Post-disaster Housing Reconstruction Projects in India on its Performance

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	521.343	1	511.212	131.331	0.000 ^b
	Residual	187.625	118	0.432		
	Total	708.968	119			
a. Dependent Variable: Performance						
b. Predictors: (Constant), problems faced in reconstruction						

Table 4. Regression Analysis of Significant Impact of Problems Faced in Reconstruction for Post-disaster Housing Reconstruction Projects in India on its Performance

Model		Standardized coefficients	t	Sig.
		Beta		
1	Problems faced in reconstruction	0.342	15.32	0.000

From the preceding table, it can be observed that difficulties encountered during rebuilding have a substantial influence on the performance of post-disaster housing reconstruction projects in India, since the p value is 0.000, which is less than 0.05 with a 95 % confidence interval.

CONCLUSIONS

The results indicate that institutional procedures, rebuilding techniques, project execution, and stakeholder management all contribute to the effective implementation of housing projects. However, the inquiry revealed that these success factors are not considered during rebuilding.

This study might contribute to our understanding of catastrophe project management. CSFs for PDR projects were generally reduced into various project management aspects. Such a categorization, which is often used for post-disaster projects, offers huge potential for the effective restoration of damaged infrastructure. With the establishment of CSFs, key players in post-disaster home reconstruction projects must be cognizant of the variables and ensure that they are monitored throughout the reconstruction process.

Frequently, external groups misjudge the capabilities of the affected community and assume they know what is best for them. The community is the greatest judge of what is best for them and what they need. Therefore, it is exceedingly improbable that a rebuilding project will be successful if the community is not included from the outset.

The CPHRP necessitates extensive collaboration between external authorities and the affected community. Without mutual trust amongst all parties participating in the rehabilitation process, the program's effectiveness is unlikely.

The success or failure of the home rebuilding programme will depend on the facilitator's skill. The facilitator engages with the community and is personally engaged in the house restoration project.

It is also logical that during a moment of political change, various institutions and systems may not function identically, especially in countries like India that have fought for more than seven decades to maintain a stable governing structure. NRA's budget, coordination, and commitment gaps among stakeholders, lack of public knowledge, incapacity of I/NGO, and lack of local participation and ownership were among the issues noted in the research that should be addressed with sensitivity with a successful NRA policy.

Some issues included crosscutting topics such as difficult topography, domestic shortfalls and incapacities, perceptions of international assistance, affected political commitments, poor housing scheme, labour shortage, lack of experience, cultural negligence, knowledge gap in building construction and materials, loss of livelihood, and the absence of a plan for retrofitting and rehabilitation. Bureaucratic barriers, entrenched interests, and corruption, as well as concentration on the distribution of housing subsidies and the neglect of rehabilitation, are among the several concerns.

Reconstruction has always been a reaction to the social, cultural, and political climate of the period after a disaster. According to worldwide experiences, the challenges related with reconstruction have a broader scope and are entangled in societal fabric. It was also determined that these problems are not just pervasive but are reduced to a handful of issues, such as governance, technological inefficiencies, and the socio-political climate.

Political instability may have contributed to the issue of shifting NRA leadership and weak local administration in India's rehabilitation, but such ineffectiveness in reconstruction is the result of broader contexts. Future research might investigate how various factors mix and contribute to the success of PDR programmes.

REFERENCES

- Ahmed, I. (2011). An overview of post-disaster permanent housing reconstruction in developing countries. *International Journal of Disaster Resilience in the Built Environment*, 2(2), 148–164. <https://doi.org/10.1108/17595901111149141>
- Anhorn, J., & Khazai, B. (2015). Open space suitability analysis for emergency shelter after an earthquake. *Natural Hazards and Earth System Sciences*, 15(4), 789–803. <https://doi.org/10.5194/nhess-15-789-2015>
- Ansary, M. A., Reja, M. Y., & Jahan, I. (2010). Rethinking the public building as post disaster shelters – In the context of old Dhaka. *9th US National and 10th Canadian Conference on Earthquake Engineering 2010, Including Papers from the 4th International Tsunami Symposium*, 6(118), 4215–4224.
- Bates, D. C. (2002). Environmental refugees? Classifying human migrations caused by environmental change. *Population and Environment*, 23, 465–477. <https://doi.org/10.1023/A:1015186001919>
- Bello, W. (2006). The rise of the relief-and-reconstruction complex. *Journal of International Affairs*, 59(2), 281–296.
- Bilau, A. A., Witt, E., & Lill, I. (2018). Practice framework for the management of post-disaster housing reconstruction programmes. *Sustainability (Switzerland)*, 10(11), 18–20. <https://doi.org/10.3390/su10113929>
- Boano, C., & García, M. (2011). Lost in translation? The challenges of an equitable post-disaster reconstruction process: Lessons from Chile. *Environmental Hazards*, 10(3–4), 293–309. <https://doi.org/10.1080/17477891.2011.594493>
- Botzen, W. J. W., Deschenes, O., & Sanders, M. (2019). The economic impacts of natural disasters: A review of models and empirical studies. *Review of Environmental Economics and Policy*, 13(2), 167–188. <https://doi.org/10.1093/reep/rez004>
- Cavallo, E., & Noy, I. (2011). Natural disasters and the economy – A survey. *International Review of Environmental and Resource Economics*, 5(1), 63–102. <https://doi.org/10.1561/101.00000039>
- Centre for Research on the Epidemiology of Disasters. (2021). *Extreme events defining our lives: Executive summary*. OECDiLibrary.
- Chang, Y., Wilkinson, S., Potangaroa, R., & Seville, E. (2010). Resourcing challenges for post-disaster housing reconstruction: A comparative analysis. *Building Research and Information*, 38(3), 247–264. <https://doi.org/10.1080/09613211003693945>
- Davidson, C. H., Johnson, C., Lizarralde, G., Dikmen, N., & Sliwinski, A. (2007). Truths and myths about community participation in post-disaster housing projects. *Habitat International*, 31(1), 100–115. <https://doi.org/10.1016/j.habitatint.2006.08.003>
- Eckstein, D., & Kreft, S. (2020). *Global climate risk index 2021. Who suffers most from extreme weather events?* Germanwatch. <https://www.germanwatch.org/en/crri>
- Eriksen, S., Schipper, E. L. F., Scoville-Simonds, M., Vincent, K., Adam, H. N., Brooks, N., et al. (2021). Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance? *World Development*, 141, Article 105383. <https://doi.org/10.1016/j.worlddev.2020.105383>
- Félix, D., Branco, J. M., & Feio, A. (2013). Temporary housing after disasters: A state of the art survey. *Habitat International*, 40, 136–141. <https://doi.org/10.1016/j.habitatint.2013.03.006>
- Ganapati, N. E., & Ganapati, S. (2009). Enabling participatory planning after disasters. *Journal of the American Planning Association*, 75(1), 41–59. <https://doi.org/10.1080/01944360802546254>

- Geipele, S., & Auziņš, A. (2015). The development of housing sector and residential real estate market after economic recession in Latvia. *Baltic Journal of Real Estate Economics and Construction Management*, 3(1), 103–119. <https://doi.org/10.1515/bjreecm-2015-0011>
- Geipele, S., Kundzina, A., Pudzis, E., & Lazdins, A. (2021). Evaluation of community involvement in participatory process – Lessons learned in the Baltic Sea region. *Architecture and Urban Planning*, 16(1), 56–65. <https://doi.org/10.2478/aup-2020-0009>
- Guarnacci, U. (2012). Governance for sustainable reconstruction after disasters: Lessons from Nias, Indonesia. *Environmental Development*, 2(1), 73–85. <https://doi.org/10.1016/j.envdev.2012.03.010>
- Hallegatte, S., & Rozenberg, J. (2017). Climate change through a poverty lens. *Nature Climate Change*, 7(4), 250–256. <https://doi.org/10.1038/nclimate3253>
- Hayles, C. S. (2010). An examination of decision making in post disaster housing reconstruction. *International Journal of Disaster Resilience in the Built Environment*, 1(1), 103–122. <https://doi.org/10.1108/17595901011026508>
- Human Cost of Disasters. (2020). *Human Cost of Disasters*. <https://doi.org/10.18356/79b92774-en>
- Johnson, C. (2007). Strategic planning for post-disaster temporary housing. *Disasters*, 31(4), 435–458. <https://doi.org/10.1111/j.1467-7717.2007.01018.x>
- Jones, S., Oven, K., Manyena, B., & Aryal, K. (2014). Governance struggles and policy processes in disaster risk reduction: A case study from Nepal. *Geoforum*, 57, 78–90. <https://doi.org/10.1016/j.geoforum.2014.07.011>
- Kalinka, M., Geipele, S., Pudzis, E., Lazdins, A., Krutova, U., & Holms, J. (2020). Indicators for the smart development of villages and neighbourhoods in baltic sea coastal areas. *Sustainability (Switzerland)*, 12(13), Article 5293. <https://doi.org/10.3390/su12135293>
- Kitzbichler, S. (2011). Built back better? Housing reconstruction after the tsunami disaster of 2004 in Aceh. *Asian Journal of Social Science*, 39(4), 534–552. <https://doi.org/10.1163/156853111X597314>
- Kotani, H., Honda, R., Imoto, S., Shakya, L., & Shrestha, B. K. (2020). Transition of post-disaster housing of rural households: A case study of the 2015 Gorkha earthquake in Nepal. *International Journal of Disaster Risk Reduction*, 44, Article 101443. <https://doi.org/10.1016/j.ijdrr.2019.101443>
- Lipper, L., Thornton, P., Campbell, B. M., Baedeker, T., Braimoh, A., Bwalya, M., et al. (2014). Climate-smart agriculture for food security. *Nature Climate Change*, 4(12), 1068–1072. <https://doi.org/10.1038/nclimate2437>
- Masurier, J. Le, & Wilkinson, S. (2014). *Regulatory frameworks for post-disaster reconstruction : Improving resilience in the process*. Academia. https://www.academia.edu/3792110/Regulatory_Frameworks_for_Post_Disaster_Reconstruction_Improving_Resilience_in_the_Process
- NIDM. (2019). NIDM annual report 2018–19. National Institute of Disaster Management, India.
- Opdyke, A., Javernick-Will, A., & Koschmann, M. (2018). Household construction knowledge acquisition in post-disaster shelter training. *International Journal of Disaster Risk Reduction*, 28, 131–139. <https://doi.org/10.1016/j.ijdrr.2018.02.038>
- Puķīte, I., & Geipele, S. (2017). Determining customer satisfaction in the real estate management sector in Riga. *Baltic Journal of Real Estate Economics and Construction Management*, 5(1), 226–237. <https://doi.org/10.1515/bjreecm-2017-0017>
- Rahmayati, Y. (2016). Post-disaster housing: Translating socio-cultural findings into usable design technical inputs. *International Journal of Disaster Risk Reduction*, 17, 173–184. <https://doi.org/10.1016/j.ijdrr.2016.04.015>
- Rogers, A. A., Dempster, F. L., Hawkins, J. I., Johnston, R. J., Boxall, P. C., Rolfe, J., Kragt, M. E., Burton, M. P., & Pannell, D. J. (2019). Valuing non-market economic impacts from natural hazards. *Natural Hazards*, 99, 1131–1161. <https://doi.org/10.1007/s11069-019-03761-7>
- Sanchaniya, J. V., Kanukuntla, S. P., Modappathi, P., & Macanovskis, A. (2022a). Mechanical behaviour numerical investigation of composite structure, consisting of polymeric nanocomposite mat and textile. *Engineering for Rural Development*, 21, 720–726. <https://doi.org/10.22616/ERDev.2022.21.TF225>

- Sanchaniya, J. V., Kanukuntla, S. P., Shereef, A., & Kaneps, J. (2022b). Modelling and analysis of composite polyacrylonitrile nanofiber mats utilized to strengthen motorbike side panel. *Engineering for Rural Development*, 21, 727–736. <https://doi.org/10.22616/ERDev.2022.21.TF226>
- Sanchaniya, J. V., Kanukuntla, S. P., Simon, S., & Gerina-Ancane, A. (2022c). Analysis of mechanical properties of composite nanofibers constructed on rotating drum and collector plate. *Engineering for Rural Development*, 21, 737–744. <https://doi.org/10.22616/ERDev.2022.21.TF227>
- Sanchaniya, R. J., & Geipele, I. (2021). The role of entrepreneurship activity in economic development. *22nd International Scientific Conference. "Economic Science for Rural Development"*, 55, 388–395. <https://doi.org/10.22616/esrd.2021.55.039>
- Sanchaniya, R., Praneeth, S., & Geipele, I. (2022). Investment attraction strategies for Indian real estate management firms. *27th RSEP International Conference on Economics, Finance & Business*, Madrid, Spain, 125–136. <https://doi.org/10.19275/RSEP/CONFERENCE205>
- Sangha, K. K., Russell-Smith, J., Evans, J., & Edwards, A. (2020). Methodological approaches and challenges to assess the environmental losses from natural disasters. *International Journal of Disaster Risk Reduction*, 49, Article 101619. <https://doi.org/10.1016/j.ijdrr.2020.101619>
- Scurfield, R. M. (2006). Post-Katrina aftermath and helpful interventions on the Mississippi Gulf Coast. *Traumatology*, 12(2), 104–120. <https://doi.org/10.1177/1534765606295924>
- Skoufias, E. (2003). Economic crises and natural disasters: Coping strategies and policy implications. *World Development*, 31(7), 1087–1102. [https://doi.org/10.1016/S0305-750X\(03\)00069-X](https://doi.org/10.1016/S0305-750X(03)00069-X)
- Sospeter, N. G., Rwelamila, P. D., & Gimbi, J. (2020). Critical success factors for managing post-disaster reconstruction projects: The case of Angola. *Construction Economics and Building*, 20(3), 37–55. <https://doi.org/10.5130/AJCEB.v20i3.7298>
- Sun, C., & Xu, J. (2011). Estimation of time for Wenchuan earthquake reconstruction in China. *Journal of Construction Engineering and Management*, 137(3), 179–187. [https://doi.org/10.1061/\(asce\)co.1943-7862.0000277](https://doi.org/10.1061/(asce)co.1943-7862.0000277)
- Tauber, G. (2015). *Architects and rural post-disaster housing: Lessons from South India*. Transcript Verlag. <https://doi.org/10.1515/transcript.9783839428627>
- Yoon, D. K. (2012). Assessment of social vulnerability to natural disasters: A comparative study. *Natural Hazards*, 63(2), 823–843. <https://doi.org/10.1007/s11069-012-0189-2>
- Yumarni, T., & Amaratunga, D. (2017). Resource capability of local governments in mainstreaming gender into disaster risk reduction: Evidence from bantul Indonesia. *Journal of Regional and City Planning*, 28(3), 178–185. <https://doi.org/10.5614/jrcp.2017.28.3.2>