CAHIERS MAGELLANES-NS
Volume 06 Issue 2
2024

ISSN:1624-1940
DOI 10.6084/m9.figshare.26310701
http://magellanes.com/

EIA OF HYDROELECTRIC PROJECTS- LITERATURE REVIEW

Purnima Manhas[1*], Pooja Sharma[2]

[1*]Assistant Professor, Department of Environmental Sciences, Government Degree College Doda, J&k (UT).
[2]Head Department of Civil Engineering & Applied Sciences, Desh Bhagat University, Mandi Gobindgarh, Punjab.

***Corresponding author**:- Purnima Manhas
[*]Assistant Professor, Department of Environmental Sciences, Government Degree College Doda, J&k (UT).

ABSTRACT
Hydropower is reliable renewable energy but there is occasionally debate on the negative social & environmental impacts caused by hydropower projects. The EIA is an instrument which is the most important tool in achieving sustainability for such hydropower projects. An EIA takes into consideration direct or indirect effects on land, water, air, flora, fauna and the living community near the propped projects. However there are several hurdles also which obstruct the implementation of EIA regulations in most of the countries throughout the globe. Studies have been carried out by many researchers to understand the requirement of EIA for hydropower projects. This paper presents a literature review of EIA with special reference to Hydroelectric Projects in respect of some countries viz India, Pakistan, Canada, Brazil, Turkey, Colombia, Ecuador, Laos, Mexico and Kenya. The work explores researchers' perspectives in the aforementioned countries so as to improve the quality and effectiveness of EIA procedures.

INTRODUCTION
Since the recent past there has been exceptional growth in interest with regard to environmental issues and the the most significant being sustainable development. With this growing awareness the new laws and legislations have come into existence and the Environmental Impact Assessment is an important one. Environmental Impact Assessment (EIA) includes identification, analysis, evaluation, and assessment of any expected impacts on the environment (Srivastav, S.K. and Bhattacharya A.1991).The United Nations Environment Program (UNEP) defines EIA as a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. Desiree , T, 2009, suggests that the EIA process can enhance the design process, advance science, and improve interdisciplinary communication of large hydroelectric project impacts.

The EIA is conducted before the project is initiated in order to ensure that the environment is not harmed neither on short term nor on long term basis (Murthy *et al.* 2005). EIA is an effective tool in environment planning and management, which aims to maintain sustainable development (Toro *et al.,* 2013).The process of EIA essentially evaluate the anticipated impacts of a project say- mining, Hydro projects, Irrigation, road construction, tunnels etc. on human health, safety, environment along with

ISSN:1624-1940
DOI 10.6084/m9.figshare.26310701
http://magellanes.com/

socioeconomic and cultural impacts, prior to the decision making. Arild Vatn (2005) suggests that environmental issues are conflicts between interests and values, and planning and decision-making are about conflict resolution, identifying the best compromise. No doubt hydroelectric power is a renewable energy source but also have potential environmental and social impacts that need to be assessed before, during, and after their construction and operation. The hydro power projects poses both positive and negative effects on the socio-economic and environment of the area and emphasised that the potential externalities needed to be studied before the projects are taken for execution (Kohler 2007).Thus EIA for river valley projects ensures that proposed projects are assessed for their potential environmental and social impacts and that appropriate measures are taken to minimize adverse effects.

EIA in respect of river Valley Projects has emerged as a popular decision-making technique which has resulted to some extent in integrating principles of sustainable development into the planning and decision making processes in many countries. Due to its applicability, EIA has gained the attention of Environmentalists and researchers working in diverse areas, which has contributed towards a rich literature in terms of theoretical development. This paper tries to bring together existence of EIA research in respect of river Valley Projects in a concise format by discussing country wise experience of the researcher in the said field.

LITERATURE REVIEW

The operation and construction stages of Hydel Project always have impacts on environment. The public participation in planning and implementation of hydroelectric projects can serve the socio-economic and environmental interests very well (Diduck, *et al.,* 2007). In India Environmental impact evaluation (EIA) has been officially added in 1994 and it has a robust assisting legislative, administrative and procedural set-up and also highlights numerous constraints, ranging from mistaken screening and scoping tips to useless monitoring and post project assessment (Paliwal, 2006). The case studies of the Alaknanda catchment in Uttarakhand, India, highlights social and environmental issues due to dense hydropower projects but Project-specific Environmental Impact Assessment studies have not adequately addressed these environmental concerns in the ecologically sensitive region. The key drivers of EIA follow up in India are Judicairy, regulatory agency and the community but the monitoring and follow up stage has shown a consistent decine (Choudhury, 2014,). During investigation of 11 EIAs of Hydroelectric Projects in Teesta river basin, Bhatt, *et al.,* 2017, stated the impacts on fish fauna and suggested fish comprehensive conservation plan. Lata, *et al.,* 2017, in respect of Kinnaur Hydroelectric Projects (India), claimed that stress has been given to technical and economical aspects but social and environmental factors have been neglected. Sinclair, *et al.,* 2000, has also asserted that public involvement and hearing processes in India are still in their infancy stages, with concerns primarily focused on safety issues, road construction, and jobs. Rana, *et al.,* 2007, has also argued that the Uttarakhand is currently witnessing a surge in hydroelectric projects in its river valleys and almost all rivers are being harnessed for eco-friendly power generation but Lessons from the Tehri Dam have led to a preference for schemes with minimal submergence and disruption to delicate ecosystems and the observations indicate that without proper attention, even these schemes could fail. Ajoy, *et al.,* 2013, in their investigation of environmental impact in North-East India, have also focused the current state,

ISSN:1624-1940
DOI 10.6084/m9.figshare.26310701
http://magellanes.com/

degradation of the environment, and environmental management in the region.

In respect of Canada, Lewis, *et al.,* 2012,stated that the Canadian Environmental Impact Assessment protocols, evaluate the effectiveness of mitigation and compensation activities during operation and construction stage of Hydroelectric Projects and these assess the environmental effects and functions as regulatory requirements for the project proponents. Lees, J, 2014, also stated that the purpose of environmental impact assessment (EIA) is to offer stakeholders entire knowledge of a proposed project as well as the possible anticipated impacts. Gardner, *et al.,* 2015 argued that an evaluation framework was developed to examine process timelines, information, resources, flexibility, and transparency, identify process deficiencies, and make recommendations for improvement. Environmental evaluation (EE) is extensively used as a means of incorporating environmental concerns into decision-making, mostly at the undertaking stage. Noble, *et al.,* 2005, claimed that the Canadian EIA Legislations recognise the follow up in EIA process with authority that will address follow up and its implementation, thus results may help in improving the quality of environmental assessments.

The Environmental Impact Assessment (EIA) System is also considered crucial for environmental protection in Turkey due to its unique ecological conditions and increasing number of hydropower projects in Turkey has further highlighted the importance of EIA. This system was first accepted in 1983 and has undergone several revisions, including 1997, 2002, 2004, 2008, and 2014 due to EU harmonization. Bobat, A. 2017 stated that the contradictions between EIA and environmental problems in hydropower projects in Turkey and developing countries, as well as the irregularities in EIA applications cannot be ignored.

The Environmental Impact Assessment (EIA) for development projects in Pakistan includes mitigation measures and an environmental management plan (EMP). Nadeem, *et al.,* 2017, argued that no doubt that there is potential of implementing these principles in Pakistan, but immediate improvement is also required in the country. The practice of EIA varies between developed and developing countries due to cultural, economic, social, and political patterns. Abdul-Sattar, N. 2007, stated that the EIA system in developing countries is not efficient, with issues not being adequately appraised, decision-making processes not fully integrated, and findings not being thoroughly considered.

In Brazil, the impact assessment in respect of hydroelectric projects, has played significant environmental improvements by including environmental programs in EIA. Brazil's hydropower projects face environmental licensing procedures that need critical assessment. By using Strategic Environmental Assessment (SEA) in hydroelectric generation, there have been significant environmental improvements, but there are still gaps in the current process. Bragagnolo, *et al.,* 2017, claimed that no doubt, EIA has played significant role but in respect of Brazil it is ineffective, as the environmental reforms are influenced by powerful lobbies in the country. Andrade, *et al.,* 2015, stated that the, SEA, application could simplify licensing, allowing for consultations and environmental diagnosis before the planning phase.

ISSN:1624-1940
DOI 10.6084/m9.figshare.26310701
http://magellanes.com/

In their analysis of a case study on Hydroelectric Projects in Ecuador, Vallejo, *et al.,* 2019, concluded that Ecuador on shifting from fossil fuel energy to hydroelectric energy also brought new risks like socio-environmental risks.

While investigating the status of EIA follow up in Mexico, Gomez, *et al.,* 2015, claimed that EIA is being systematically applied at planning and construction stages of the Hydroelectric Projects and monitoring is carried out when it is expected that environment may get modified. Mexico's environmental protection legislation, established in 1917, is based on the general law of ecological balance and environmental protection, providing a comprehensive approach to environmental conservation.

Campbell, *et al.,* 2015, in respect of Laos, argued that, EIA processes are needed to be supported by appropriate institutional frameworks and transparent public participation and this shift would require the region to prioritize environmental and social concerns.

Aldana, A. 2012, in his analysis claimed that Colombian legislation dictates methodology, but EIS work group selects qualitative method based on legislation, technical aspects, comparison, and background, with proposed adjustments for environmental impacts. Hirji, *et al.,* 1991, claimed that the Tana and Athi Rivers Development Authority (TARDA) in Kenya has minimised effect of EIA on its decision making and the studies show evidence the inability of Environment secretariat of Kenya to get, EIA requirements complied by the proponents.

CONCLUSION

Environmental Impact Assessment (EIA) is a well-established and mature tool in environmental management, consisting of environmental indicators, reporting, and audits. But It has been observed through the instant literature review that EIA system in terms of implementation is not sufficient in most of the countries and laws and regulations in such countries related to EIA needed to be revised and more effort should be spent on follow up. Wende (2002) emphasized the correlation between the quality of Environmental Impact Assessment (EIA) reports and the proposed modifications and mitigation measures for the projects. The EIA regulations be designed more realistic and government agencies must carefully analyze the real conditions in their respective countries. No doubt EIA has evolved into a mature system but the final decision in most of the countries still the decision rests with political authorities who may approve the EIA report or turn it down in the name of better interests of the country.

REFERENCES

1. Abdul-Sattar, N. (2007). *Comparative analysis of the EIA system of developed and developing countries: Cases of hydroelectric power plants*. Gothenburg: Environmental System Analysis, Chalmers University of Technology.
2. Aldana, A. (2012, September). Environmental impact assessment (EIA) for electrical infrastructure. In *2012 Sixth IEEE/PES Transmission and Distribution: Latin America Conference and Exposition (T&D-LA)* (pp. 1-8). IEEE.

ISSN:1624-1940
DOI 10.6084/m9.figshare.26310701
http://magellanes.com/

3. Andrade, A., & Dos Santos, M. A. (2015). Hydroelectric plants environmental viability: Strategic environmental assessment application in Brazil. *Renewable and Sustainable Energy Reviews*, *52*, 1413-1423.
4. Bhatt, J. P., Tiwari, S., & Pandit, M. K. (2017). Environmental impact assessment of river valley projects in upper Teesta basin of Eastern Himalaya with special reference to fish conservation: a review. *Impact Assessment and Project Appraisal*, *35*(4), 340-350.
5. Bobat, A. (2017). Environmental impact assessment of hydropower projects in Turkey: Applications and problems. *Fresenius Environmental Bulletin*, *26*(2), 1192-1200.
6. Bonnell, S., & Storey, K. (2000). Addressing cumulative effects through strategic environmental assessment: a case study of small hydro development in Newfoundland, Canada. *Journal of Environmental Assessment Policy and Management*, *2*(04), 477-499.
7. Bragagnolo, C., Lemos, C. C., Ladle, R. J., & Pellin, A. (2017). Streamlining or sidestepping? Political pressure to revise environmental licensing and EIA in Brazil. *Environmental Impact Assessment Review*, *65*, 86-90.
8. Choudhury, N. (2014). Environment in an emerging economy: the case of environmental impact assessment follow-up in India. *Large dams in Asia: contested environments between technological hydroscapes and social resistance*, 101-124.
9. Campbell, L., Suhardiman, D., Giordano, M., & McCornick, P. G. (2015). Environmental impact assessment: theory, practice and implications for Mekong hydropower debate.
10. Desiree Tullos, Assessing the influence of environmental impact assessments on science and policy, An analysis of the Three Gorges Project: Journal of Environmental Management 90, pp. 208– 223, 2009.
11. Diduck, A., Sinclair, J., Pratap, D., & Hostetler, G. (2007). Achieving meaningful public participation in the environmental assessment of hydro development: case studies from Chamoli District, Uttarakhand, India. *Impact Assessment and Project Appraisal*, *25*(3), 219-231.
12. Gómez-Balandra, M. A., del Pilar Saldaña-Fabela, M., & Llerandi-Juárez, R. D. (2015). Environmental approaches during planning and construction stages of hydropower projects in Mexico. *Journal of Environmental Protection*, *6*(10), 1186-1195.
13. Gardner, H. L., Kirchhoff, D., & Tsuji, L. J. (2015). The Streamlining of the Kabinakagami River Hydroelectric Project Environmental Assessment: What is the" Duty to Consult" with Other Impacted Aboriginal Communities When the Co-Proponent of the Project is an Aboriginal Community?. *The International Indigenous Policy Journal*, *6*(3).
14. Hirji, R., & Ortolano, L. (1991). EIA effectiveness and mechanisms of control: case studies of water resources development in Kenya. *International Journal of Water Resources Development*, *7*(3), 154-167.
15. Lata, R., Rishi, M. S., Herojeet, R., & Dolma, K. (2017). Environmental and social impact assessment: A study of hydroelectric power projects in Satluj Basin in district Kinnaur, Himachal Pradesh, India. *International Journal of Earth Sciences and Engineering*, 270-280.
16. Lees, J. (2014). *Consideration of Uncertainties in Environmental Protection Plans and Follow-up Programs in Canadian EIA* (Doctoral dissertation, Concordia University).

ISSN:1624-1940
DOI 10.6084/m9.figshare.26310701
http://magellanes.com/

17. Lewis, F. A., Harwood, A. J., Zyla, C., Ganshorn, K. D., & Hatfield, T. (2012). Long-term aquatic monitoring protocols for new and upgraded hydroelectric projects. *DFO Canadian Science Advisory Secretariat Research Document*, *166*, 2013.
18. Nadeem, O., & Hameed, R. (2010). Exploring the potential and constraints to implementing the international best practice principles of EIA follow-up: the case of Pakistan. *Journal of American Science*, *6*(12), 108-121.
19. Paliwal, R. (2006). EIA practice in India and its evaluation using SWOT analysis. *Environmental impact assessment review*, *26*(5), 492-510.
20. Srivastav, S.K. and Bhattacharya A.1991. Remote Sensing in Lithological and structural mapping. Presented at National Workshop on role and status of Remote Sensing in Ground Water Prospecting, 4-5th Sep.1991, NRSA, Hyderabad, India.
21. Sinclair, A. J., &Diduck, A. P. (2000). Public involvement in environmental impact assessment: a case study of hydro development in Kullu District, Himachal Pradesh, India. *Impact assessment and project appraisal*, *18*(1), 63-
22. Toro, J., Requena, I., & Zamorano, M. (2010). Environmental impact assessment in Colombia: Critical analysis and proposals for improvement. *Environmental Impact Assessment Review*, *30*(4), 247-261.
23. Vallejo, M. C., Espinosa, B., Venes, F., López, V., & Anda, S. (2019). Evading sustainable development standards: Case studies on hydroelectric projects in Ecuador. In *Development Banks and Sustainability in the Andean Amazon* (pp. 175-215). Routledge.
24. Ajoy, D., Hirakjyoti, D., Amitava, R., &Writuparna, N. (2013). Environmental impact assessment and management: protecting ecology in North-East India. *Journal of Environmental Research And Development*, *7*(4).
25. Rana, N., Sati, S. P., Sundriyal, Y. P., Doval, M. M., & Juyal, N. (2007). Socio-economic and environmental implications of the hydroelectric projects in Uttarakhand Himalaya, India. *Journal of Mountain Science*, *4*, 344-353.
26. Vatn, A. (2005). Rationality, institutions and environmental policy. *Ecological economics*, *55*(2), 203-217.
27. Wende, W. (2002). Evaluation of the effectiveness and quality of environmental impact assessment in the Federal Republic of Germany. *Impact Assessment and Project Appraisal*, *20*(2), 93–99.