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EVALUATING FACILITY DEPRIVATION IN AREAS ADJACENT TO SERLUI-B DAM, MIZORAM, INDIA

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ABSTRACT

The construction of one of Mizoram's major infrastructure projects, Serlui-B Hydel Project was intended to enhance energy production and bring about socio-economic development. However, its impact on the surrounding communities, particularly on the accessibility and availability of essential facilities remains insufficiently examined. This study evaluates the Facility Deprivation in areas adjacent to Serlui-B Dam, aiming to understand how the dam's presence has affected the villages. The study area encompasses a 10 km radius from the dam site/embankment, as specified in the "Standard Terms of Reference for EIA/EMP Reports for Projects/Activities Requiring Environmental Clearance Under EIA Notification, 2006" by the Ministry of Environment, Forest and Climate Change, Government of India. Primary data were collected using random sampling method through interviews and questionnaires. The study then measured the Deprivation Index and Facility Deprivation Index following the methodologies developed by Bhattacharjee and Wang (2011). Our findings revealed contrasting levels of deprivation, highlighting how the same project can have varying impacts on different segments of society. Disparities between rural and semi-urban areas are evident from the analysis, indicating that those who sacrifice the most for the sake of development may have benefited the least.

KEYWORDS: *Hydel Project, GIS, Deprivation Index, Facility Deprivation Index, Serlui-B*

1. INTRODUCTION

North-East India is endowed with condition favourable for harnessing hydropower because of its favourable physiographic condition and perennial river system. Hydropower project is usually introduced in the name of development, to meet the demand of our present global situation which is energy intensive and largely economized, thus necessitates harnessing of power. However, the introduction of hydropower projects in any area comes with a cost and benefit, in relation to the area concerned. The cost seems to be particularly high in the fragile landscape of young fold mountains. Introduction of dams not only affects the physical landscape in terms of land-use/land-cover but also the socio-economic conditions and demography of a region including the life of the people living in its vicinity changes drastically, as a very large portion of the forested land and agricultural field gets submerged due to construction of dams.

From a socio-economic perspective, there is key issue to consider for sustainable development of dams and reservoirs to ensure that it address the need and well-being of local communities, who are largely dependent on the natural resources for survival (World Commission on Dams, 2000) even though it may be beneficial for the nation/state as a whole. A state or a country is a sum of its entire community. If minorities suffer in the name of development, soon the entire country might suffer, as the well-being of the whole depends upon the well-being of its parts.

To understand the impact of dams on local people, we need to understand how they cope after the construction of dam. If properly executed, they have the potential to uplift and improve the region and its communities, bringing tons of opportunities to improve the quality of life with better facilities of infrastructures and potential of employment opportunities to increase their income level and raise their standard of living. But more often than not, the local communities tend to suffer the adverse effect of development disproportionately, leading to displacement, loss of livelihood, cultural significance among others. It would be important to assess the present quality of life and their deprivation index to understand their socio-economic conditions.

To assess the development of an area another important analysis that can be carried out is to study the deprivation index of a given area as it will paint a clearer picture of the development/deprivation of the communities. Deprivation index is a standardised measure of socio-economics aiming to improve understanding of social inequalities (Grussu, et.al, 2016). In other words, deprivation index is a simple tool used to study the level of deprivation or disadvantages experienced by communities. Depending upon the need of the studies, it can combine various indicators related to socio-economic factors such as, availability of educational institute, health institute, drinking water, roads or any other basic amenities which are essential in today's world to have a good quality of life. Different factors are taken into consideration depending upon the type of deprivation we want to examine. This is a powerful tool to study the disadvantages of society and determine their quality of life and standard of living.

In an effort to harness hydropower resources, the monumental development project of Serlui-B Hydel Project was launched by the Government of Mizoram. The implementation of the project resulted in the relocation of all inhabitants of Builum village to a

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new location which is 15 kilometres away. Builum and the surrounding areas were submerged by the Serlui-B Hydel Project. This resulted in a paradigm shift of the villages adjacent to the dam, particularly Builum. The tribal people have always lived in close proximity with nature and the introduction of the dam in the region has restricted their movement and relationship with nature. The construction of Serlui-B Hydel Project changed the local base level and has affected the regular flow and pattern of the Serlui-B river which poses a serious threat to the lower reaches such as decaying of river and loss of biodiversity, resulting in a bigger impact on the physical settings of the area. The change in the physical environment has brought about alteration to land-use/land-cover which affected the livelihood of majority of the people as they are heavily dependent on agriculture. The submerged agricultural area in the upper reaches of the dam which was once the backbone of the economy could no longer be replaced. In contrast, benefits accrued from the dam were marginal, pertaining mainly to flood control and meagre power supply. Due to this some of the villagers of New Builum were willing to retrogress to their prior inhabitation. The study delves deeper into the collateral effects of the construction of Serlui-B Hydel Project by assessing the Facility deprivation Index of the adjoining villages.

2. LITERATURE REVIEW

In terms of modern hydropower, dams are the primary way to manipulate a river for human benefits (International Hydropower Association, 2003). First Prime Minister of India, Pandit Nehru calls dams as “secular temples of modern India” (Elwin, 1960). As hydropower generation requires less maintenance in comparison with other types of power-generating technologies, hydro-powers are encouraged as they are not only eco-friendly but also cost-effective, and the plan can be passed on to future generations without much problem, thereby minimizing negative impacts on the environment and future well-being as it is clean energy (IHA, 2003).

Dams have positive implications, and their construction can control flooding, store water for drinking and irrigation purposes, and generate clean power (Workman, 2009). Large dams promised to solve the problem of hunger and starvation by providing irrigation, boosting food production, controlling floods, and providing much-required electricity for industrial development (Elwin, 1960). The construction of dams reduces the number of people exposed to floods (Boulange, et.al, 2021). They also provide other benefits such as power generation, recreation opportunities, and flood protection, but their social value is difficult to draw due to heterogeneity across contexts and biases in economic frameworks (Jeuland, et.al, 2020).

Hydropower projects drastically change the land-use/land-cover pattern as large areas of land are submerged for the construction of dams, leading to loss of biodiversity due to clearing of forests for development of infrastructure, leading to environmental degradation. It brings about the displacement of people from their native habitat and causes large-scale loss of traditional livelihood practices and also brings about socio-economic and demographic changes in dam-affected areas (Patwardhan, 2000; Choy, 2004). Indigenous groups most often than not are the most deprived of the facilities of development. In the name of compensation and rehabilitation, the local communities are given land that is far from their original villages, lacking in communication linkages that they enjoyed earlier (Choy, 2024). Dam projects can lead to migration and resettlement, changes in the rural economy, infrastructure, housing, community health, and relations (Tilt, et.al 2009). They can have unequal social impacts, while providing flood mitigation benefits, they can cause water allocation conflicts (Fung, et.al, 2019) and cause social disruption and involuntary resettlement (Lerer, et.al, 1999). They can also create wealth gaps at household and community levels (Wang, et.al, 2012).

While Scudder (2012) argued that the construction of large dams has been inconsistent for many reasons. The profits resulting from constructing large dams have been overvalued, while the adverse impacts are underestimated (Scudder, 2012). Their construction has a direct impact on agricultural productivity, poverty, health, electricity generation and flood control, but empirical evidence is limited and it is an emerging issue which need further research (Dillion, et.al, 2019). Dams create an adverse impact not only on the geomorphological features (Ligon et. Al., 1995) but also on socio-cultural (Cernea, 1995) and economic aspects of life (World Commission on Dam Report, 2000), and on the health (Mahapatra, 1999) of the population living near the dam sites. The inundation of land and alteration of riverine ecosystems have detrimental effects on the economic activities of the local communities. The dominant response to upstream dams has been channel narrowing, loss of biodiversity and agricultural land due to deforestation and other infrastructural activities, creation of large submergence area leading to displacement of native population (Friedman, et.al., 1998). As a result, people are no longer able to engage in conventional subsistence activities including farming, herding animals, gathering fuel wood, and harvesting forest goods (WCD, 2001).

Deprivation index is a standardised measure of socio-economics level, aiming to improve understanding of social inequalities (Grussu, et.al, 2015). It is a marker of social inequality (Pampalon, et.al, 2012) as it ranks levels of deprivation within different geographic areas (Zelenina, et.al, 2021). A Multidimensional measure of social deprivation is more strongly associated with health outcomes than a measure of poverty alone (Butler, et.al, 2013). Deprivation indices consist of factors related to occupancy/Labour market, education and immigration, with stability varying across different spatial units (Cebrecos, et.al, 2018). Access to services, racial composition, language barrier (Eiber, et.al, 2006), illiteracy, percentage of unemployment and percentage of unemployment are few simple indicators of deprivation index (Cantalejo, et.al, 2008). Deprivation indices capture more than just poverty, particularly when geography is taken into account, for both urban and rural areas (Hegerty, et.al, 2019). Deprivation indices impact socio-economic understanding by providing consistency over time and between different geographical areas through effective transformation of constituent variables (Gilthorpe, 1995) which helps to identify elements of socio-economic inequalities (Lillini, et.al, 2018), offering valuable tool for research and policy makers (Lamnisos, et.al, 2019). Deprivation indices shows that populations in deprived areas have higher mortality rates and wider inequalities in health compared to those in affluent areas (Carstairs, et.al, 1995).

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3. OBJECTIVE

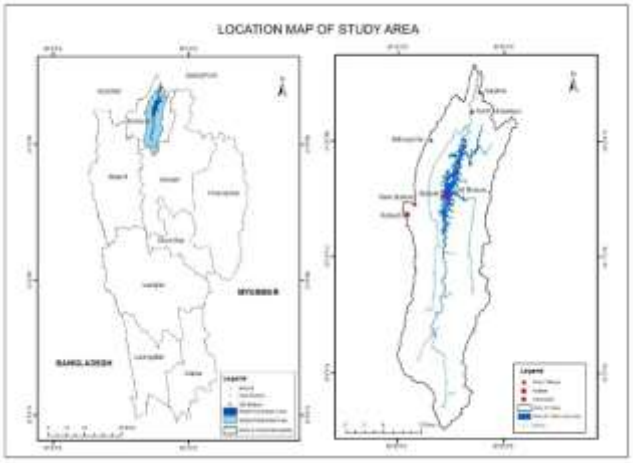
To analyse the impact of Serlui-B Hydel project on the socio-economic development of the adjoining areas using Facility Deprivation Index.

4. METHODOLOGY

The study utilises both primary and secondary data. Primary data is collected through structured questionnaires in five villages within a 10km radius of the Serlui-B Hydel Project from the dam site/embankment, as specified in the "Standard Terms of Reference for EIA/EMP Reports for Projects/Activities Requiring Environmental Clearance Under EIA Notification, 2006" by the Ministry of Environment, Forest and Climate Change, Government of India, for impact assessment. Books, journals and other e-resources are consulted to enhance the paper.

4.1 Study Area

Fig. 1: Location map of the Study Area.



The study area is located in Kolasib district of Mizoram. The dam where the river is constructed is in the Serlui-B River and falls under the Serlui-B River Basin. The river flows from south to north towards the Barak valley. The Serlui River Basin covers an area of 551.66 Sq.km, and it extends from 92º39'57.769" East to 92º51'11" East longitudes and 23º 5'8.655" to 24º20'34.319" North latitudes. The Serlui-B Hydropower Project submerges an area of 18.87 Sq.km in the lean season. The project site is in the northern corner of the state of Mizoram and in the district of Kolasib, adjacent to the state of Assam.

The ranges in Kolasib district and Mizoram as a whole run in north-south directions and because of these topographic features the pattern of rivers in the region either flows South to North or vice versa. Most of the north flowing river originated in the middle section of the state, but Serlui River Basin originated in the north and flows towards Cachar and it is part of a tributary of Barak River. The study area differs from other parts of the regions. Merging of the hills and the plains result into formation of unique drainage pattern.

4.2 Data Analysis Techniques

In order to assess the socio-economic impact of the Serlui-B Hydel Project, the study utilises the Facility Deprivation Index proposed by Bhattacharjee and Wang (2011). The methodology builds its foundation on the Deprivation Index given by:

$$DI_{jk} = \frac{Max\ (x_{.k}) - x_{jk}}{Max\ (x_{.k}) - Min\ (x_{.k})} \quad \ldots (1)$$

Where,

- j = 1, 2, 3, 4, 5 for the five villages surrounding Serlui-B Hydel Project, viz. Bilkhawthlir, New Builum, Old Builum, Saiphai, North Chawnpui
- k = 1, ..., 7 for the seven basic necessities, viz. sanitary toilet, safe drinking water, electricity supply, decent housing, all weathered road connectivity, healthcare facilities and basic education facilities
- Max ($x_{.k}$) = The percentage of household in the particular district having the best coverage of k^{th} facility
- Min ($x_{.k}$) = The percentage of household in the particular district having the worst coverage of k^{th} facility

It is important to note that all the indicators are not equally important and so a simple average of all the deprivation indices of the entire facilities may result in a less robust statistical measure. Therefore, it is necessary to assign appropriate weights to the various facilities in order to derive the aggregate deprivation of all the facilities. Thus, the weighted index of deprivation, i.e., the Facility Deprivation Index is given by:

$$FDI_{jk} = W_1 \times DI_{j1} + \cdots + W_7 \times DI_{j7}, \text{with } \sum_{k=1}^{7} W_k = 1 \quad \ldots (2)$$

Where W_k represents the weight associated with the k^{th} basic facility.

The weights of each facility are given by:

$$W_k = \frac{C}{\sqrt{Var\ (DI_{jk})}} \quad \ldots (3)$$

Where C is a normalizing constant that follows

$$C = \left[\sum_{k=1}^{7} \frac{1}{\sqrt{Var\ (DI_{jk})}} \right]^{-1} \quad \ldots (4)$$

The choice of the weights would ensure that a large variation in any one of the indicators would not dominate the contribution of the rest of the indicators (Iyengar and Sudarshan, 1982; Bhattacharjee and Wang, 2011). The Facility Deprivation Index can thus indicate the status of deprivation in a village for all the seven facilities taken together. A score of near 0 indicates the availability of basic facilities, i.e., low level of deprivation while values close to 1 indicates poor availability of basic facilities, i.e., high level of deprivation.

The study identifies seven facilities as an indicator of deprivation. They are sanitary toilet, safe drinking water, electricity supply, decent housing, all weathered road connectivity, healthcare facilities and basic education facilities. The availability and unavailability of these facilities is measured as below:

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TABLE 1: IDENTIFICATION OF FACILITIES

Facilities	Available	Unavailable
Sanitary toilet	Septic Tank	Pit Latrine
Safe drinking water	Piped water connection	Unavailable
Electricity supply	Available	Unavailable
Decent housing	RCC / Assam Type	Kutcha House
All weathered road	Available	Unavailable
Health facilities	Health & Wellness Centre / PHC	Unavailable
Education facilities	Middle School	Primary School

Source: Field Survey, 2024.

Households having only pit latrine toilet and kutcha houses were considered as not having sanitary toilet facilities and decent housing respectively. For educational facilities, having only a Primary School is considered as lacking adequate education facilities because the government is required to provide free elementary education to all children under the Right to Education Act.

5. RESULTS

The extent of coverage of basic facilities amongst the villages within the study area is as follows:

TABLE 2: COVERAGE OF BASIC FACILITIES (IN PERCENTAGE)

Villages	Facilities						
	Toilet %	Water %	Electricity %	Housing %	Road %	Health %	Education %
Bilkhawthlir	96.67	100	100	94.17	100	100	100
New Builum	36.59	100	100	73.17	100	100	0
Old Builum	14.29	0	0	21.43	0	0	0
Saiphai	88.46	100	100	88.46	100	100	100
North Chawnpui	100	100	100	100	100	100	100

Source: Field Survey, 2024.

The above field survey data showed that all households of most villages (Bilkhawthlir, New Builum, Saiphai and North Chawnpui) had safe drinking water connection, electricity supply, all weathered road connectivity and primary healthcare facilities while all households of Old Builum had none of these facilities. With regards to primary education facilities, all households of Bilkhawthlir, Saiphai and North Chawnpui had access to them while no households of New Builum and Old Builum had them. With regards to sanitary toilet and decent housing facilities, Bilkhawthlir, Saiphai and North Chawnpui had over 88% coverage while Old Builum had only 14.28% and 21.42% coverage. These simple statistics clearly reflected the immense disparity amongst villages when it comes to basic facility.

5.1. Deprivation Index

The availability of basic facilities to the households of each village can be better understood using the Deprivation Index as follows:

TABLE 3: DEPRIVATION INDEX OF VILLAGES

Villages	Deprivation Index (DI)						
	Toilet DI	Water DI	Electricity DI	Housing DI	Road DI	Health DI	Education DI
Bilkhawthlir	0.0389	0	0	0.07424	0	0	0
New Builum	0.7398	0	0	0.3415	0	0	1
Old Builum	1	1	1	1	1	1	1
Saiphai	0.1346	0	0	0.1469	0	0	0
North Chawnpui	0	0	0	0	0	0	0

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The most notable finding from the above field survey data is that Old Builum had an absolute deprivation across all facilities. The village is isolated from the adjoining areas by Chemlui river and is not accessible throughout the year due to the unavailability of bridges. During monsoon their predicament becomes even worse as they have to cross the flash flood prone river on foot, battling the strong currents with their lives on the line. Basic amenities such as electricity, water connection and health care facilities are entirely out of reach. On the other hand, North Chawnpui had absolute perfect coverage of all facilities and scores nil in the deprivation index. Bilkhawthlir also scores nil in the deprivation indices of safe drinking water, electricity supply, all weathered road and healthcare facilities and a near zero (0.03 and 0.07) in toilet and housing indices respectively.

5.2. Weighted Deprivation Index

Since all the indices are not of equal importance, weights calculated from each of their variance is assigned to them.

TABLE 4: WEIGHTS OF EACH FACILITY

Index/Facility	Weights
Sanitary toilet	0.1381923556
Safe drinking water	0.1411675413
Electricity supply	0.1411675413
Decent housing	0.1559699478
All weathered road	0.1411675413
Healthcare facilities	0.1411675413
Basic Education facilities	0.1411675413

From the above data in Table 4, the availability of decent housing had the greatest impact on the Deprivation Index while sanitary toilet had the least weightage. The weighted deprivation index of all the facilities is given in Table 5 below:

TABLE 5: WEIGHTED DEPRIVATION INDEX

Villages	Weighted Deprivation Index						
	W × Toilet DI	W × Water DI	W × Electricity DI	W × Housing DI	W × Road DI	W × Health DI	W × Education DI
Bilkhawthlir	0.0054	0	0	0.0116	0	0	0
New Builum	0.1022	0	0	0.0533	0	0	0.1412
Old Builum	0.1382	0.1412	0.1412	0.1560	0.1412	0.1412	0.1412
Saiphai	0.0186	0	0	0.0229	0	0	0
North Chawnpui	0	0	0	0	0	0	0

5.3. Facility Deprivation Index

The Facility Deprivation Index provides a weighted aggregate of all the facilities for a given village. It is calculated as a summation of all the weighted deprivation indices of all facilities, given as under:

$$FDI_j = W_1 \times DI_{j1} + ... + W_7 \times DI_{j7}$$

TABLE 6: FACILITY DEPRIVATION INDEX (FDI)

Villages	FDI
North Chawnpui	0
Bilkhawthlir	0.016953744
Saiphai	0.041507493
New Builum	0.296665441
Old Builum	0.999999999

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It can be seen form the above field survey data that North Chawnpui scored a perfect nil on the Facility Deprivation Index, indicating that it has a perfect coverage of all the seven basic facilities by all households. On the polar opposite, Old Builum scored an almost absolute maximum Facility Deprivation Index. This state of absolute destitution is because of the retrogression of some villagers from their rehabilitation site, New Builum to the old deserted Builum. This radical decision was compelled by the inaccessibility of their remote government granted agricultural fields which is situated near the old Builum over 15-20 kilometers away. The inaccessibility and detachment from the natural forest resources also exacerbated their distress. This retrogression resulted in the absence of basic provisions provided by the government. In spite of their predicament, the villagers were contented with their relocation as it provided them with easy access to their agricultural fields and allowed them to revel in the bounty of the forest resources such as firewood, herb and plants, fish and meat, etc. Bilkhawthlir and Saiphai scored a relatively low FDI which indicates their relative better coverage across all facilities. New Builum on the other hand had a slightly higher FDI score indicating a modest deprivation across all facilities since this is the new rehabilitation centre for the submerged village, although their situation is not as dire as the households of Old Builum.

6. CONCLUSION

The findings of the study clearly illustrated the disparities in facilities enjoyed by the villages surrounding Serlui-B Hydel Project. It is evident from the findings supported by the field survey data that the supposed development project initiated by the government is not equally benefited by all villages. An inference from the retrogression of villagers of old Builum is that the resettlement provided by the government posed immense hurdles to their daily lives that they would rather choose to return to their native origin even at the expense of forgoing all basic facilities. Judging from the quantitative measure of this study, the new rehabilitation site New Builum appears to be decently equipped with basic facilities. However, beyond this quantitative index lies the nuances of qualitative deprivations and disenchantment with the Serlui-B Hydel Project and their rehabilitation site. The government oversight the requirement for social rehabilitation needs such as appropriate mental acclimatization to new environments and proper human capital training in preparation for new occupational challenges. The study brings into light the need for a broader evaluation of both quantitative and qualitative human development indices while considering the potential cost and benefit of large development projects.

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