Designing Climate-Resilient Port-Hinterland Connections: Application of Machine Learning and Optimization Techniques

Problem Description

With the ongoing impacts of climate change, the frequency and duration of low water levels in the Rhine River are increasing, posing significant challenges for inland waterway transportation (IWT). Prolonged droughts compromise the loading capacity of vessels, disrupt transport schedules, and necessitate costly and inefficient modal shifts to rail and road transport. The body of the literature is still limited, leaving a gap in long-term planning and infrastructure optimization needed to ensure resilience against future low discharge scenarios.

Objectives & Assignment

The main objective of this research is to enhance the resilience of port-hinterland connections along the Rhine River through the strategic prediction and facilitation of modal shifts to rail and road transport in response to low water levels. This will be achieved by developing advanced machine learning models to predict long-term discharge conditions and analyze their impact on vessel loading rates and IWT performance. The study will identify and optimize strategic transport hubs to support effective modal shifts, using historical discharge data, climate projections, and transport statistics. Scenario-based planning will be used to assess various low water scenarios, evaluating their economic and environmental implications, and providing insights and recommendations for transport stakeholders and policymakers to improve resilience and sustainability in Rhine River transport.

Research Group

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