Political economy of 2020 landslides, road construction and disaster risk reduction in Nepal

Summary report

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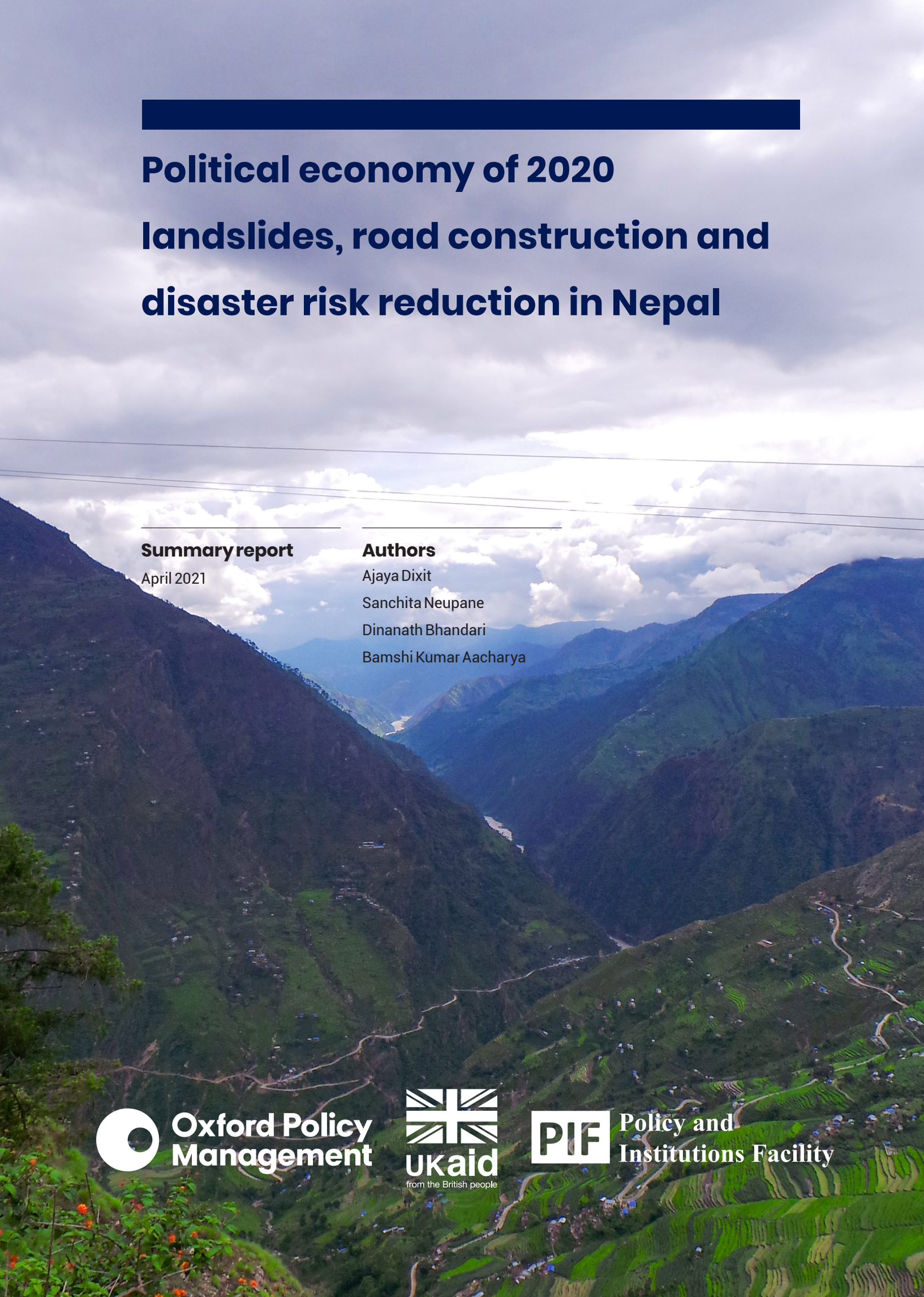

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1. Background

In 2020, Nepal's mid-hills faced an unprecedented number of landslides. Unpacking the genesis of landslides in Nepal brings a myriad of factors into light: political, socio-economic, and natural context. Landslide hazards are linked to hydro-meteorological conditions, such as extreme rainfall and cloudburst and geophysical conditions (drainage systems and/or earthquakes). Changes in land use cover and development interventions are also important catalysts in slope failures. Politics and power shape development interventions, such as informal road building, which can be linked to slope failure. This brief examines the linkages among natural landscapes, development, and disasters. It suggests a way forward for effective preparedness and response to mitigate landslides.

2. Why this analysis?

The causal factors of landslides extend beyond the obvious natural reasons. Thus, it is necessary to understand the political economy context that enlightens the landslide hazards differently. This Political Economy Analysis (PEA) focuses on the drivers of political behaviour, who the main "winners" and "losers" are, and the implications for development strategies, policies, and programs. It unpacks the interests and incentives of different groups while examining the dynamic interactions among social, political, economic, and natural systems.

It does so by focusing on 2020 landslide disasters and also looks into historical landslide events, the science behind slope failure, and the nation's response to landslides. Specifically, it examines the linkage between landslides and road construction in Nepal applying a mixed analysis of technical and political economy perspectives. It is based on a broad literature review of landslides and road construction in Nepal and consultations with key actors.

3. Findings of the analysis

3.1 Increasing frequency of landslides

According to existing landslide records, the frequency of landslide incidents is increasing (Figure 1) over the last 10 years but their spatial distribution is not uniform across the country even within the hilly region. Between 2011 and 2020, the highest number of incidents of landslides (518) occurred in Bagmati Province (Figure 2). Province 1 has faced the second-highest number of landslides (494). Gandaki stands third with 444 landslides. Province 2, which lies in the Terai region, barely faced any landslide (only three incidents in the last 10 years).

Figure 1. Landslide frequency over the last 10 years (Source: bipadportal.gov.np)

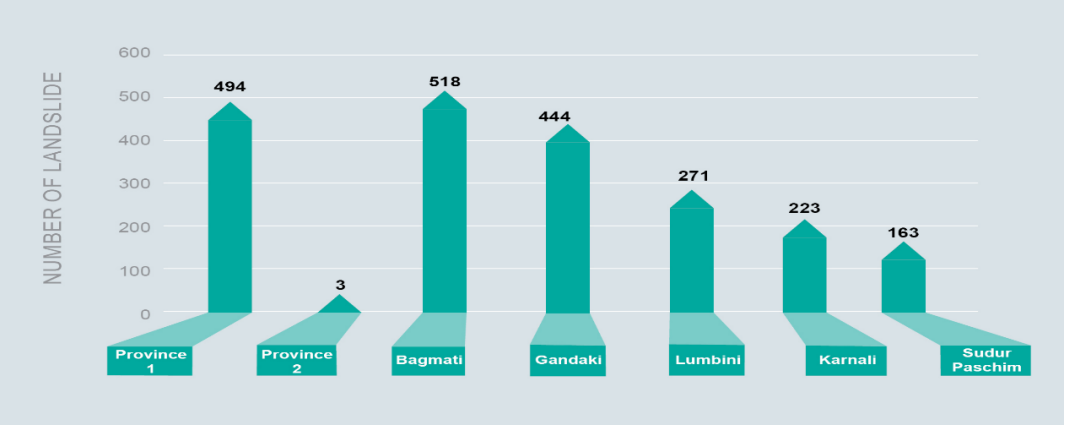


Figure 2. Landslide frequency in different provinces (2011- 2020) (Source: bipadportal.gov.np)

In 2020, 488 landslide incidents occurred during the monsoon (June to October) resulting in 297 human deaths[1]. The spatial distribution of the incidents is consistent with the records of the last 10 years, with Gandaki, Bagmati and Province 1 the most affected districts (Figure 3). Gandaki Province faced the greatest number of landslides with 127 deadly incidents occurring across the province. Altogether, 2020 landslides affected 58 districts while 18 districts faced more than 10 landslide incidents.

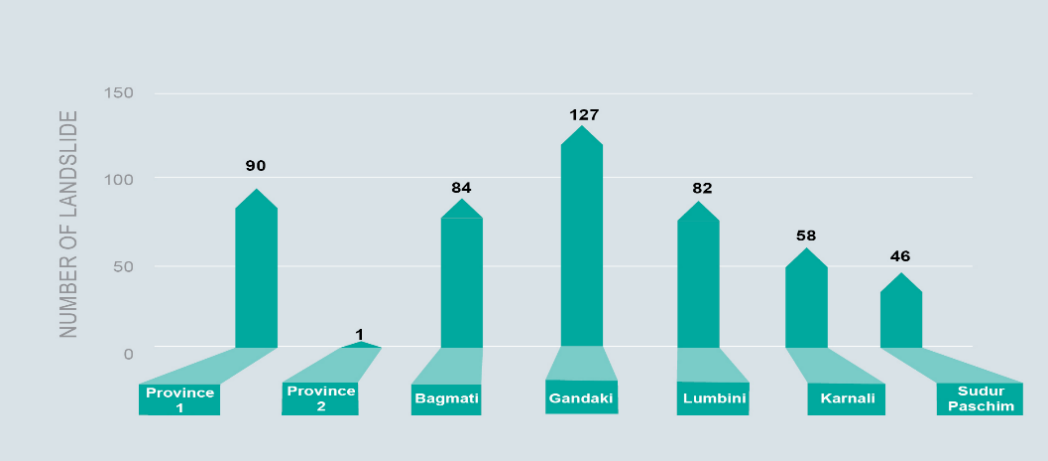


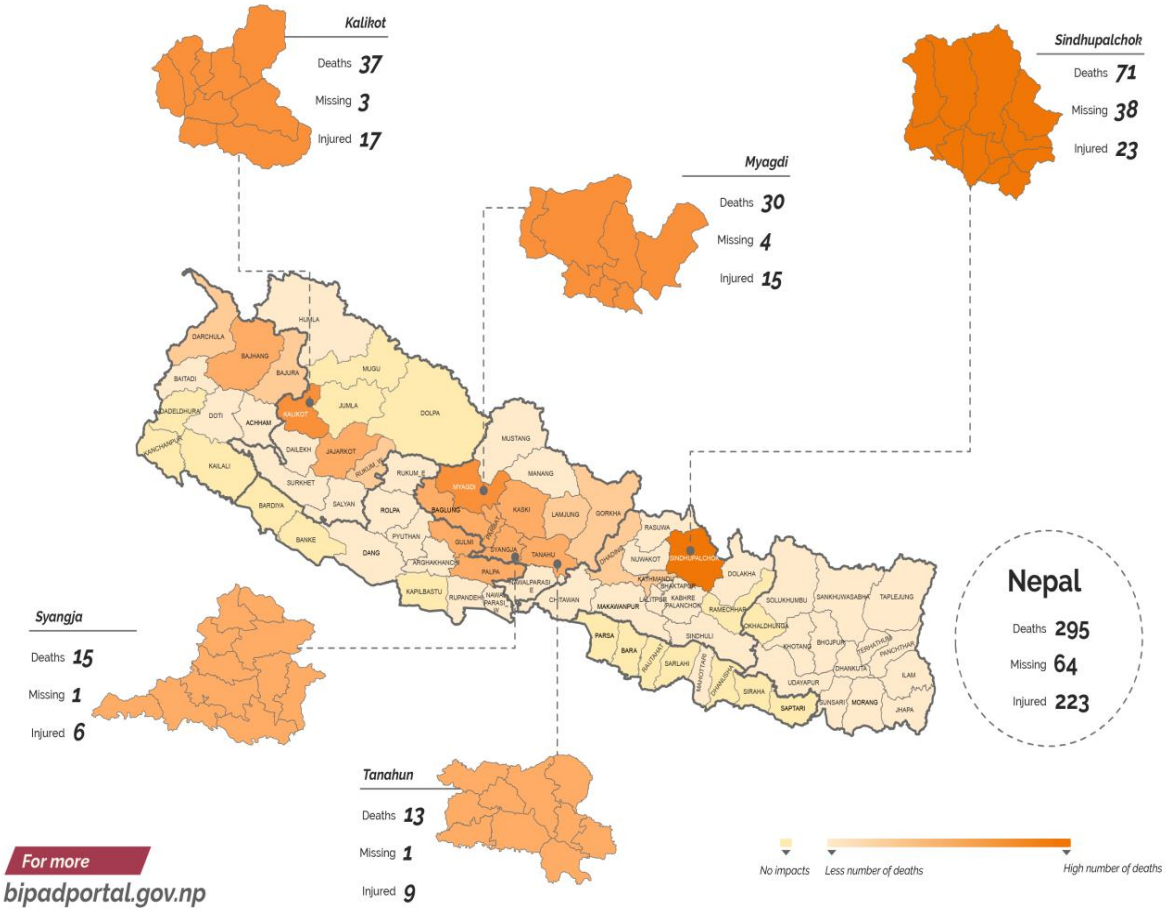
Figure 3. 2020 Landslide frequency by province (Source:bipadportal.gov.np)

[1] The data on incidents were extracted from bipadportal.gov.np, accessed on 2nd March 2021

LANDSLIDE IMPACTS OVERVIEW

(JUNE 01- OCTOBER 15)

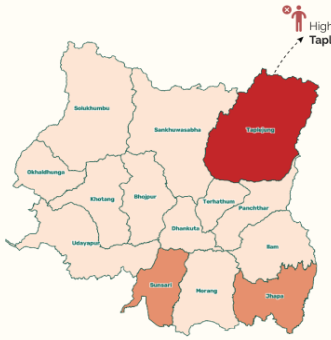
479 landslide incidents have resulted in 295 deaths throughout Nepal. Among the affected districts, Sindhupalchok has been hit the hardest with 71 deaths. There were 37 deaths in Kalikot and 30 in Myagdi, making them the second and third most affected districts in Nepal. Similarly, with 15 and 13 deaths, Syangja and Tanahu are the districts with 4th and 5th highest deaths.



Source: Youth-Innovation Lab (2020)

PROVINCIAL IMPACTS OF LANDSLIDE (JUNE 12-SEPTEMBER 22)

While landslides have highly impacted numerous places in Nepal this monsoon, Gandaki province endured the highest impacts in lives of people. Total 113 landslides occurred in Gandaki Province claiming 86 lives of which 28 lives were lost in the Myagdi district alone, making it the highest impacted district of Gandaki province this monsoon. In Bagmati Province, Sindhupalchok district has the greatest number of deaths resulted due to landslide incidents. Similarly, Taplejung in province 1, Kalikot in Karnali province, Bajhang in Sudurpashchim province and Gulmi district in Province 5 faced the highest number of deaths due to monsoonal landslide this year.



Province 1

Number of Incidents	81
People Death	4
People Missing	11
People Injured	19

Sudurpashchim

Number of Incidents	43
People Death	23
People Missing	1
People Injured	25

Province 2

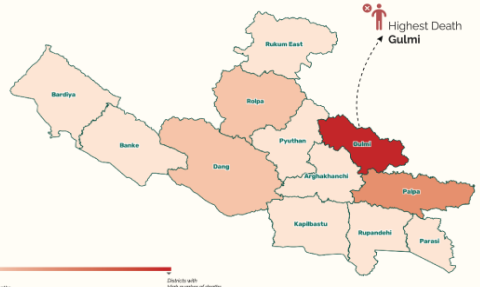
Number of Incidents	1
People Death	0
People Missing	0
People Injured	0

Bagmati

Number of Incidents	75
People Death	82
People Missing	39
People Injured	29

Karnali

Number of Incidents	55
People Death	57
People Missing	5
People Injured	36



Province 5

Number of Incidents	78
People Death	19
People Missing	2
People Injured	18

Gandaki

Number of Incidents	113
People Death	86
People Missing	7
People Injured	78

For more
bipad.gov.np

Source: Youth-Innovation Lab (2020)

3.2 Multiple causal factors

Landslides result from a combination of geological, hydrometeorological, earthquake, and human interventions. They are discussed as follows:

Geological: The mid-hills of Nepal's terrain are susceptible to weathering, erosion and slope failure due to steep terrain and weak geological composition. The region is susceptible to landslides.

Hydrometeorological: The majority of landslides in Nepal occur in the mid to late monsoon months when the moisture content of the land surface reaches saturation, making the terrain susceptible to landslides. It must be mentioned that the distribution of rainfall is not uniform spatially. In Western Nepal, landslides also occur in January and February as this region receives more rainfall during this period than Eastern Nepal does. In 2020, the average monsoon precipitation (June-September) was around 1600 mm, 400 mm more than the average.[2] According to the Department of Hydrology and Meteorology (DHM), the daily accumulated rainfall was higher than normal (as determined by the average rainfall amounts observed between 1981 and 2010 in Eastern Nepal) but it was less than normal in Western Nepal.

Earthquake: Earthquakes and rainfall act in tandem to increase landslide effects throughout the country. The 2015 Gorkha earthquake and its aftershocks ruptured large sections of the central mountainous region of Nepal, making it more vulnerable to landslides than it had been. Using satellite imagery to map landslides revealed that more than 7,000 new landslides occurred on the day of the earthquake[3].

Human interventions: Some of the human-caused factors include the following:

I. Land-use change: Deforestation reduces the cohesion of soil and increases overland flow, which in turn generates landslides.
II. Infrastructures: Road infrastructure, especially the construction of non-engineered roads can lead to potentially damaging mass movements in several different ways.

- Excavated materials stored on the downslope side of a newly constructed road cause debris flows.
- Poor road drainage results in water seepage that promotes bedrock failures and deep-seated landslides.
- Extensive mechanical excavation and improper blasting generate secondary fractures within rock masses that may lead to slides.

Even today, Nepal mid-hills face a major potential threat from future landslides that could be triggered by a high-magnitude earthquake, intense monsoon rainfall, and/or the haphazard construction of infrastructure.

[2] DHM (2020). Analysis Report of 2020 Monsoon (June-September 2020) Daily Rainfall Monitoring. Available at: http://dhm.gov.np/uploads/climatic/565191851Monsoon%20Rainfall%20Monitoring%202020.pdf. Accessed on 2nd March 2021. Department of Hydrology and Meteorology. Kathmandu.

[3] Kincey, M.E., Rosser N.J., Robinson, T.R., Densmor, A.L., Shrestha, R., Pujara, D.S., Oven, K.J., Williams, J.G., and Swirad, Z.M., (in review). Evolution of coseismic and post-seismic landsliding after the 2015 Mw 7.8 Gorkha earthquake, Nepal. *Journal of Geophysical Research – Earth Surface*.

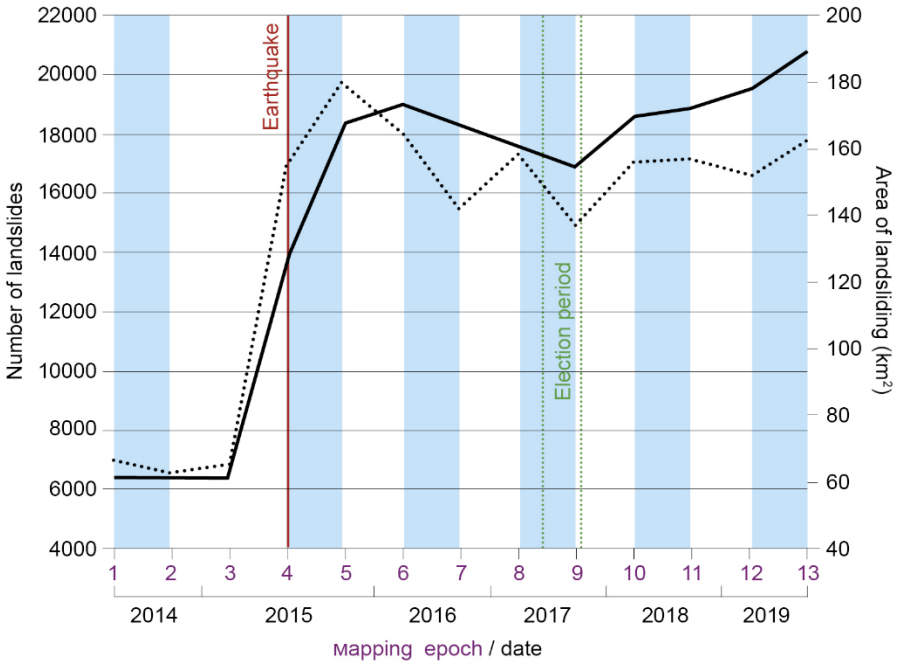


Figure 4. Changes in mapped landslide numbers and area of landsliding (Rosser et. al, 2021)[4]

3.3 Road and landslide nexus

The Nepal Police reported that 488 landslide incidents occurred across the country in 2020. A comparison of 337 visible landslide sites across 35 hill districts with the nearest road on Google Earth showed that 205 landslides (61%) had occurred near roads. The remaining 132 (39%) were on hills without nearby roads. A temporal analysis based on Google Earth images showed that since 2008, 179 of the 205 landslides (87%) had evolved following the construction of a road. The remaining landslides (13%), in contrast, were in existence before roads were built. This spatial relation between roads and landslides reinforces road building as an important causal factor for landslides in Nepal's hills.

Before the 2015 earthquake, in many locations of the mid-hills, the building of roads might not have triggered landslides. In the landscape disrupted by the Gorkha earthquake, however, the stress of road building is now considerably more evident as its residual impacts act in tandem with extreme rainfall and increase the occurrence of landslides. Changes in dynamics of surface runoff influence the occurrence of landslides. After a road is built, runoff is re-channeled to new areas. The construction of roads also disrupts the phreatic balance of springs. While environmental impact assessments of roads do mention the need to mitigate adverse impacts, compliance remains a major gap. As a result of current practices, many hill roads are poorly aligned, excavated, and built. The prevailing cut-and-throw approach has altered the landscape and negatively impacted drainage, slope stability, erosion, and downstream sediment supply.

[4] Rosser, N., Kincey, M., Oven, K., Densmore, A., Robinson, T., Pujara, D.S., Shrestha, R., Smutny, J., Gurung, K., Lama, S. and Dhital, M.R. (2021). Changing significance of landslide Hazard and risk after the 2015 M_w 7.8 Gorkha, Nepal Earthquake. *Progress in Disaster Science*, Vol.10. https://doi.org/10.1016/j.pdisas.2021.100159

3.4 History of rural roads

To increase transport connectivity, the Government adopted the concept of "green roads,"[5] using sustainable methods for constructing rural roads in Nepal's mid-hills region during the 1980s. They were perceived to be an appropriate way to construct roads to reduce their vulnerability to surface erosion and landslides. In constructing green roads heavy machinery is avoided, the road is built by first opening a narrow track and then gradually widening it over a four- to five-year period. The muck is managed by balancing cut and fill. Simultaneously, bioengineering measures are applied to stabilize the cut slopes and engaging in regular maintenance. Over 3,000 kilometers of rural roads were constructed using the green road approach. It is said that the learning from these projects later helped develop specifications and design standards for rural roads in Nepal.

This approach, however, was lost when the demand for roads began to soar and the budget allocated for roads increased. Up till the 1990s Nepal's road network implementation would start with the inclusion of plans in the annual budget and master plans and the securing of parliamentary approval. With the advent of the 10th plan in 1990, these requirements began to get diluted and political imperatives began influencing the selection of projects for implementation.

In 1994, the Government began its *'afno gaon afai banau' ('build your village yourself')* program, which made fiscal transfers to locally elected bodies. It created incentives for building roads. The road construction process would start by opening a track and then expanding it until it was wide enough for a vehicle to ply. The program started with a financial transfer. The roads built did improve access but this would only last till the next monsoon when flooding, landslides, rock-fall, and lack of river crossing facilities damaged them. The practice of building local roads without expert input became the norm. With subsequent central and provincial governments increasing the amounts transferred to local governments, the momentum of local road-building continued with more vigor. Although initiatives such as the UK aid's Rural Access Programme (RAP) have piloted environmentally sound rural roads in Nepal's mountains[6], learning is limited. The approach to building a good rural road has not yet been replicated in rural road projects in the country.

3.5 The trend in road expansion

From 4,780 km in 1998, the local road network increased to 53,310 km in 2016, an increase of 1200 %[7]. By mid-March 2019/20, out of the total 61,395 km[8] of local and provincial roads, the shares of blacktop, gravel, and fair-weather roads were 6.4%, 22.1%, and 71.5% respectively. 54.7% of local and provincial roads are in the hilly region, whereas roads in the mountainous and Terai regions comprise 13.7% and 31.58% of the total respectively.

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[5] These 'Green Roads' began to be built in Dhading and Palpa districts. The Rampur–Aryabhanjhyang road in Palpa and the Kathmandu–Sitapaila–Bhimdhunga road in Kathmanu were the two pilot green roads. See: Dixit, A., & Gyawali, D. (2003). A Cultural Theory Perspective on Environment and Scarcity in Nepal. Environment, Development and Human Security (ed.) Nijam, A. Boulevard: University Press of America.

[6] Rural Access Programme (RAP). http://archive.rapnepal.com/background. accessed on 2nd March 2021. (This project supported by DFID along with transport infrastructure projects supported by ADB and the World Bank did aim to overcome some challenges.

[7] Sudmeier-Rieux, K., McAdoo, B. G., Devkota, S., Rajbhandari, P. C. L., Howell, J., and Sharma, S. (2019). Invited perspectives: Mountain roads in Nepal at a new crossroads, Nat. Hazards Earth Syst. Sci. 19, 655–660. https://doi.org/10.5194/nhess-19-655-2019. Accessed on 2nd March 2021.

[8] Ministry of Finance (2020). Economic Survey, 2019/2020. Ministry of Finance. Kathmandu. Available at: https://mof.gov.np/en/archive-documents/economicsurvey-21.html accessed on 2nd March 2021.

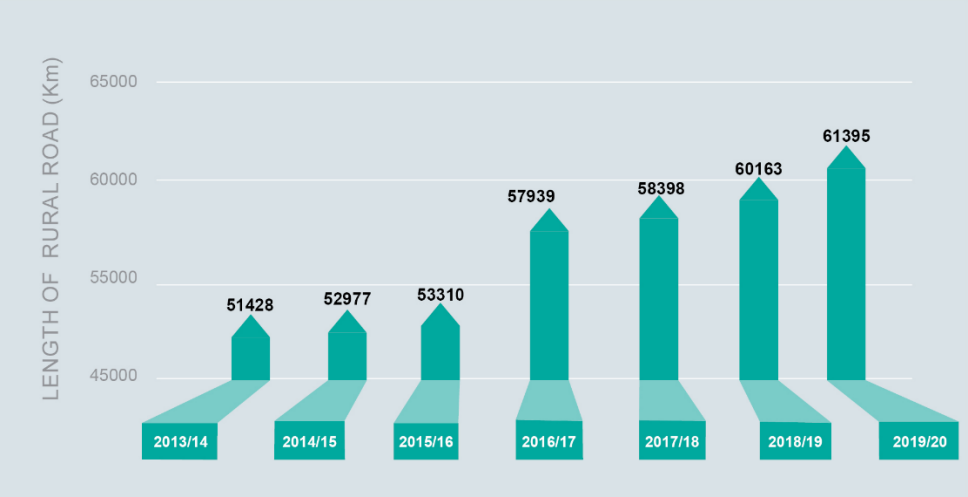

Figure 5. Status of road network over last 7 years[9] (Source: MoF, 2020)

It is expected that the development of rural roads will continue to rise until 2030. Total road length is predicted to reach more than 200,000 km by 2025. This expansion aligns with Target 9.1 of the SDG94, which is related to road development. The length of widened blacked-topped roads was less than 1,400 km in 2015 and will be greater than 36,000 km in 2030. This focus on expansion has not, however, considered the conditions needed to build safe roads. This pursuit needs to assess the risks of landslides and take measures to minimize them.

3.6 Public financing inroads

The dramatic increase in the length of rural roads in the last 30 years also corresponds to an increase in investment in the local road network. Until 2007/08 investment in rural roads was increasing at a uniform rate. Then, in 2008/09, the budget for rural roads increased by almost 1.9 times the budget for 2007/08. This increase can be linked to the end of the Maoist rebellion. The rise in the budget over the next few years, quite dramatic in 2016/2017, can be linked to the promulgation of the 2015 Constitution and the Gorkha earthquake. The budget allocated in 2018/19 was 7.5 times the budget allocated in 2007/08[10]. After 2018/19, the budget began to be allocated as called for by the new public financing mechanism under the federal governance architecture. Today, investments in the local road network are spread across the federal, provincial, and local governments. This network is financed through the Government's budget as well as through development partners[11].

Investments in rural roads are increasing and, with mechanisms for financial procedures and fiscal monitoring measures in place, it is theoretically possible to improve accountability and thus the quality of roads built. Instead, preference is for building fast, ignoring basic norms or standards, using inappropriate techniques and cutting corners, ignoring the hazard-risk context.

3.7 Agencies

The overall management of national highways and feeder roads rests with the Department of Roads (DoR). Collectively, these roads are known as federal roads. The DoR has division offices across the country and employs around 450 engineers. The Ministry of Physical Transport and Infrastructure (MoPIT) and the DoR have more than 50 years of experience in the

[9] Ministry of Finance (2020). Economic Survey, 2019/2020. Ministry of Finance Kathmandu. Available at: https://mof.gov.np/en/archive-documents/economicsurvey-21.html. Accessed on 2nd March 2021.

[10] Based on the consultations at Department of Local Infrastructure (DoLI)

[11] Based on the consultations at Department of Local Infrastructure (DoLI)

road sector and have one of the most educated and well-trained teams in the nation. Despite this, the state of the roads in the country is poor.

District, urban, and village roads are collectively designated as the Local Roads Network (LRN). Before the promulgation of the 2015 Constitution, the Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR), which was established in 1998, managed LRN roads. Though DoLIDAR (now known as DoLI) had branch offices in all 75 districts, it did not have a single geotechnical engineer or geologist, even at central level[12].

The management of Local Road Network roads is now under the jurisdiction of individual provinces and municipalities. DoLI has two decades of experience in building district and village roads, and its collaborations with development partners expanded its areas of expertise. While most of DoLI's rural road standards and guidelines are related to road capacity, road safety, and vehicle capacity, some do address roadside stability[13]. Determinants of roadside slope stability are, among other factors, horizontal alignment, vertical alignment, camber, cross slope, and the level of road embankments above high-flood level. However, standards remain theoretical and are hardly implemented in practice.

In their current state, provinces and municipalities are poorly equipped to carry out the road design, construction, and supervision necessary for establishing engineered local roads. How DoLIDAR's experience in developing local infrastructure can be transferred to the newly formed provincial and municipal bodies is a major question.

3.8 Machines, procurement, and contracting

In 2017/18 Nepal had a total of 83,710 bulldozers. Before 2010 there were only 43,558. Records at the Department of Transport Management (DoTM)[14] maintained since 2010 show that 12,712 units were added in 2017. This increase coincides with the holding of local elections in 2017 and is seen across Palikas. It is common knowledge that local representatives (mayors of municipalities or chairpersons of rural municipalities) own the excavators. They rent them out at inflated prices to contractors. There is no standard cost of renting, contractors can hire excavators or dozers at prices ranging from NPR 4,000/hr. to NPR 12,000/hr.[15]. Local representatives directly or indirectly award contracts to their relatives. Landslide mitigation, bioengineering, and building of protection walls are generally left out for low-budgeted roads. Construction takes place without considering basic grading, drainage, or slope stability.

[12] Based on the consultation at Department of Roads (DoR) and Department of Local Infrastructure (DoLI)
[13] Government of Nepal (2014). Nepal Rural Road Standards.
[14] Based on the consultation at Department of Transport Management (DoTM).
[15] The procurement process itself creates compromises for the quality of roads after the successful lowest bidder begins implementing the project. https://www.nepalitimes.com/opinion/dozers-and-nepals-development/. Accessed on 2nd March 2021.

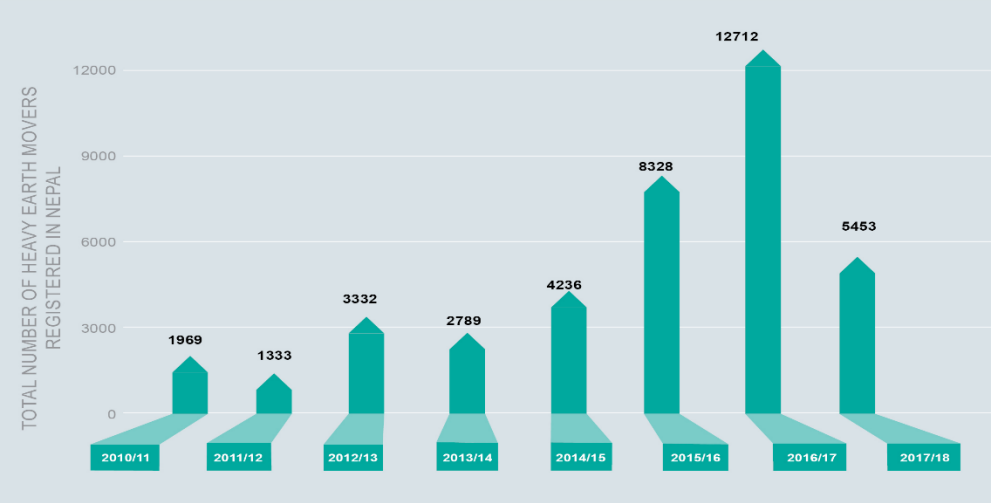

Figure 6. Annual registration of bulldozers (2010-2018) (Source: DoTM)

3.9 Why are roads prioritised over disaster risk reduction?

Road construction has tangible and immediate benefits. Roads reduce the drudgery of walking on trails on steep terrain, often with loads. Road construction is intrinsic to the development and prosperity narrative. Some road projects are intended to promote the public good, others to gain individual profits. The fact that 33% of local representatives are associated with the construction industry sends a clear message about the political-economic imperative of road building in Nepal. There are cases in which differently motivated people offer incentives to drivers of excavators to modify an alignment so that the price of land adjacent to a road increases after a road is completed.

Road building is one of the best methods of securing votes in an election. Local governments want to build roads to show off their ability to bring about development, the public wants roads built to improve connectivity and avoid drudgery, farmers want roads to improve access to markets and landowners want roads to increase the price of their land. Thus, the construction of roads, whether engineered or non-engineered, impacts a wide range of stakeholder interests.

Landslide disaster mitigation, in contrast, is less tangible. Engaging in landslide disaster risk mitigation does not create immediate incentives and the general public, government and political leaders seem to care less about the benefits. The mitigation of landslides, conservation of forests, and the environment are seen as secondary priorities in comparison to the construction of roads. In Nepal's socio-economic landscape, environmental oversights are perceived as obstacles to development rather than accepted as measures to balance development and conservation. Activists, environmentalists, and a section of the media have highlighted the need for conserving nature and using precautionary principles while building infrastructure, but their voices appear to be too feeble to make a difference. Instead, the power and influence of the supporters of non-engineered road development prevail.

One of the reasons for the growing impact of landslides is the increase in the number of exposed populations living in hazard-prone areas[16]. Whenever a rural road is built to improve

[16] Petley, D.N. Hearn, G.J., & Hart, A.B. (2005). Towards the development of a landslide risk assessment for rural roads in Nepal. In: T. Glade, M. Anderson, & M.J. Crozier (Eds.) Landslide Hazard and Risk. Chichester, United Kingdom: Wiley, pp. 597–619.

access to a village, the overall settlement pattern changes[17]. The inhabitants of adjacent areas buy land along the road corridors and build shops and houses to better seize nearby economic opportunities. It is a strategy people adopt to diversify their livelihood options or to handle the other risks they face, such as crop failure. They tend to know little about landslide risks but choose to profit from roadside opportunities.

Landslides tend to affect marginalized and those discriminated against based on caste and ethnicity more, as they usually live in more hazardous areas[18]. Because such areas have relatively low value and can be purchased or rented at low cost, more and more people opt to live in roadside settlements, though they may be hazard prone. Studies have shown that landslide fatalities have increased due to the establishment of new settlements and the expansion of existing settlements into sites that are susceptible to slope failure.

Since decision-making is often in the hands of a few powerful people in the village who influence the alignment of the road, marginalized groups are either voiceless in the process or their voices are dismissed. Decision-making on local-level roadbuilding (even regarding rudimentary concepts, alignments, designs, construction, and maintenance) is done mostly by men who own land by roadsides. Women do not have rights to their parental property, including land, and there are very few female landowners.

4. Institutional responsibility to landslide risk management

Landslides fall inside an institutional fault line and have no owner. Responsibilities are not spelled out; the result is a fragmented and therefore inefficient effort to address landslides. Several organizations are involved in landslide issues. The Department of Mines and Geology (DMG) studies landslides, especially in the context of geohazards. The Department of Soil Conservation and Watershed Management (DSCWM) implements some projects on landslide mitigation under the theme of watershed and forest conservation. The Department of Water and Irrigation's (DWRI) Water-Induced Disaster Management Division covers the mitigation aspects of landslides. Other agencies include the Ministry of Home Affairs (MoHA), provincial governments, and Palikas, all of which are mostly engaged in the response. Recently, the National Disaster Risk Reduction and Management Authority (NDRRMA) is trying to fill the existing knowledge gap in landslide risks through partnering with research institutions.

Another major gap in disaster risk reduction and management and mitigating landslides is the GoN's budget allocation. The Department of Road (DoR) allocates a budget for landslide mitigation under its annual maintenance heading. In practice, the bulk of the budget is used for resurfacing the roads and only a limited amount is allocated to stabilizing slopes. There is still no designated separate budget code for disaster risk reduction and management. This means that DRRM budget allocation is under different headings and not easily collated.

The allocation and the practices of budget disbursement have an implication on the rehabilitation of disaster victims. Many times, funds to rehabilitate disaster victims are not spent due to the lack of procedural guidelines. The absence of operational guidelines means the victims of the 2020 landslides have not yet received anything beyond immediate relief[19]. It is

[17] Lennartz, T. (2013). Constructing roads—Constructing risks? Settlement decisions in view of landslide risk and economic opportunities in Western Nepal. Mountain Research and Development, 33(4), 364-371. https://doi.org/10.1659/MRDJOURNAL-D-13-00048.1. Accessed on 2nd March 2021.

[18] Wisner, B., Blaikie, P.M., Cannon, T., & Davis, I. (2004). At Risk: Natural Hazards, People's Vulnerability and Disasters (2nd ed). London, United Kingdom: Routledge. Google Scholar. Accessed on 2nd March 2021.

[19] Based on the consultation at MoHA

likely that that the fund will be unspent and the amount may freeze. The procedural limitations mean families affected by landslides, whether in 2014 or 2020, continue to live in makeshift homes.

The Department of Urban Development and Building Construction (DUDBC) has allocated a budget of NPR 500,000 per landslide-affected household to resettle. However, the management of land for these families remains a major bottleneck for the Government in implementing its relocation and resettlement plans. The Ministry of Finance (MoF) has yet to provide consent to the 2021 guideline Procedures for Resettlement to Flood and Landslides Victims. This issue of rehabilitation and relocation did not arise just in the case of the landslides of 2020. The 2014 Jure landslide victims are still waiting for the Government to roll out a rehabilitation plan, 6 years after the incident[20]. Palikas, although responsible for mitigation and response, have limited capacity, not just in addressing landslides but broadly in project planning and management, technology, and policy. Palika officials do not know enough about the economic and environmental implications of non-engineered roads.

At the same time, the roles and responsibilities of the three tiers of government have not yet been delineated[21], a gap that leads to the duplication of response, sometimes with major cost implications. In any case, responses to disasters, including landslides, are influenced by post-event political incentives. Instead of investing in landslide disaster preparedness to prevent the loss, officials and leaders appear to be drawing major political mileage from visiting landslide-affected sites and providing disaster relief.

5. Differential impacts

The building of non-engineered roads and landslides produces winners and losers at the nexus involving state actors, market actors, critical actors, and common people who end up as losers. The actors at the nexus of the state and market benefit; they are political actors, contractors, bureaucrats, suppliers, and party-based cadres. Besides, a completed road also brings benefits to villagers. However, villagers, primarily low-income disadvantaged households, are also among the losers, as are natural ecosystems such as springs and streams and biodiversity. Ultimately, disruptions in ecosystem services cascade into local societies and communities and particularly into vulnerable and disadvantaged households. In this socio-political landscape, the task of raising critical voices that highlight the risk that externalities will fall upon the losers rests with the media, ecologists, and non-government and community-based organizations. Some aid agencies, by providing support for building environmentally friendly local roads, also support such critical voices.

6. Recommendations

1. Data and information: Improving hydro-meteorological data infrastructure is a major task so that many micro-climates are well represented. Expanded network management is particularly important for developing warning mechanisms for landslides and flash floods. Since local

[20] Ministry of Irrigation (2014). Report on Jure Landslide, Mankha VDC, Sindhupalchowk district. available at: http://www.sabo-int.org/case/2014_aug_nepal.pdf, accessed on 10th December 2020.

[21] Oxford Policy Management Limited (2020). Disaster risk reduction and management in Nepal: Delineation of roles and responsibilities. Available at: https://www.opml.co.uk/files/Publications/a1594-strengthening-the-disaster-risk-response-in-nepal/delineationof-responsibility-for-disaster-management-summary-english.pdf?noredirect=1. Accessed on 2nd March 2021

variations in weather are substantial, the relation between rainfall and landslides will become clear only if we have a much more representative database. This will help better understand climate change impacts on landslides. It is also important to communicate information about rainfall events to the Palikas and local communities likely to be affected. The process must focus on establishing two-way communications between members of the scientific community and local functionaries and in making information available to communities in languages they understand. It will help them develop response arrangements and scaling up forecasting and warning systems that suit local contexts.

2. Planning approaches: For federal and strategic roads in Nepal, focus is on building roads quickly. Phased construction practices are not always feasible. Even if this is the case, slope stability should be a priority investment for strategic roads. Where time is less of an issue, as in the case of rural roads that connect villages, phased construction and/or green road modalities should be employed. These modalities naturally include stability as one of their criteria. Palikas should not use machines to hasten the construction of roads. Instead, they must try to use an appropriate mix of labour and machines. Village roads should be built in phases. A transparent framework for assessing the costs and benefits of road-building will show the value of building risk-sensitive roads with minimal environmental disruptions. The integration of landslide risk data into development projects may have technical and financial implications for those projects; these trade-offs can be analysed or at least discussed before every development project is implemented. This should be supported by delineating the roles and responsibilities of the three governments.

3. Engagement and dialogue: The dialogue must cover different aspects of building engineered local roads, including basic geological and engineering standards. The trade-off between a non-engineered road and a risk-sensitive one must be worked out in monetary terms and used as evidence during dialogues. This study has also underscored the need for aid agencies to creatively engage not only with the MoHA and the Ministry of Energy, Water Resource and Irrigation (MoEWRI) but also with the Ministry of Physical Infrastructure and Transport (MoPIT) and the Ministry of Federal Affairs and General Administration (MoFAGA) to achieve the goal of disaster risk reduction for inclusive development. To that end, the NDRRMA has the potential to play a proactive role in shifting the conversation towards risk reduction by directing efforts toward generating scientific evidence that supports the mitigation of disaster risks, including those from landslides. This process must include the private sector (heavy equipment suppliers, construction and contractor groups), think tanks, investors, university faculties, government departments, and local elected officials on risks, environment conservation, and sustainable development. The dialogue needs to use tangible evidence of the cost of non-engineered roads and the benefits of risk-sensitive road building to communities in the hills and mountains.

4. Capacity-building: Strengthening the capacity of local governments in various aspects (engineering, geological, environmental, economic, and social) of road design, construction, and monitoring is necessary. They need geological, engineering, hydrological and environmental backstopping along with tools, skills, and training. The pool of knowledge from the erstwhile DoLIDAR as well as the DoR and other interventions needs to be harnessed and synthesized. Capacity building does not happen without budgetary provisions that help in the coproduction of products and knowledge. A separate heading for ‘slope stabilization’ is necessary to ensure that a dedicated budget is available for landslide mitigation. Investment in better understanding the cultural and livelihood barriers to designing a successful rehabilitation and relocation plan is necessary.

5. Risk-sensitive land-use: It is necessary to look into the development of a risk-sensitive land-use plan for Palikas, developing policies and tools. One step towards this goal is to collate and synthesize the existing data sets for landslide hazards, risks, and susceptibility maps prepared by the National Reconstruction Authority (NRA), DMG, DOR, Durham University, and others. Another major task is to establish a coherent set of terminologies for risk assessment that will be broadly acceptable across the board. The inputs of geologists, geotechnical engineers, and hydrological experts should be at the core of this conception.

7. Conclusion

Continuation of the practice of haphazard road building will see Nepal walk down the "road to landslides" even though the country's professed goal is "roads to the village." To avoid such a future Nepal must begin risk-sensitive road construction as a precondition to sustainable development. This will not be easy or straightforward but need a systematic and continuous process of multi-stakeholder initiative of action research and pilots involving government agencies at all level, federal, provincial, and local, non-governmental and community-based organizations, federation, cooperatives, academics, researchers, and think tanks as well as the private sector.

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