

# Prospectus

**Understanding the Land Use and Water Systems of the Mekong River**  
(Technical Topic)

**Assessing the Impacts of Hydropower Production on South Asian Riparian Societies**  
(STS Topic)

By

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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## **Sociotechnical Problem**

Formally established as a Communist state in 1975, The People's Democratic Republic of Laos has a short history marked by explosive growth, and with this growth has come an increasing demand for economic resources. Similar to many of its South Asian neighbors, the Government of Laos relies heavily on the Mekong, Asia's seventh largest river, to satisfy this economic demand. Currently, efforts in hydropower production in the Mekong River Basin account for 30% of the country's exports. Approximately two thirds of all hydropower produced is exported to neighbors including Vietnam and Cambodia, strengthening regional trade relations (Phomsoupha, 2009). The remaining power is used to provide electricity to Laotian communities. In addition to hydropower generation, sand mining is also an important factor in the economy, as yearly extraction totals over 2.2 million tons. Products of mining are then converted into building materials or exported to neighboring countries (Bravard, Goichot, & Gaillot, 2013).

These export generation projects are undoubtedly a major factor in Laos' ability to sustain and endure growth as a developing nation. However, river damming and excavating both negatively alter the river environment in a number of ways. For example, damming the Mekong and its tributaries severely impact sediment flow, aquatic migration patterns, and flood cycles (Nguyen, et al., 2018). Sand mining contributes to erosion of river banks and permanently changes the flow of the river. Current practices may continue to benefit Laos if used correctly, and this is especially true of hydropower given its high annual export rate, but if Laos overuses these mechanisms to the point of resource extinction it may ruin its own economic future and

stability. In this thesis I will prepare a data driven analysis on the inefficiencies of the current system and its interactions with relevant resources in order to propose a more sustainable plan of action for generating economic stability in Laos.

Hydropower generation and sand mining pose grave societal threats to inhabitants of the Mekong River Basin. While these efforts bolster the national economy and provide necessities such as electricity and building products, a harsh reality is that hydropower generation and sand mining drain the Mekong of many natural resources which inhabitants of Laos need to survive. With over 80% of Laotian households partaking in subsistence fishing, the curbing of fish migration by hydropower dams results in strained aquaculture in downstream communities (Baran, Jantunen, & Chong, 2007). Additionally, the change in sediment flow and flood cycles negatively impacts agriculture in the same areas. Without this social consideration, a solution to the Laotian economic issue may favor methods like hydropower and sand mining which carry hidden consequences to the subsistence population of Laos.

In considering both the technical and social aspects of ensuring economic future for Laos, it is evident that the solution is not as cut and dry as solving the technical or the social. In the following thesis, I prepare a data driven analysis on the efficiency and sustainability of current Laotian economic efforts. Using Technological Politics, I then analyze the impact of hydropower damming and sand mining on riparian social systems and highlight an updated viewpoint necessary to ensure quality of life for the inhabitants of the Mekong River Basin.

## Technical Problem

The employment of hydropower generation and sand mining has helped Laos achieve an 11% lift in GDP over the last 20 years (Tang & Zhu, 2018). These projects have not only carried the Laotian economy but have also helped Laos establish a reputation as a world player through foreign aid and trade agreements with countries such as China and Vietnam. While the general economy benefits from hydropower generation and sand mining, the two methods are extremely disruptive to the natural environment along the Mekong River Basin. Among the most affected are sediment flow, aquatic migration patterns, erosion, and flood cycles. These disruptions not only endanger the environment but also impact the sustainability of these economic ventures. Hydropower generation and sand mining also prove to be detrimental to each other. The damming of rivers disrupts sediment flow needed for excavation projects, and the mining of river banks decreases local water flow significantly, meaning that the use of both at once results in a gain that is lesser to the sum of the individual contributions (Ramkumar, Kumaraswamy, & Mohanraj, 2015).

The majority of current research attempts to quantify the ecological impact of damming. For example, studies have been focused on the effect of hydropower damming on the ecological diversity and variations in water flow (Nguyen, et al., 2018). However, these approaches have had difficulty disseminating between dam related effects and effects of other variables such as climate change, river mining, and urbanization. Further, current literature only considers environmental impacts and does not contextualize these costs in terms of economic development. Additionally, very little analysis has been conducted on the Mekong River, which has a unique economic situation tied to these environmental impacts. By forgoing this analysis, the government of Laos may find itself in difficult situation in which it overinvests in unsustainable

economic projects, the result of which could be crippling to its natural resources and its growth as a developing nation.

The goal of this project is to analyze the Mekong economic and environmental system through a data driven approach. By using primarily statistical modeling and cost benefit analysis, the project will deliver a model to bridge the gaps in current knowledge discussed earlier and will attribute changes in the system to specific causes unique to the Mekong situation. An emphasis will be placed on understanding the compounding and interacting effects of river damming, sand mining, and other possible contributors in order to fully understand the wide spread effects of the economic ventures on the entire resource pool. The model will add to current research by improving breadth of analysis in both contributing factors and outcomes using data and information that is specific to the country of Laos. The approach aims to then use these findings to gain a more complete picture of the environmental and economic tradeoffs of hydropower generation and river mining in Laos.

### **STS Problem**

Laos is still a nation in its infancy, and it trails the rest of the world by modern development standards. By a conservative estimate supplied by World Bank, 60% of the country is employed in the agricultural sector, and most of this figure is contributed by rice production in the southern Mekong region (Schiller, 2006). Many households rely on rice yields as a form of self-sustenance. In addition, roughly 70% of all household protein consumption can be traced to fish and aquaculture captured by the households themselves. Rice and fish products which are not directly consumed by households account for over 20% of family income (Baran, Jantunen, & Chong, 2007).

It is clear that the Laotian hydropower dams fulfill their technical purpose, as for the most part they have performed as intended by creating national revenue, a surplus of electricity, and important construction products. However, the dams also introduce a large social and political impact on the inhabitants of the Mekong River Basin. Specifically, the hydropower system concentrates wealth and power to those who control the dams, and the dams also severely constrict many natural resources which inhabitants of the river basin rely on for survival. Among the most pressing issues are migratory disruption, which severely impacts yields in downstream fish catcheries (Baran & Myschowoda, 2009). The physical altering of water and sediment flow by hydropower also ruins agricultural sites and irrigation to remote paddy areas (Brunier, Anthony, Goichot, Provansal, & Dussouillez, 2014). Hydropower then functions as a technology but also jeopardizes local agricultural and aquaculture resources which millions need to survive. The result is a sizeable impact on the social and political interactions in this region. By continuing to interpret the Mekong dam system as a purely technical system, we will miss an entire dimension of understanding power relations, resource scarcity, and riparian quality of life in the Mekong River Basin. Further, we will fail to recognize the marginalizing and uprooting effects of these dams on societies which rely on the Mekong for basic survival.

Popular academic opinion of Mekong River societies relies on Karl Wittfogel's theory of the Hydraulic Society, in which "the need for water-based societies and economies to regulate water through hydraulic management has created strong centralized hydraulic state bureaucracies" (Evers & Benedikter, 2009). However, this view focuses on the success of higher caste groups in profiting from the new hydraulic bureaucracy and infrastructure and neglects to address the negative impact on riparian societies. I argue that the application of Wittfogel's Hydraulic Society is appropriate in the sense that it addresses the political qualities of Laotian

hydropower dams but that it fails to address the marginalization of a majority of local societies along the Mekong River Basin. Additionally, the current hydropower system does not favor quality of life in the societies of the Mekong River Basin, and government economic efforts in the region severely impact the ability of individuals to provide for themselves.

My analysis of the Mekong River economic system as an imperfect system relies on the science, technology, and society (STS) concept of Technological Politics, an approach which assumes technology is inherently endowed with political qualities capable of altering the power balance between certain social groups. Important to this analysis is the concept that this bias is either intentionally or unintentionally coded into the design of the technology. In this specific context, Technological Politics will allow me to determine the current social and political impacts on marginalized river societies which are attributable to the introduction of the hydropower system into the Mekong River Basin. Additionally, we may use Technological Politics to better understand why these dams and their builders either intentionally or unintentionally cause these effects and how this may tie into the already unique political and social landscapes of Laos.

### **Conclusion**

The proposed technical research will help to identify key inefficiencies and resource concerns with hydropower generation and sand mining on the Mekong river and its tributaries. The model will involve statistical analytics and cost-benefit analysis in order to better understand the interaction between these economic projects and their economic and environmental sustainability. The STS research paper will use Technological Politics to understand the threat of hydropower dams to Laotian quality of life and food security. By doing this, insight may be

formed to understand social and political impacts associated with hydropower dams in the Mekong River Basin. The results of the technical study will contribute to the Socio-Technical problem of providing a sustainable future for both the Laotian Government and the inhabitants of the Mekong River Basin. The STS research will help contextualize this problem in terms of the basic needs of Mekong River societies, and will identify dynamics which endanger these needs. Together, the technical and STS research projects will propose a solution to Laos' economic and environmental situation, and this solution will include a proper and robust consideration of the Laotian government, the natural resources of the Mekong river, and the riparian societies of the Mekong River Basin.



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