

# Impact of Road Network on Sustainability of Rural Community- A case of Gorkha, Nepal

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## Abstract

Rural areas gain access to various facilities when connected by road to town. Rural roads play a crucial role in the socio-economic development of rural areas. Construction of rural road also result in exploitation of natural resource and may cause various positive and negative changes in rural village. These conflicting effects of rural road poses a challenge to policy makers who are interested in sustainable development. Acknowledging this fact, the main objective was to analyze the contribution of road to sustainable communities of Barpak and Laprak of Gorkha district. The research follows case study method in which in depth questionnaires, focus group discussions were conducted with the villagers and the key informants on the basis of developed indicators extracted from literature review. Qualitative data were analyzed and on the basis of findings, it was found that Laprak village which is still majorly dependent on the foot trails from Barpak has slow progress in village transformation to modernity whereas Barpak having easier road access from major towns, has seen high paced progress in development and settlement reconstruction after 2015 earthquake. The findings revealed that Laprak is conserved and well maintained village, maintaining sustainable livelihood which has excellent opportunity in tourism. Barpak on other hand which is influenced from modern development has suffered drastic change in physical, social and economic dimension has lost its rural identity.

## Keywords

Sustainability, Rural road, Access

## 1. Introduction

Rural areas are defined as places which are far away from large towns or cities. The main occupation in the rural areas are farming. The rural population (% of total population) in Nepal was reported as 81% in 2016 and Annual Rural Population Growth in the country was 0.6649% [1]. The services and facilities available in rural area are limited thus the people are compelled to make trip to urban area. Road provides connectivity and access to various facilities available in urban area. This helps in reducing isolation of village, creates opportunities of various employment, increases public services, increase living standard of people, stimulates market activities, etc. Even the urban areas also gain access to agricultural products. Definition of road networks in the hilly regions is difficult task due to its steep terrain and the location of existing settlements and public facilities.

Economic development of any area is guided by the amount of transportation facilities available which is

directly linked with the road infrastructure. Road can be basically called as infrastructure for infrastructure. Basic (also called essential or lifeline) accessibility which refers ability of people to reach activities that society considers basic or essential [2]. These essential activities can only be accessible from the basic mobility system through planned road infrastructure. In rural areas usually there are few alternatives once a road is blocked and that may increase vulnerability of rural areas when facing extreme hydro climatological events that impact transportation infrastructure.

John F Kennedy has pointed out the importance of road with the statement “It is not the wealth of a nation to build roads but it is our roads that build the wealth of a nation”. Rural roads play a crucial role in the socio economic development of rural areas. Rural roads are a necessary element for fostering rural income growth and reducing poverty. Rural road planning decisions can affect development location and type, and therefore accessibility, land values and

local economic activity. Rural transport plays an indispensable role in achieving more than half of the Sustainable Development Goals (SDGs) and fulfilling the promise of the 2030 Agenda for Sustainable Development to 'leave no one behind'. Although there is no dedicated SDG target on rural access, there are numerous linkages between rural access and the SDGs. SDG 9 and SDG 11 to contribute to sustainable infrastructure and communities for all; In addition to indirect linkages to SDGs and associated targets, there is a direct linkage to rural access in SDG indicator 9.1.1 (Proportion of the rural population who live within 2 km of an all-season road) developed by the Interagency Expert Group on Sustainable Development Goals.

### 2. Research objective

The main objective is to analyze the contribution of road to sustainable communities of BARPAK and LAPRAK of Gorkha district. To achieve the aim, other specific objective are as follows:

- To identify the sustainable indicators that are affected by road infrastructure
- To investigate direct and indirect impacts from road access
- To compare the impacts from road between two rural community, one with road and one without proper road access

### 3. Literature review

In Nepal, about 20 percent of rural residents have to spend more than 3 hours to go to the nearest marketplace or agriculture center. Majority of Rural residents spend more than 30 minutes of their time to access to paved roads. The road deficiency has adverse effects on social welfare[3]. The findings for Nepal suggest that providing extensive road access to markets would confer substantial benefits on average, much of these going to poor households. It is important to mention the other benefits of rural roads besides cheaper transport to and from agricultural markets, such as better access to schools and health facilities and, more generally, to a greater variety of consumer goods. [4]

Rural urban linkage being a fundamental element of regional development, the balanced urban and rural development in developing country like Nepal lies in

strong and mutually supported linkage. The impact of Beni-Jomsom highway has occurred around its corridor region which will open a new avenue of regional development as it would provide opportunities of development to the remote areas that had previously no linkage to the mainstream of development[5].

In contrary to urban areas, where increasing motorization has led to problems of air pollution, congestion, etc., rural areas are affected by these problems to a lower extent. In the context of Nepal, lots of environment problems can be cited out that emerged out of developing transport infrastructures by neglecting the environment. The famous Krishnabhir which had been affecting Nepalese on the main Prithvi highway from a long period of time by seasonal landslides, is a result of defective constructive methods and overlook of environment but the problem has been solved by Bioengineering process. A rural road must fulfill two conditions to be sustainable: first, it must contribute to and enhance rural livelihoods and livability, and secondly, its planning and design (as well as construction and maintenance) must be context sensitive to ensure a balance among economic, social and environmental objectives, that is reflective of community values, aspirations, and needs[6].

Aggarwal et. al concludes that solutions should be provided for a sustainable mobility that enable a balanced development where different related sectors of public life are benefiting from the derived efforts [7]. Sustainable mobility system can be adapted to ensure overall individual mobility without increasing the total number of cars (and therefore congestions and air pollution). The establishment of a sustainable form of individual transport can be initiated by introducing a car-sharing system and shared Village Truck [8].

In order to increase tourism in the rural areas the project of National Tourist Routes in Norway was started which has boosted activities along the tourist roads [9]. Tourists are able to experience and explore the mountains safely due to the mountain roads. In rural area improving the quality of road and maintaining safety in areas vulnerable to landslides becomes a top priority. The areas in the tourist routes have added value of social change because of the change in lifestyle, production practices, built environment and population migration pattern [10]. It is important to take the rural road network and public

facility locations issues at the same time for the development of rural areas. Linking the nodal points by the road links which cover the settlements and public facilities forms a basic road network. (Jacoby, 1998) The implementation of the method in Bhimsen Gaupalika of Gorkha district reveals that the proposed method is a practical and realistic to the definition of nodal points and road networks in the hilly areas of Nepal [11].

The concept principles, a design approach and implementation procedure of the green road concept is best adaptable to rural road construction in Nepal. Environment friendly construction techniques, participatory and decentralization approach, optimum utilization of local resources, simple technology, local capacity building and self help efforts justified Green road approach as a best way of constructing rural roads in hill districts of Nepal [12].

Bell and Dillen (2018) has explained about the positive impacts of road on decreasing rate of morbidity in Upland Orissa[13]. Soltani et. al analyzed on consequences of an improved road network in rural Iran using a non-linear bio-economic model for a community. Natural resource exploitation, environment degradation may also be the serious impact caused by the road construction. Access to roads provides less costly access to previously isolated forests, thereby potentially accelerating the rate of deforestation. Also, access to markets could shift labor use from forestry to non-farm activities which may reduce pressure on forest resources. This conflicting effects of rural road poses a challenge to policy makers who are interested in sustainable development [14].

Milbourne (2007) elaborated the positive impacts of migration to rural areas including increased cultural diversity that these migration bring to rural places not known for their tolerance of cultural difference.[15] Rye(2018) did a comprehensive survey of mobility transformation and rural change of Hitra/Froya, Norway from labor migrants. He found that the region has undergone societal transformations due to large scale in-migration of Eastern European workers to the region's booming fish farming industry. The urban to rural migration of mobile labors has resulted in heterogeneous character of rural population. Fish farming industry of Hitra/Froya resulted in upgradation of road connecting to national road system reducing travel time to major cities, to airport and harbor. The general population has also gained

access to a larger region for work and leisure purposes due to improved access[16].

Nidup (2016) found out that providing rapid access to road in rural Bhutan, only very poor section of rural societies have benefited with wealth. There was no impact seen on poor, medium and rich categories and decrease in wealth in rich categories was observed. This insignificant impacts is an indication that road connectivity alone cannot increase wealth, it should be complemented by vibrant market structure[17]. Fan and Chan-Kang (2004) investigated the quality of road in contribution to GDP in China. They found that low quality roads which are mostly rural roads has the higher potential to contribute to the Gross Domestic Product (GDP) and alleviate rural and urban poor from poverty. For this, size of market near the area is also found to be important. The authors suggest road development should be planned based on quality of road in rural and urban area. Priority to high quality road such as highways and freeways doesnot contribute to balanced development. The government should also consider giving greater priority to low-quality and rural roads in its future investment strategy[18].

#### 4. Study Area

In Nepal, there are still fifteen districts in which are not connected to the national road networks which all lies in the hilly and mountain region. Barpak and Laprak are the areas in the mountainous region in Gorkha district where the infrastructure of accessibility has not been properly managed. Laprak village still majorly dependent on the foot trails from Barpak has slow progress in village development whereas Barpak having easier road access compared to Laprak with public bus route, has seen high paced progress in development and settlement reconstruction after 2015 earthquake. Not only the direct effects that were seen due to road availability, the indirect impacts needed to be studied which would further help in planning and monitoring various road project.

Two different case of road network were selected. One is 46.2 km graveled Daraundi Link road from 12 kilo to Barpak in which travel time by public bus is 4 hours (see figure 1). When measured from Google Earth pro (2019) the elevation from sea level ranges from 457 m(12 kilo,Gorkha junction) to 1892m (Barpak) with difference of 1435m altitude height. Second stretch of road is 14.7 km Earthen road from

Barpak to Laprak in which travel time by jeep is 2.25 hours (see figure 2). The elevation from sea level ranges from 1892m (Barpak) to 2694 m(Gupsipakha) above sea level uphill and again altitude declining to 2449 m height (Sano Reislung, Laprak).

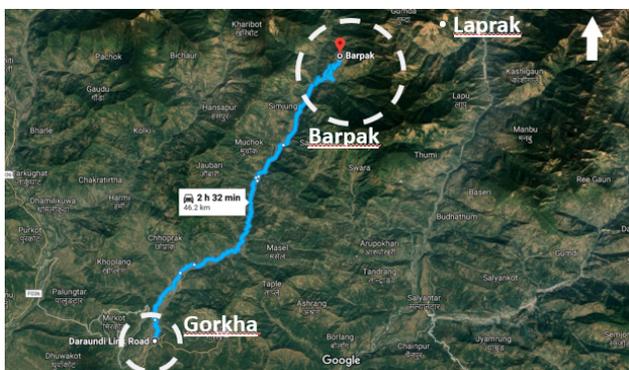


Figure 1: Gorkha junction to Barpak road

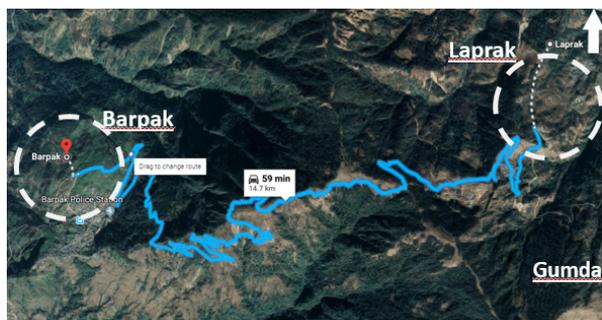


Figure 2: Barpak to Laprak road

## 5. Methodology

The ontological position in this research completely focused on subjective reality, interactions and on quality basis rather than quantity. The paradigm that suited my research was Constructivism Paradigm as the information were obtained through the interpretation between the researcher and the participants. Inductive logic was more suited which involved the search for pattern from observation and the development of explanations and finally theories for those patterns through series of hypothesis.

An extensive and investigative theoretical review of relevant literature was conducted to derive a relevant indicators. The initial established sustainable indicators were developed under three pillars i.e., the economic, environmental and socio-cultural. Consequently, the list was reduced to indicators.

The preliminary study of the case area was done and problem was identified on the first visit through

interviews and Focus group discussion. The study of similar cases was done through literature review. Secondary data collection was progressed side by side. The literature study included information and data collection of authentic sources in the internet for developing sustainable indicators. Data collection regarding topography, demography and land use information, etc was collected from journals, publications, NGOs, INGOs, etc. From the literature, set of indicators were extracted on the basis of which questionnaire were developed for field visit. The information were collected and analysed on the basis of the indicators which is listed in the table below.

Table 1: Indicators

Dimension	Indicators	Key performance indicator
Environmental	Solid waste	<ul style="list-style-type: none"> <li>Disposal method</li> <li>Frequency of Import of goods from town</li> </ul>
	Effect in nature	<ul style="list-style-type: none"> <li>Air/Noise pollution</li> <li>Health hazard from dirty road</li> <li>Landslide frequency</li> <li>Deforestation/ Reforestation frequency</li> <li>Impact on Natural sceneries</li> </ul>
	Road accidents	<ul style="list-style-type: none"> <li>Frequency of traffic problems</li> <li>Frequency of accident due to road condition</li> </ul>
	Energy Access	<ul style="list-style-type: none"> <li>Cost of Fuel/ Cost during scarcity</li> <li>Travel time for fuel purchase</li> <li>Medium of procurement</li> </ul>
	Land use	<ul style="list-style-type: none"> <li>Ribbon development pattern</li> <li>Land value</li> <li>Identity of village</li> </ul>
Socio- Cultural	Accessibility	<ul style="list-style-type: none"> <li>Transportation mode</li> <li>Transportation cost</li> </ul>
	Proximity to facilities	<ul style="list-style-type: none"> <li>Distance to market centers</li> <li>Distance to service area</li> </ul>
	Travel behavior	<ul style="list-style-type: none"> <li>Situation when vehicle is used</li> <li>Situation when people walk (with/without load)</li> </ul>
	Village norms and values	<ul style="list-style-type: none"> <li>Cultural influence from town</li> <li>Negative influence in village</li> </ul>
	Gender mainstream	<ul style="list-style-type: none"> <li>Women empowerment programs</li> <li>Travel and education of women</li> <li>Women groups and programs</li> </ul>
Economic	Economic activities	<ul style="list-style-type: none"> <li>Agricultural sell</li> <li>Non farm sector job opportunity</li> </ul>
	Market availability	<ul style="list-style-type: none"> <li>Cost of goods</li> <li>Frequency in Import/Export of agriculture goods</li> <li>Location of market</li> </ul>
	Tourism opportunity	<ul style="list-style-type: none"> <li>Increase/Decrease of tourist number after road availability</li> </ul>

Under the Qualitative method, Ethnography and phenomenology methods were also taken into consideration as some social groups formed in a society are required to study and the experience of the researched living in a certain phenomena are essential which is acquired through the interpretation between the researcher and participants. There were certain cases where quantitative method was used. The data that were collected on notes, recorders, photos, videos.

Triangulation was used to check the results for validating the data through cross verification from two or more sources. The conclusions drawn from the data collected were reduced and displayed. After required

calculations and analysis, findings were extracted followed by recommendation and conclusion.

## 6. Data collection and Analysis

The primary data was collected through field work which involved interview with 4 key informants and in depth interviews with 8 persons in each village. Observation and real life scenario was felt which included interaction with the residents, taking photographs, video recordings, tape measurement etc.

Qualitative information were analyzed through comparison with literature, and based on own reasoning of the interviews and reasoning observation.

### 6.1 Socio cultural aspect

Both the village have similar social problem after the introduction of road but Laprakies are facing more problem of unacceptable activities in the society. Problem of young girls eloping with unknown drivers and conductors and persons of far remote village of different parts of Nepal were complained by the locals. The problem of drugs and alcoholism were also seen. These type of problems were seen after the connection of village to towns through road. Other factors also effect such social problems such as lack of awareness, lack of opportunity in the village which opts them to explore outside in the towns by fleeing away with unknown persons.

The rate of mobility of villagers from Barpak have increased due to availability of public bus and better road condition whereas in Laprak there was no change in frequency in mobility as Laprakies have been using the foot trail frequently before and even after the introduction of road.

Most of the Barpakies have shifted their occupation of farming to hotel business where as in Laprak, such scenario is not seen. Easier access to Barpak leads to increase in tourism thus need of hotel and homestays resulting in shift in occupation of Barpakies.

In Laprak, road condition was also one of the factor from which travel of women was affected. The winding road with turns and curves with bumpy ride in uncomfortable and costly vehicle ride limited their mobility from village. With no load to carry, they preferred to hike 1.5 hours up to Barpak rather than to use vehicle even when they are available. In case of Barpak, easier travel of women was seen although family responsibility and household work played a

role in the travel pattern. The availability of transportation service with average road condition allowed both men and women to travel up to urban areas and market centers as per their need.

### 6.2 Services and facilities

The hospital and school in Laprak village are located uphill which takes upto 45 to 80 minutes walk from village. Due to far distance many people have left using the service. This implies that the location of required services and infrastructures should be planned keeping in mind the physical, social and cultural context of the village. They should also be planned with appropriate service distance from the main road.

From the study, it has been concluded that the water, electricity, communication service has not been affected by road till now as they were available before the road construction but cooking fuel is seen affected by road condition. The price of LPG is higher in Laprak than Barpak. In both villages, LPG supply is affected yearly during road blockage due to landslide. In Laprak, villagers use organic fertilizer in their farms. Till now chemical fertilizers has not been imported till now whose credit also goes to bad road access and before the incoming of such practices they have banned it which is one of the good initiatives.

### 6.3 Economic aspect

Road access has helped in increasing the flow of tourist in Barpak. The number of hotels has increased due to inflow of number of internal and external tourists. Had it been the good road condition in Laprak, the number of tourist would certainly increase. However the trekkers on the way to Manaslu area have changed their route going from other way due to introduction of vehicular road. The number of days spent by maximum trekkers on one stay is one day as this only the transit point of trekking. However more tourist tend to stay more number of days due to availability of vehicle as the walking time is reduced. In Barpak, due to road access and transportation service, the price of goods and household commodities is low compared to Laprak. The development of road and transport in Barpak has led to exposure to various educational and career opportunities in female thus encouraging women to get involve in other income generating activities like hotel business, shops, politics etc.

Along Barpak road, there are several junctions and nodes seen on the road linking them to other villages. In which small settlement has flourished with various economic activities like hotels, banks, restaurants, side markets and shops. The presence of market area, side market and other business activity in the road offers Barpakies with non farm activities and business. In Barpak, there is a shift in occupation of villagers even the female groups from farming to non farm activities involving in shop, mainly Hotel business, construction field etc. The development of road and transport in Barpak has led to exposure to various educational and career opportunities thus encouraging them to involve in other income generating activities. Whereas in Laprak, there are very few Hotels and occupation shift to non farm activities is not seen as much as that of Barpak.

Majority of people did not sell the agricultural products and there were very less export of agricultural products from Barpak and Laprak, However only some people quoted that better road and more buyer are also the necessary condition for better selling of agricultural produce.

### 6.4 Physical aspect

After earthquake, vehicular road access had eased the donors in providing shelter and donation in both village but the difficult road condition in Laprak affected the relief works. During monsoon due to landslide and muddy road, the relief work was disturbed.

For reconstruction of building, road has positive impact as the material and labor availability has been much easier. The rate of material was cheaper compared to the one which has to be procured by foot. In case of Laprak, CGI roofing has been used. As Barpak has easier road access than Laprak, there is drastic change in identity of village due to wide use of modern material and modern RCC technology. Only few vernacular buildings remain. This also has impact on energy use as insulation in individual house is low resulting in higher energy consumption for heating.

The agricultural land and forest area has been exploited due to road construction. There is no reforestation program or proper management to stop landslide and soil erosion in both village. In both the villages ,the settlement has sprawled along the road side. The agricultural land along the road side has been converted into built up area and is used for

commercial purpose like hotels, shops, markets.

The vehicle charge is also directly proportional to quality of road. To reach Laprak from Barpak, the jeep ride of 2.5 hours(14.2 km) is very costly i.e Rs 6000 per trip with the passenger seat of 5 person (Rs 1200 per person). This is due to bad and dangerous road condition. Whereas for 8 hours trip (176 km) from Kathmandu to Barpak the public bus charges Rs 750 per person.

The negative impacts from road development were pointed out by the respondents both in Barpak and Laprak. In case of Barpak, Majority of people said that Landslide was the main problem due to road development. This is because no extra measures to reduce major landslide parallel to the road construction has been taken till now. Villagers from both Barpak and Laprak quoted that the construction of road on the hill side made many areas vulnerable to landslide. Air and noise pollution has also been the problem in both villages but these problems were only pointed out by those who were living near the bus stops or Vehicular road. In Laprak, Majority of people said there were no negative impact in the village due to road. This is due to the far distance of village from the vehicular road. Due to easier road access and transportation in Barpak compared to Laprak and nearby market centre, there is more import and supply of modern materials and junk food packaging. These plastic wastes are thrown in the drains, burnt or disposed in a site which are causing visual hindrance. There is problem of solid waste management in Barpak than Laprak. From the study, it has been concluded that the production of solid waste is affected by road condition and transportation availability.

## 7. Conclusion

Rural roads play a crucial role in the socio economic development of rural areas. Rural roads are important medium in transforming the society. Construction of rural road result various effect in the village which may lead to transformation of rural area in physical, social, cultural and economic terms. The effects of rural road poses a challenge to policy makers who are interested in sustainable development.

In Barpak and Laprak the condition of road and access vary. The condition of the road and its vulnerability differ thus resulting in tangible and intangible effects to the livelihoods of people. Low

mobility in Laprakies can be seen due to difficult road access whereas in Barpak higher mobility is seen due to better road condition and better access than Laprak. Due to difference in mobility pattern in these two areas, similar or different effects can be seen in the particular area of research from which meaningful relation can be drawn out. Three indicators each from environmental, socio-cultural and economic dimensions were analyzed and compared from each village. In environmental dimension, solid waste management was studied in which the cause and rate of generation of solid waste up to disposal method was compared in relation to road network and rural urban dynamics. It was found out that Barpak had more problems in management of solid waste which is the cause of easier procurement of modern plastic material facilitated by easier road access than Laprak. In socio cultural dimension, the status and shift in role of women in both the villages which has been affected by the access and mobility due to availability of road, was analyzed. In Barpak, women travelled, shift in occupation of women was more and young girls had better possibilities of further studies than Laprak. In terms of economic dimension, opportunity for tourism in both the village and status of tourism sector in both village was analyzed. Barpak being an earthquake memorial there is increase in tourism and rate of increase in internal tourist because of better road and transportation facility than Laprak.

Barpak is an iconic memorial area of earthquake 2015 and there has been various plans on building memorial park, museum, etc. Various construction works are being done for the improvement of the road condition and minimize the landslide but the rate of work are slow. With better road with less risk of natural disaster in near future, the vehicular flow are bound to increase. With increased transportation, there will be increased flow of people and increased inflow of modern material in village. More amount of modern materials results in increase in waste. This effect is already seen in Barpak village where waste management and disposal problem has started and the problem will grow in future if not managed. Increasing number of incoming tourist resulting in hike in hotel business. Water pollution is also seen and may be the main problems as the open water drainage and open sewage may pollute air as well which may also lead to various diseases. The non-farm employment activities make people to engage more in modern ways of livelihood. Despite the rise in construction of infrastructures and

increment of tourist attraction centers, the negligence and degradation of environment and resource plus loss in vernacular identity of village will result in downturn in tourism industry.

## Recommendation

For starting the project of development of rural road, necessary plan and study should be done referring to areas which already has road. Impact of road need to be analyzed before construction of road. Various policies should be implemented along with the construction of new roads, create new non farm employment and extend the services for local communities by strengthening traditional institutions.

During 2015 earthquake in Nepal, many people left the Kathmandu valley and joined families in less affected areas. Though proper evacuation plan have not been implemented, people left the valley in their private cars and public bus. ([www.reliefweb.com](http://www.reliefweb.com)) In Laprak during 1999 huge landslide occurred claiming one life and destroying hectares of agricultural land. The main settlement is still in the landslide prone zone and there has been many geographical studies of the area. If the disaster is predicted , there should be proper evacuation plan for evacuating the settlement not only to the safer grounds by walking but transportation may be also required to move mass of people. The previous experience of people from landslide and recent earthquake, their needs and the consequences when they had to shift temporarily on the safer grounds should be addressed for safer rural road planning.

The study settlements are also affected by what happens in the wider landscape, at the regional, national and global levels. At national level, Safe and sustainable road development policies along with macro economic policies will help the village in maintaining sustainable urban to local linkage. Land use pattern can be controlled by various policies where improved grazing land can also be separated for production of animal products.

At the regional level, local government should find out the cause of road failures and keeping in mind the mobility of villagers local chiefs should plan and act in maintaining the access and linkage. Safe road with green road approach and sustainable transport networks should be developed which will provide maximum opportunity of export of local products as mentioned above. Laprak village, which is far from

market center can be benefitted by subsidization system for the procurement of the basic goods supply on reasonable amount. The amount paid for transportation of goods from retailer to household which covers great distance from can be subsidized by government in regional level. This will allow residents to buy the basic goods in reasonable cost. In case of Laprak, the key local products dokos, baskets, interwoven mat called Chitra by use of Nigalo, animal products and in case of Barpak a unique traditional winter portable blanket Bakhu which is hand woven by skilled women of Barpak using sheep wool can be exported by making a business out of it. These iconic product if tagged as ones those are produced from village that has once been devastated by earthquake, can get promotion in national and international market . This intangible linkage along with the better road infrastructure with better transportation facility will help in preserving the local essence of village without the need of villagers to shift in other non farm occupation. Taking an example of Hitra/Froya in Norway, by setting up a certain indigenous industry and exporting the products will demand the up gradation of road connection to national road system and thus can result to safe and better access facility.

With the approach of constructing rural roads considering environment and rural poverty alleviation measures, Green road approach is proving to be a sustainable way of constructing rural roads. Environment friendly construction techniques, participatory and decentralization approach, optimum utilization of local resources, simple technology, local capacity building and self-help efforts justified Green road approach as a best way of constructing rural roads in hill districts of Nepal.

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