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Impact of Hydropower Projects on Physical and Socio- Cultural Environment of Tribal Region of Himachal Pradesh.

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Abstract

The various elements that have a negative impact on society, had discussed. One thing has emerged in this section that human activities create obstacles in the nature of environment and presently economic development is possible only by human activities. Energy acts as a fundamental pillar for the activities of any country Renewable energy is a new phase now a day with the hydropower being an important energy source and this is possible where the turbines have been rotated after the river flow from the mountains and collect the water. In this process blocking the flow of river water created an environmental process barrier. Thus, the economic activities results from the construction of these projects, but also create many problems for the local residents and wildlife.

Keywords: Hydro power project, Economic development, Health, Eco-system.

According to the National Hydropower Association "hydropower has been used in the U.S. since the late 1800s and the origins of the technology reach back thousands of years. Ancient cultures from the Greeks to Imperial Rome to China used water-powered mills for essential activities like grinding wheat." The modern water turbine emerged in the mid-18th century. The type of turbine most commonly used today was developed in 1849 by an engineer named James Francis and the turbine was given the name Francis Turbine. Since that time, humans have harnessed falling water to power crops and sawmills, as well as a variety of other uses. The first generation has used electricity running water with a water wheel on the Fox River in Wisconsin in 1882. The storage areas at the most convenient locations were created later. The water flow rate to power station turbines was controlled by constructing the dams.

In America, Niagara Falls was the ancient hydroelectric power station built for large-scale electricity generation and is still a source of electrical power today. Hydropower continued to play an important role in the expansion of electrical services in North America and around the world earlier, hydroelectric power plants were the most efficient and trustworthy among the fossil fuels and nuclear power plants of the day. This led to a proliferation of small to medium-sized hydroelectric power stations, which were distributed wherever there was

an adequate supply of running water and a need for electricity. Over the past two decades, an accelerated pace of dam construction has been witnessed around the world, transforming the landscape and economies of nations. Most large dams have only been built in the last three decades. In 1950, 5,195 dams were built worldwide. In 1982 there were 35,000 dams, of which 34,798 dams were over 15 meters high. From 1997 to 2020 there was a moderate increase of 54 percent in the consumption of hydroelectricity.

As for hydropower, it was noted that a great deal of development was seen in those countries that were poorly endowed with solid or liquid fuel resources. In some countries such as Norway, Sweden, France, Italy and Switzerland, a high percentage of potential hydropower resources have already been developed. As per the Hydropower Status Report (2009), "China installed a maximum hydropower capacity 8540 megawatts(MW), Pakistan installed 2487 megawatts (MW), India installed 535 megawatts (MW) and Norway installed 419 megawatts (MW)

In the world is a growing demand for clean, reliable and affordable energy. Hydropower plays a very important role in poverty alleviation and sustainable development. Hydropower projects have a powerful contribution to make regional cooperation and world economy development .Hydropower has been the foremost source of renewable energy in the world.

The highlights of electricity generation during 2021 were such as;

- Electricity generation reached 4,306 terawatt hours (TWh), the highest ever contribution from a renewable energy source.
- A total of 1,308 GW of hydropower capacity was put into operation last year, including pumped storage.
- A total of 15.6 GW new capacities was added in 2021, down on the 21.8 GW recorded in 2020. This represents a 2021 rise of 1.2 percent.

The East Asia and Pacific region once again held its position as the fastest growing region with 6,463 MW hydropower installed capacity. Fastest growing regions by new installed capacity in 2021 are given below table:

Review of Literature

Tshering Dorji andPareek S. K. (2017) revealed that dependent variable and selected independent variables like housing security, electricity supply, bank, education, hospital, transportation, water, sanitation, road and telecommunication have positively or negatively impacted due to Chukha hydropower project in Bhutan. **Kichong Baraka (2018)** studied the small hydropower projects development to utilization and several benefits available from water resources in Tanzania country. The study concluded that hydropower potential is the main clean domestic energy resource option and ensure more sustainable growth to the economy.**Kougias Ioannis et al. (2019)** conducted a study on **"Analysis of emerging technologies in the hydropower sector"** and undertaken the recent research and progress activities. The study has highlighted the potential and role of hydropower in the current operating conditions. The study has suggested that minimize environmental effects and presented the footprint to environmentally friendly

installations.**Li Jiqing et al. (2020)** analysed the optimize power generation by minimizing the water consumption effectively to get more revenue from the optimal operation. They have suggested that the future scholar could take into account start-up/shut down and power plant equipment constraints in the case of most favorable operation.

Objective of the Study

1. To analyze the negative impact of hydro power projects on the physical environment and socio cultural value of the tribal people.

Research Methodology

The application of appropriate method and adoption of scientific form of mind is an essential requirement for any study. Keeping in view the said assumption, sampling element, sampling technique, the size of the sample, methodology of data collection and analysis of data have been discussed.

Source of Data

Both primary and secondary data has been used to achieve the objective ,primary data has been collected through questionnaire / schedules .secondary data has been collected from various magazines journals books.

Sampling

The universe of the study consisted of project affected area in the three development block of Kinnaur District. The multistage sampling technique has been used to frame the sample. The sample selection was done from 6 projects affected Panchayat (two projects affected panchayat from each three development blocks) from each 6 panchayat 18 villages has been randomly selected for the study (6*3=18) and 25 households was randomly taken from each selected village (18*25=450) Thus response for the study was taken from 450 respondents.

Tools and Techniques of Data Analysis

Factor analysis is used to resolve a large set of correlated variable interims of relatively few uncorrelated categories known as factor which may be further be treated as new variables. In this study it was applied on the 5point likert scale variable to obtain independent factor

Table-1 Descriptive Statistics Analysis

Variables	Mean	Std. Deviation	Analysis N
Loss of agricultural land due to soil erosion.	3.77	1.270	450
It is adversely affecting the agriculture/horticulture	3.80	1.128	450
It is adversely affecting the live stock.	3.77	1.151	450
It is shifting local people from agricultural to other activities causing reduction in agricultural/horticultural activities.	3.39	1.146	450
It is affecting local customs adversely.	3.09	1.225	450
It is creating new social evils like alcoholism, crime drugs, etc due to more inflow of tourists in such areas.	3.25	1.356	450
It is polluting local culture.	3.31	1.245	450
It is causing deterioration in the moral value of the local people.	3.46	1.290	450
It leads to deforestation in the local area.	3.62	1.183	450
It increases pollution during the construction period.	3.89	1.137	450
It adversely affects the eco system.	4.04	1.070	450
It has increased landslides.	4.07	1.119	450
It has adverse impact on wild life	3.96	1.101	450
It has adverse impact on land size pattern.	4.01	1.087	450
It enhances global warming.	4.03	.944	450
It is responsible for climate change.	4.24	.953	450
It is spoiling the purity of water.	4.01	1.038	450
It is adversely affecting horticulture.	4.09	1.083	450
It is adversely affecting grass/bushes.	3.89	1.010	450
It has adversely affected irrigation of your land.	3.98	1.096	450
It has affected soil fertility.	3.93	1.089	450
It has increased chances of floods in your area.	3.91	1.072	450
It has increased chances of damage due to earthquake.	4.02	1.071	450
It has increased chances of cloud burst.	4.02	1.002	450

Source: Data Collected through Questionnaire

Further, the calculated values of standard deviation expose high variation in the factors affecting socio economic development. Most values are concentrated on the right of the mean with extreme value to the right, Further; the mean scores for all variables have been found more than three which mean more than moderate which reveals that there is no impact of hydropower on socio economic development of people in Kinnaur district of Himachal Pradesh.

Table- 2 Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.820
Bartlett's Test of Sphericity	Approx. Chi-Square	5203.210
	Df	276
	Sig.	0.000

Table- 2 depicts the results of a Kaiser-Meyer-Olikin measure of sampling adequacy and Bartlett's test of Sphericity. The Kaiser-Meyer-Olkin (KMO) measures the sampling adequacy which should be greater than 0.5 for a satisfactory factor analysis to proceed. This measure assesses the overall significance of the correlation matrix with the Bartlett test, when taken overall; the results are significant at 1 percent level which is 5203. 210.The

Kaiser-Meyer- Olkin (KMO)measures the sampling adequacy which should be greater than 0.5 for a satisfactory factor analysis to proceed.

Table shows that the Kaiser-Meyer-Olkin measure is 0.820, which implies that the sample is adequate and factor analysis is appropriate for the data. The Bartlett's test is another indication of the strength of the relationship among variables. This tests the null hypothesis that the correlation matrix is an identity matrix in which each variable correlate perfectly with itself but has no correlation with other variables. Further, the table shows that Bartlett's test of Sphericity is significant i.e., its associated probability is less than 0.05. In fact, it is actually 0.000 i.e., the significance level is small enough to reject the null hypothesis. This means that correlation matrix is not an identify matrix. All the measures tested above, indicate that the reduced set of variables is appropriate for factor analysis.

Table-3 Communalities

Variables	Initial	Extraction
Loss of agricultural land due to soil erosion.	1.000	.757
It is adversely affecting the agriculture/horticulture	1.000	.696
It is adversely affecting the live stock.	1.000	.699
It is shifting local people from agricultural to other activities causing reduction in agricultural/horticultural activities.	1.000	.613
It is affecting local customs adversely.	1.000	.574
It is creating new social evils like alcoholism, crime drugs, etc due to more inflow of tourists in such areas.	1.000	.702
It is polluting local culture.	1.000	.682
It is causing deterioration in the moral value of the local people.	1.000	.740
It leads to deforestation in the local area.	1.000	.707
It increases pollution during the construction period.	1.000	.707
It adversely affects the eco system.	1.000	.720
It has increased landslides.	1.000	.829
It has adverse impact on wild life	1.000	.651
It has adverse impact on land size pattern.	1.000	.682
It enhances global warming.	1.000	.562
It is responsible for climate change.	1.000	.587
It is spoiling the purity of water.	1.000	.676
It is adversely affecting horticulture.	1.000	.711
It is adversely affecting grass/bushes.	1.000	.599
It has adversely affected irrigation of your land.	1.000	.608
It has affected soil fertility.	1.000	.670
It has increased chances of floods in your area.	1.000	.551
It has increased chances of damage due to earthquake.	1.000	.511
It has increased chances of cloud burst.	1.000	.585

Source: Data Collected through Questionnaire

Table-explains common differences. The table also contains all the factors that can be taken from the study, their Eigen values, the proportion of variance that can be attributed to each component, the summation form, and the variance of the previous factor. Community, which determines the total number of original variables that are shared with other variables in the study and is useful in determining the final variables obtained, was initially designed to further improve the sample size adequacy. After extraction, the average variable commonality was .657.

Table -5 Component Matrix

Variables	1	2	3	4	5	6
It is spoiling the purity of water.	.736	-.015	-.248	-.237	-.127	.031
It is responsible for climate change.	.692	-.081	-.099	.161	.154	.198
It has adversely affected irrigation of your land.	.689	.081	.263	-.077	-.215	.079
It has adverse impact on wild life	.680	-.224	.328	-.120	.019	.128
It is adversely affecting horticulture.	.679	-.067	-.199	-.252	-.337	-.166
It has increased chances of cloud burst.	.664	.203	-.245	-.023	.070	-.192
It enhances global warming.	.658	-.115	-.080	-.318	.084	.030
It has increased chances of damage due to earthquake	.640	.002	-.298	-.081	-.001	.078
It is adversely affecting grass/bushes	.634	.134	-.113	-.368	.125	-.120
It has increased chances of floods in your area	.628	-.026	-.368	.064	-.119	.043
It has adverse impact on land size pattern	.626	-.218	.381	.252	-.186	.000
It has affected soil fertility.	.598	.201	-.200	-.476	-.062	-.003
It has increased landslides.	.583	-.299	.458	.349	-.147	-.217
It adversely affects the eco system.	.579	-.270	.493	-.182	.110	.154
It is adversely affecting the agriculture/horticulture	.473	.075	-.136	.445	.425	-.263
It is causing deterioration in the moral value of the local .people	.108	.775	.265	-.186	-.150	-.015
It is creating new social evils like alcoholism, crime drugs, etc due to more inflow of tourists in such areas.	.014	.735	.306	-.206	-.153	-.046
It is polluting local culture.	.133	.735	.168	.153	-.265	-.049
It is affecting local customs adversely.	.102	.662	.344	.082	.021	.010
It increases pollution during the construction period.	.492	-.316	.511	.061	-.211	-.235
It is adversely affecting the live stock.	.438	.350	-.061	.501	.272	.235
It is shifting local people from agricultural to other activities causing reduction in agricultural/horticultural activities.	.146	.317	-.318	.480	-.075	.392
Loss of agricultural land due to soil erosion.	.382	.273	.212	.036	.653	-.252
It leads to deforestation in the local area.	.223	-.083	.437	-.104	.219	.633

The above table reveals the loadings of the twenty four variables on the six factors extracted. The higher the

absolute value of loading, the more the factor contributes to the variable.

Total Variance Explained

Table-6. explains the total variance. Further, table 4.22 shows all the factors extractable from the analysis along with their Eigen values, the percent of variance attributable to each factor, the cumulative variance of the factor and the previous factors.

Table-6 Total Variance Explained

Component	Initial Eigen Values			Extraction Sum of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	6.837	28.488	28.488	6.837	28.488	28.488	4.952	20.634	20.634
2	2.922	12.175	40.663	2.922	12.175	40.663	3.287	13.695	34.328
3	2.160	8.999	49.662	2.160	8.999	49.662	2.270	11.335	45.663
4	1.662	6.924	56.586	1.662	6.924	56.586	1.809	7.537	53.199
5	1.214	5.057	61.644	1.214	5.057	61.644	1.589	6.621	59.821
6	1.024	4.266	65.910	1.024	4.266	65.910	1.461	6.089	65.910
7	.937	3.904	69.814						
8	.779	3.247	73.062						
9	.698	2.907	75.969						
10	.624	2.600	78.568						
11	.581	2.419	80.987						
12	.571	2.380	83.368						
13	.531	2.214	85.582						
14	.489	2.040	87.621						
15	.449	1.872	89.494						
16	.437	1.820	91.314						
17	.354	1.476	92.790						
18	.321	1.337	94.128						
19	.306	1.276	95.403						
20	.275	1.148	96.551						
21	.264	1.099	97.650						
22	.233	.972	98.623						
23	.202	.843	99.466						
24	.128	.534	100.000						

Extraction Method: Principal Component Analysis.

The table reveals that, the first factor accounts for 28.488 % of the variance, the second factor 12.175 %, third factor 8.999%, fourth factor 6.924%, the fifth factor 5.057% and the value of last factor is 4.266. All the remaining factors are not significant.

Figure-shows the Scree plot, it is a graph of the Eigen values against all the factors. The graph is useful for determining how many factors to retain

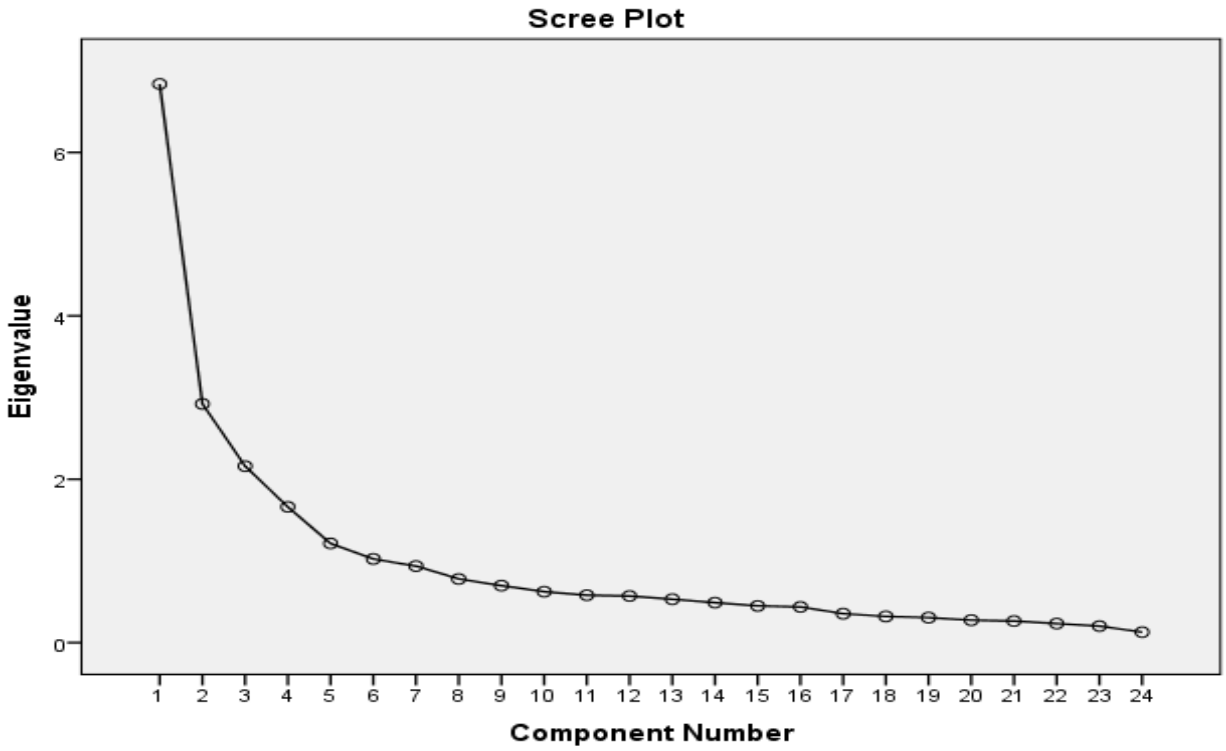

Figure- 1

Rotated Component Matrix

Table: exhibit the results of rotated component matrix. Further, the table reports that six factors are extracted through factor analysis. The rotation matrix reduces the number of factors on which the variables under investigation have high loadings.

Table-7 Table Rotated Component Matrix

	Component					
Variables	**Climate Change**	**Land Sliding**	**Adverse Impact on Society/culture**	**Migration from agriculture**	**Soil Erosion**	**Biodiversity**
It is spoiling the purity of water.	**.780**	.113	-.063	.046	.183	.122
It has affected soil fertility.	**.778**	-.016	.208	-.124	-.018	.072
It has adversely affected irrigation of your land.	**.707**	.204	.069	.236	-.074	-.030
It is adversely affecting grass/bushes.	**.706**	.077	.137	-.155	.215	.074
It enhances global warming.	**.676**	.192	-.074	-.103	.104	.203
It has increased chances of damage due to earthquake.	**.669**	.112	-.065	.198	.079	.033
It has increased chances of cloud burst.	**.648**	.141	.128	.134	.295	-.154
It has increased chances of floods in your area.	**.633**	.172	-.105	.313	.016	-..105
It is adversely affecting	**.527**	.492	-.034	.313	-.020	-.302

horticulture.						
It is responsible for climate change.	**.523**	.394	-.055	.378	-.026	.107
It has increased landslides.	.093	**.886**	-.042	.059	.173	.013
It increases pollution during the construction period.	.124	**.805**	.004	-.196	.030	.067
It has adverse impact on land size pattern.	.212	**.768**	.009	.150	.053	.150
It adversely affects the eco system.	.292	**.549**	-.024	-.178	.116	.536
It has adverse impact on wild life	.425	**.545**	-.025	-.054	.085	.402
It is causing deterioration in the moral value of the local people.	.106	-.069	**.850**	-.020	.008	.039
It is creating new social evils like alcoholism, crime drugs, etc due to more inflow of tourists in such areas.	.021	-.079	**.828**	-.092	-.014	.030
It is polluting local culture.	.028	.061	**.769**	.251	.006	-.153
It is affecting local customs adversely.	-.063	.040	**.710**	.123	.200	.094
It is shifting local people from agricultural to other activities causing reduction in agricultural/horticultural activities.	.078	-.120	.110	**.762**	-.017	-018
It is adversely affecting the live stock.	.168	.094	.187	**.649**	.434	.136
Loss of agricultural land due to soil erosion.	.172	.074	.213	-.088	**.803**	.154
It is adversely affecting the agriculture/horticulture	.221	.204	-.084	.314	**.686**	-.169
It leads to deforestation in the local area.	.014	.151	.037	.101	-.005	**.820**

Source: Data Collected through Questionnaire

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Further, table shows the loading of different statements on identified six factors. Following ten variables are loaded on first factor, (climate change), i.e., it is spoiling the purity of water, it has affected soil fertility, it has adversely affected irrigation of your land, it is adversely affecting grass/bushes, it enhances global warming, it has increased chances of damage due to earthquake, it has increased chances of cloud burst, it has increased chances of floods in your area, it is adversely affecting horticulture and it is responsible for climate change. Five variables which are loaded on second factor (land sliding) i.e., it has increased landslides, it increases pollution during the construction period, it has adverse impact on land size pattern, It adversely affects the eco-system; it has adverse impact on wild

life. Four variables which are loaded on third factor (adverse impact on society / culture) i.e., it is causing deterioration in the moral value of the local

People, it is creating new social evils like alcoholism, crime drugs, etc due to more inflow of tourists in such areas, it is polluting local culture and it is affecting local customs adversely. Two Variables which are loaded on factor fourth, (migration from agriculture), i.e., it is shifting local people from agricultural to other activities causing reduction in agricultural/horticultural and it is adversely affecting the livestock. Two Variables which are loaded on factor fifth, (soil erosion)i.e., loss of agricultural land due to soil erosion and it is adversely affecting the agriculture/horticulture. The last factor is deforestation and only one variable loaded in this factor i.e., it leads to deforestation in the local area.

Table shows the results of rotated component matrix. Variables that have a negative impact on the society after the hydro power project is set up. Further, the table reveals that six factors are extracted through factor analysis i.e, Climate Change, Land sliding, Adverse Impact on Society/culture, Migration from agriculture, soil erosion and deforestation. The rotation matrix reduces the number of factors on which the variables under investigation have high loadings of different statement on indentified six factors i.e.

Reliability Statistics:

The results of reliability statistics have been presented in table-5.15. The reliability of the construct is determined by computing the Cronbach's alpha. Cronbach's coefficient alpha value of 0.6 is considered acceptable for the exploratory purposes, 0.7 is considered adequate, and 0.8 good for confirmatory purposes.

Table-8: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha based on Standardized Items	No. of Items
0.862	0.862	24

Further, table reveals that the Cronbach alpha value based on standardized items obtained is 0.923 which shows high reliability of the scale. The overall reliability and validity of the scale as depicted by Cronbach alpha is well above 0.7, therefore it is valid to use this scale.

Conclusion

it has been found that six factors are extracted through factor analysis i.e., climate change, land sliding, adverse impact on society/ Culture, Migration from Agriculture, Soil erosion, Biodiversity in the study area.

The results of a Kaiser Meyer-Olkin measures support that factor analysis is appropriate for the data and Bartlett's test of sphercity is significant i.e., its associated probability is 0.00 which means that correlation matrix is not an identity matrix. The total variance table reveals that the first factor accounts for 28.488 of the variance the second factor 12.175, third factors 8.899, fourth factor 6.924, fifth factor 5.057 and sixth factor 4.266 while all the

remaining factors are not significant. Scree plot also reveals that only six factors are found significant further, components matrix depicts loading of twenty four variables on the six factors extracted.

Rotated Component matrix shows that only six factors have been extracted through factor analysis i.e. climate change, land sliding, adverse impact on society/ culture, migration from agriculture, soil erosion and deforestation. Factor 1 i.e. climate change comprises of ten variables which are as follows: It is spoiling the purity of water, It has affected soil fertility, It has adversely affected irrigation of your land, it is adversely affected irrigation of your land, It is adversely affecting grass/bushes, It enhances global warming, It has increased chances of damage due to earthquake, It has increased chances of cloud burst. It has increased chances of floods in your area, It is adversely affecting horticulture, It is responsible for climate change.

Factor 2 i.e. Landslides includes five variables i.e. it has increased landslides, it increases pollution during the construction period, it has adverse impact on land size pattern, It adversely affects the eco-system, it has adverse impact on wild life. Factor 3 i.e. Adverse impact on society / culture includes four variables i.e. it is causing deterioration in the moral value of the local People, it is creating new social evils like alcoholism, crime drugs, etc due to more inflow of tourists in such areas, it is polluting local culture and it is affecting local customs adversely. Factor 4 i.e. Migration from agriculture two variables i.e., it is shifting local people from agricultural to other activities causing reduction in agricultural/ horticultural and it is adversely affecting the livestock.

Factor 5 i.e. Soil erosion includes two variables i.e. loss of agricultural land due to soil erosion and it is adversely affecting the agriculture/horticulture. Factor 6 i.e. deforestation includes only one variable i.e. it leads to deforestation in the local area.

Cronbach alfha has been used to study the overall reliability and validity of the scale. The value shows by the test is above than 0.7 which implies that the scale used in the study is valid.

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