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Assessment of Positive Impacts of Hydropower ProjectS on Economic Development of Kinnaur Districts of Himachal Pradesh.

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Abstract

The large-scale construction of developmental projects such as hydropower projects, mines, national highways, industries, etc in the tribal area has put an ambiguous position in the terms of social inclusion and social exclusion of tribal communities across India. Although the development projects are meant to improve the infrastructure along with the standard of living of the people, it leads to massive displacement many times. The development projects are crucial in creating job opportunities, building new skills, increasing income and consumption levels, but sometimes they can have more adverse effects that need to be addressed(Gautam, 2017). The development may sometimes bring disparity between the people and places. If handled properly, development activities may be socially inclusive for the affected populations. These projects have also brought about many socio-economic changes related to family type, income, housing patterns, social ties, mores and culture in the lifestyle of the people affected by the project. The present study is an attempt to study the demographic profile of the projects affected families viz -a viz positive impact of hydro power projects on the livelihoods of project affected people. Hydropower projects have marginally increased job opportunities for people affected by the project. Unemployment was not a major problem in the area affected by the project as agriculture and horticulture are the two main sources of income. Since the projects were installed and put into operation, the livelihoods and marketing opportunities for the agricultural products in the project area have increased. The results of the study shows that in order to get the maximum benefit from the hydropower projects, many joint families have broken into small families, which has weaken the social support systems. Even, after hydropower projects are built, access to educational facilities in project-affected areas is difficult due to heavy snowfall and road closures in winter. The living environment in the region is changing. From this it can be concluded that the installation and commissioning of hydroelectric power projects have improved the road infrastructure, which indirectly affected the housing conditions of the people affected by the projects.

Keyword: Hydropower Project, Economic Growth, Opportunities.

Introduction

The large-scale construction of developmental projects such as hydropower projects, mines, national highways, industries, etc in the tribal area has put an ambiguous position in the terms of social inclusion and social exclusion of tribal communities across India. Although the development projects are meant to improve the infrastructure along with the standard of living of the people, it leads to massive displacement many times. Hydro-power projects, a renewable source of energy, are a major source of energy in many countries. The developmental activities are of paramount importance for the economy of the country and overall for the national progress. The development projects are crucial in creating job opportunities, building new skills, increasing income and consumption levels, but sometimes they can have more adverse effects that need to be addressed(Gautam, 2017). The development may sometimes bring disparity between the people and places. If handled properly, development activities may be socially inclusive for the affected populations. Gautam (2017) stated that the huge dam associated with hydropower generation leads to submergence of agricultural fields and forests that brings ecological changes in the affected area. The dams also bring demographic changes leaving its impact on the quality of life of the people living in its vicinity. With the construction of large dams for the generation of hydroelectricity, millions of people suffer due to displacement. According to Balzani, Credi& Venturi (2008), "Energy is the most important issue of the 21st century. About 85 % of our energy comes from fossil fuels, a finite resource unevenly distributed beneath the Earth's surface."By using the basic primary energy available on this planet, i.e. the potential and kinetic energy, modern electricity is generated. The combination of both energies is supposed to do work to generate electricity. "Hydropower is the largest source of renewable energy and it is derived from the energy of water moving from higher to lower elevations. It is a proven, mature, predictable, and typically price-competitive technology" (Edenhofer et al., 2011). These sources can be roughly divided into two groups, namely renewable sources and non-renewable sources.

Objective of The Study

1. To study the positive impact of hydro power projects on the social economic status of the people and infrastructure development of the tribal region under study.

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

Gender-Wise Distribution of Respondents:

Gender is an important variable in understanding the rational roles and functions assigned to women in a given society. Gender distribution helps researchers understand the level of awareness, the level of education, the level of participation of men and women in certain phenomena.

Table-1: Gender Wise Distribution of Respondents:

Gender	Frequency	Percent
Male	314	69.8
Female	136	30.2
Total	**450**	**100.0**

Source: Data Collected through Questionnaire

It is evident from the table-1 and that majority of the male respondents higher than female respondents, which is 314 (69.8%) male and 136 (30.2%) female respectively.
It is due to patriarchal system majority of women's, are participate in hydropower project as compared to men.

Age-Wise Distribution of Kinnaur District's Respondents:

Each age group has different characteristics, and the level of impact of development projects may vary among different age groups. Coping skills and personality vulnerabilities vary across age groups. The sampled respondents belong to different age groups. Efforts have been made to present a clear and independent picture of the age distribution of the respondents in tables and figures.

Table-2 Age Wise Distribution of Respondents

Age	Frequency	Percent
Below 20 Year	68	15.1
21 to 40	206	45.8
41 to 60	129	28.7
Above 60 Years	47	10.4
Total	**450**	**100.0**

Source: Data Collected through Questionnaire

The table-2 depicts the age wise distribution of Respondents, it is observed that out of 450Respondents, 68(15.1%) belong to the below age group below 20 years. The respondents belongs to the age group of 21-40 years are younger comprise 206(45.8%), respondents followed by 41-60 years of age 129(28.7%) and 47(10.4%) above 60 years that age group above 60 years. It was found that local leaders are very active in mobilizing the local community to raise their voice against the adverse effects of hydropower projects. The participation of senior citizens in creative activities reinforces the idea of participation and use local wisdom is a very positive sign for the development of all social activities in the right and positive direction.

Table -3 Occupation Wise Distribution of respondents

Occupation	Frequency	Percent
Agriculturist	160	35.6
Entrepreneur	93	20.7
Employee	104	23.1
Student	93	20.7
Total	**450**	**100.0**

Source: Data Collected through Questionnaire

It has been observed that majority of respondents are agriculturist i.e., 35.6% as compared to employees i.e., 23.1% and students 20.7%. It reveals that percentage of agriculture occupation is highest, so, most of the people in the district working in agriculture activities

Significant Positive Impact of Hydro Power Projects: Factor Analysis

The various elements that have a positive impact on society, had discussed in this section. Hydropower projects play a significant role in the growth of the economy and Locals in the area have benefited in a few ways from the hydropower project's commissioning in the Kinnaur district.,(social development)i.e. creating awareness among people regarding their rights, creating market at door step to the local producer, saving labour /transportation cost of carrying agriculture produce to the market, helped to prevent early marriage system in the area, enhancing life style of people from traditional to modern, increased the agriculture /horticulture production, helped in improving sanitation, proper rehabilitation of the displaced households was done, created better health facilities, created better educational facilities , provides electricity to the local residents at concessional rate and created exposure to outsider world amongst local people

(Biodiversity/Environment protection),I.e. works for the conservation of wild life, works for providing irrigation facilities, ‘ provides uninterrupted electricity supply for domestic as well as commercial uses, works for the maintenance of natural resources, works for purity of drinking water, , works for forestation. (Economic growth) i.e., Job in the project has been to the affected household, increased the saving of people, enhanced the investment opportunities for the people, has created inflow of tourist in the area and enhanced the investment opportunities for the people, (Education/health) i.e., it has increased educational and health facilities network and in the area and(Infrastructure development) i.e., it has increased road network.

A 5 point likert scale has been framed comprising of 25 variables. These statements are measured in5point likert scale i.e., strongly disagree, agree, neutral, agree, strongly agree .On the basis of the responses of respondent related to different aspect factor analysis has been done to extract the factors observed variable which makes easy to measure the impact of hydropower projects. Descriptive statistics for different aspect have been presented in table 4

Table -4 Descriptive Statistics

Variables	Mean	Std. Deviation	N
Job in the project has been provided to the affected household.	2.99	1.363	450
It increased the saving of people.	2.76	1.166	450
It enhanced the investment opportunities for the people.	2.81	1.407	450
It has created inflow of tourist in the area.	2.64	1.175	450

It increased the agriculture /horticulture production.	2.47	1.403	450
It is saving labour /transportation cost of carrying agriculture produce to the market.	2.42	1.175	450
It is creating market at door step to the local producer.	2.54	1.374	450
It provides electricity to the local residents at concessional rate.	2.54	1.345	450
It has increased standard of living of the people.	2.69	1.275	450
It has created better educational facilities.	2.89	1.248	450
It has created better health facilities.	3.00	1.434	450
It has helped in improving sanitation.	2.57	1.325	450
It has created exposure to outsider world amongst local people.	2.67	1.288	450
It has helped to prevent early marriage system in the area.	2.49	1.466	450
It is enhancing life style of people from traditional to modern.	2.88	1.320	450
It is creating awareness among people regarding their rights.	2.63	1.281	450
Proper rehabilitation of the displaced households was done.	2.63	1.300	450
It has increased road network.	3.00	1.271	450
It has increased educational and health facilities network.	2.96	1.239	450
It works for purity of drinking water.	2.57	1.279	450
It works for providing irrigation facilities.	2.61	1.337	450
It works for forestation.	2.38	1.185	450
It works for the maintenance of natural resources.	2.27	1.288	450
It works for the conservation of wild life.	2.33	1.221	450
It provides uninterrupted electricity supply for domestic as well as commercial uses.	2.51	1.172	450

Source: Data Collected through Questionnaires

The mean scores for only three variables have been found 3 and all others variables less than three which reveals that there is a moderate and below moderate impact of hydropower projects in enhancing road facilities, health facilities and employment opportunities in the study area. Further, the calculated values of standard deviation expose high variation in the factors affecting socio economic development.

Table -5 Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	.924	
Bartlett's Test of Sphericity	Approx. Chi-Square	6254.597
	Df	300
	Sig.	0.000

The table -5 shows the results of Kaiser-Meyer-Olikin sampling adequacy and Bartlett's Test of Sphericity. Kaiser-Meyer-Olkin (KMO) measures sampling adequacy, which must be greater than 0.5 for satisfactory factor analysis. This measure evaluates the significance of the entire correlation matrix with Bartlett's test when accepted; the result is significant at the 1 percent level with 6254,597. Kaiser-Meyer-Olkin (KMO) measures sampling adequacy, which must be greater than 0.5 for satisfactory factor analysis. The Kaiser-Meyer-Olkin coefficient was 0.924, indicating that the sample was adequate and that the factor analysis was appropriate for the data. Bartlett's test is another indicator of the strength of the relationship between variables. This tests the hypothesis that the correlation matrix is an identity matrix in which each variable is perfectly correlated with itself but has no correlation with other variables. It shows the significance of Bartlett's Test of Sphericity, that is, the probability of association is less

than 0.05. In fact, it is 0.000, meaning that the level of significance is sufficient to reject the null hypothesis. This means that the correlation matrix is not the determinant matrix. All measures tested above show that the reduced set of variables is suitable for factor analysis.

Table -6 Communalities

Variables	Initial	Extraction
Job in the project has been to the affected household.	1.000	.694
It increased the saving of people.	1.000	.671
It enhanced the investment opportunities for the people.	1.000	.693
It has created inflow of tourist in the area.	1.000	.628
It increased the agriculture /horticulture production.	1.000	.595
It is saving labour /transportation cost of carrying agriculture produce to the market.	1.000	.546
It is creating market at door step to the local producer.	1.000	.615
It provides electricity to the local residents at concessional rate.	1.000	.576
It has increased standard of living of the people.	1.000	.395
It has created better educational facilities.	1.000	.762
It has created better health facilities.	1.000	.801
It has helped in improving sanitation.	1.000	.644
It has created exposure to outsider world amongst local people.	1.000	.657
It has helped to prevent early marriage system in the area.	1.000	.629
It is enhancing life style of people from traditional to modern.	1.000	.624
It is creating awareness among people regarding their rights.	1.000	.587
Proper rehabilitation of the displaced households was done.	1.000	.589
It has increased road network.	1.000	.536
It has increased educational and health facilities network.	1.000	.521
It works for purity of drinking water.	1.000	.619
It works for providing irrigation facilities.	1.000	.625
It works for afforestation.	1.000	.544
It works for the maintenance of natural resources.	1.000	.644
It works for the conservation of wild life.	1.000	.621
It provides uninterrupted electricity supply for domestic as well as commercial uses.	1.000	.663

Source: Data Collected through Questionnaire

Extraction Method: Principal Component Analysis

Table-6 explains common differences. The table-6 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-7 explains the total variance. Further, the table shows that 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 -7 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	10.579	42.316	42.316	10.579	42.316	42.316	5.808	23.234	42.316
2	1.385	5.538	47.854	1.385	5.538	47.854	3.434	13.735	47.854
3	1.279	5.116	52.970	1.279	5.116	52.970	2.942	11.768	52.970
4	1.161	4.645	57.615	1.161	4.645	57.615	1.964	7.857	57.615
5	1.076	4.303	61.917	1.076	4.303	61.917	1.331	5.323	61.917
6	.901	3.602	65.520						
7	.832	3.328	68.848						
8	.789	3.157	72.005						
9	.732	2.927	74.932						
10	.690	2.762	77.693						
11	.615	2.458	80.152						
12	.588	2.350	82.502						
13	.543	2.172	84.673						
14	.503	2.010	86.683						
15	.486	1.942	88.626						
16	.428	1.711	90.336						
17	.395	1.581	91.917						
18	.351	1.403	93.320						
19	.322	1.289	94.609						
20	.305	1.220	95.829						
21	.285	1.142	96.971						
22	.230	.921	97.892						
23	.210	.840	98.731						
24	.177	.706	99.438						
25	.141	.562	100.000						

Extraction Method: Principal Component Analysis.

The table 7 reveals that, the first factor accounts for 42.316 % of the variance, the second factor 5.538 %, third factor 5.116%, fourth factor 4.645% and the fifth factor 4.303%. All the remaining factors are found insignificant.

Table 8 exhibits the results of rotated component matrix. Further, the table reports that five factors are extracted through factor analysis i.e., social Development, biodiversity/ environment protection, economic Growth, Increased educational/health facilities and Infrastructure development**.** The factor analysis rotation matrix reduces the number of factors on which the variables under investigation have high loadings.

Table -8Rotated Component Matrix

	Component				
Variables	**Social Development**	**Biodiversity/ Environment Protection**	**Economic Growth**	**Increased Educational/Health**	**Infrastructure Development**
It is creating awareness among people regarding their rights.	.728	.154	.176	.056	.007
It is creating market at door step to the local producer.	**.692**	.354	.043	.079	.052
It is saving labour /transportation cost of carrying agriculture produce to the market.	**.684**	.227	.148	.069	-.022

It has helped to prevent early marriage system in the area.	.652	.318	.257	.038	.190
It is enhancing life style of people from traditional to modern.	.643	.204	.247	.328	.003
It increased the agriculture /horticulture production.	**.641**	.217	.370	-.012	-.002
It has helped in improving sanitation.	.616	.272	.252	.351	.058
Proper rehabilitation of the displaced households was done.	.615	.274	.240	.117	.252
It has created better health facilities.	.600	.196	.381	.486	.145
It has created better educational facilities.	.598	.017	.357	.485	.202
It provides electricity to the local residents at concessional rate.	**.541**	.311	.077	-.197	.376
It has created exposure to outsider world amongst local people.	.510	.119	.294	.505	-.203
It works for the conservation of wild life.	.301	**.717**	.019	.128	-.012
It works for providing irrigation facilities.	.240	**.672**	.220	.224	.132
It provides uninterrupted electricity supply for domestic as well as commercial uses.	.183	**.651**	.269	-.111	.347
It works for the maintenance of natural resources.	.330	**.609**	.285	.272	.092
It works for purity of drinking water.	.509	**.519**	.143	.263	.007
It works for afforestation.	.259	**.497**	.032	.477	-.042
Job in the project has been to the affected household.	.132	.033	**.781**	.133	.220
It increased the saving of people.	.317	.298	**.693**	-.028	.009
It enhanced the investment opportunities for the people.	.396	.416	**.599**	-.001	-.062
It has created inflow of tourist in the area.	.255	.380	.547	.111	-.326
It enhanced the investment opportunities for the people.	.296	-.048	**.397**	.224	.312
It has increased educational and health facilities network.	-.057	.207	-.038	**.615**	.307
It has increased road network.	.078	.118	.064	.173	**.694**

Source: Data Collected through Questionnaire

Extraction Method:PrincipalComponent Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 24 iterations

Further, table indicates the loading of different statements on identified five factors. Following twelve variables are loaded on first factor, i.e., (Social Development), factor it is creating awareness among people regarding their rights, it is creating market at door step to the local producer, it is saving labour /transportation cost of carrying agriculture produce to the market, it has helped to prevent early marriage system in the area, it is enhancing life style of people from traditional to modern, it increased the agriculture /horticulture production, it is helped in improving sanitation, proper rehabilitation of the displaced households was done, it has created better health facilities, it has created better educational facilities ,it provides electricity to the local residents at concessional rate and it has created exposure to outsider world amongst local people

The following six variables which are loaded on factor-second,(Biodiversity/Environment protection) It works for the conservation of wild life, It works for providing irrigation facilities, 'it provides uninterrupted electricity supply for domestic as well as commercial uses, it works for the maintenance of natural resources, It works for purity of drinking water, , it works for afforestation. In the factor-third(Economic growth) following five variables are loaded i.e., Job in the project has been to the affected household, it increased the saving of people, it enhanced the investment opportunities for the people, it has created inflow of tourist in the area and it enhanced the investment opportunities for the people, The factor-fourth(Education/health) following1 variable is loaded i.e., it has increased educational and health facilities network and in the fifth factor (Infrastructure development) one variable is loaded, i.e., it has increased road network. Further, the table reports that five factors are extracted through factor analysis i.e., social Development, biodiversity/ environment protection, economic Growth, Increased educational/health and Infrastructure Development**.** The rotation matrix reduces the number of factors on which the variables under investigation have high loadings of different statements on identified five factors i.e. Social development, biodiversity environment protection, economy growth, increased educational/ health facilities and infrastructures development

ReliabilityStatistics:

Theresultsofreliabilitystatisticshavebeenpresentedintable-5.15.ThereliabilityoftheconstructisdeterminedbycomputingtheCronbach'salpha.Cronbach's coefficient alpha value of 0.6 is considered acceptable for the exploratorypurposes,0.7 is considered adequate,and 0.8good forconfirmatorypurposes.

Table-:9 ReliabilityStatistics

Cronbach'sAlpha	Cronbach's Alpha based onStandardizedItems	No.ofItems
0.939	0.939	25

Further, table reveals that the Cronbach alpha value based on standardizeditemsobtainedis0.923whichshowshighreliabilityofthescale.Theoverallreliability and validity of the scale as depicted by Cronbach alpha is well above 0.7,thereforeit is valid to usethis scale.

Conclusion

To meet the main objective of the study, a scale has been developed, Comprising of positive Twenty five positive variables and Twenty four negative variables. These variables are measured On five-point likert scale i.e. (1) Strongly disagree (2) Disagree (3) Netural (4) Agree (5) Strongly Agree. On the basic of responses from the respondents factor analysis has been extracted from the observed variables which facilitate to measure the significant impact of Hydro Power Projects on the local habitants of Kinnaur district of H.P.

On the positive side, It has been found that five factors are extracted through factor analysis i.e., social development, Biodiversity/Environment Protection, Economic growth, increased Educational/Health facilities and Infrastructure development in KInnaur district of H.P.

The result of a Kaiser-Meyer-Onkin measures support that factor analysis is appropriate for the data and Bartlett's test if sphercity is significant i.e., its associated probability is 0.000, which means that Correlation matrix is not an identity matrix. The total variance table reveals that the first factor accounts for 42.316 of the variances, the second

factor 5.538, third factor 5.116, fourth factor 4.645 and fifth factor 4.303 while all the remaining factors are not significant Scree plot also reveals that only five factors are found significant. Further, components matrix depicts loading of twenty five variables on the five factors extracted.

Rotated Components matrix shows that only five factors have been extracted through factor analysis i.e., Social Development, biodiversity/ environment protection, economic growth increased education/ health facilities and infrastrure development factor i.e., social development comprises of twelve variables which are as follows: It is creating awareness among people regarding their rights, it is creating market at door step to the local producer, it is saving labour/ transportation cost of agriculture produce to the market. It has helped to prevent early marriage system in the area, it is enhancing life style of people from traditional to modern, it increased the agriculture/ horticulture production, it is helped in improving sanitation, proper rehabilitation of the displaced households was done. It has created better health facilities. It has created better educational facilities, it provides electricity to the local residents at concessional rate and it has created exposure to outside world almost local people.

Factor-2 i.e., Biodiversity/ Environment protection includes six statements it works for the conservation of wild life. It works for providing irrigation facilities. It provides uninterrupted electricity supply for domestic as well as commercial uses, it works for the maintenance of natural resources, it works for purity of drinking water, it works for afforestation. Factor-3 i.e., Economic growth includes five variables that is job in the project has been to the affected household, it increased the saving of people, it enhanced the investment opportunities for the people. Fourth factor i.e., Education/health includes one variables. i.e., it has increased educational and health facilities network, Fifth factor i.e., infrastructure development includes only one variables i.e., it has increased road network.

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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