

Hybrid MCDM Framework for Sovereign AI Adoption

Kao-Yi Shen Ph.D

Professor, Chinese Culture University, Taipei, Taiwan

Nien-Ping Chen

PwC Consulting Company

Abstract:

As artificial intelligence (AI) becomes a strategic national asset, Sovereign AI has emerged as a key policy concern, yet lacks a clear academic conceptualization or systematic evaluation framework—particularly for small and medium-sized economies facing geopolitical and technological constraints. This study conceptualizes Sovereign AI as a national-level technology adoption problem and proposes a multidimensional framework encompassing political economy, law and governance, technology and infrastructure, and society and culture.

To operationalize this framework, a hybrid multi-criteria decision-making (MCDM) approach integrating DEMATEL, DEMATEL-based ANP (DANP), and VIKOR with SAW aggregation is employed. Using Singapore as an empirical case, three Sovereign AI strategies—self-built data centers, co-located national partnerships, and CSP-managed cloud models—are evaluated.

The results show that political economy and technology–infrastructure dimensions form the causal core of the Sovereign AI system, with strategic autonomy and supply chain security emerging as the most influential criteria. Across crisp and fuzzy VIKOR as well as SAW assessments, the self-built data center consistently ranks as the optimal strategy.

This finding suggests that Sovereign AI decisions are primarily driven by long-term control, resilience, and geopolitical risk mitigation rather than short-term cost or deployment convenience. The study contributes by providing a clear conceptual foundation for Sovereign AI, demonstrating the applicability of hybrid MCDM methods to national AI strategy evaluation, and offering policy-relevant insights adaptable to other national contexts.

Keywords:

Multiple criteria decision making (MCDM), DEMATEL, VIKOR, Sovereign AI.