Integration of Site Risk Factors for Wind Turbine Installation Location Selection Using Bivariate Fuzzy Membership Functions and Dynamic Pairwise Comparison

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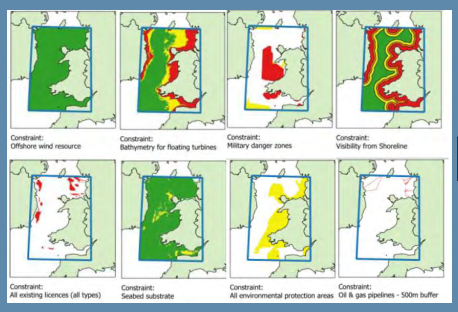
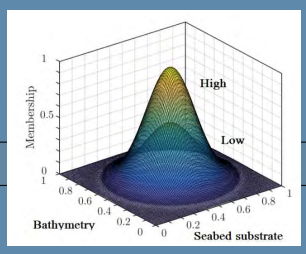
Background

The selection process for wind turbine installation locations is influenced by a multitude of factors that collectively contribute to comprehensive site risk assessment.

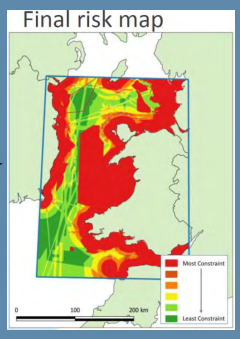
bathymetry | wind speed | protected areas | oil and gas infrastructures
visibility | shipping | seabed substrate | military danger and exercise areas

Each factor contributes to the overall risk level based on their respective values. However, the challenge lies in effectively integrating these risks to make informed decisions.





Dynamic AHP



Methodology

Traditional methods for addressing this challenge often rely on weighted linear regression. Analytical hierarchical process (AHP) is commonly used to determine these weights through pairwise comparisons. However, AHP's static pairwise comparison approach may overlook the dynamic nature of the factors and fail to capture complex relationships.

In this research, we propose a novel approach utilizing fuzzy logic and Bivariate Membership Functions (BMFs) to tackle this dynamic nature of risk assessment.

Benefits

- ✓ Enhanced Representation
- ✓ Adaptability to Changes
- ✓ Handling of Uncertainty
- ✓ Reduced Cognitive Burden
- ✓ Improved Consistency
- ✓ informed and robust decision outcomes

Outputs and conclusion

By leveraging fuzzy logic and dynamic pairwise comparison, we can better capture the complexities and dynamics of the risk factors, leading to more informed and robust site risk assessments with reduced uncertainty. Overall, our work aims to advance the understanding and application of fuzzy logic and dynamic pairwise comparison within AHP in the context of wind turbine installation location selection.