

Mitigating the Efficiency Resilience Tradeoff in Critical Infrastructure

Built infrastructure owners must choose how to invest limited resources to maintain or improve performance. This often requires selecting operational efficiency to increase output or resilience to improve performance and recovery when the system experiences perturbation, such as from natural disasters. Recent natural disasters, such as Winter Storm Yuri in Texas, have highlighted the impacts of the efficiency-resilience tradeoff on critical infrastructure functionality. Resilience investments often reduce operational efficiency through associated costs and excess capacity and vice versa. This study modified and expanded an existing critical infrastructure model to study its disaster resilience and operational efficiency. Hypothetical efficiency and resilience improvement strategies are simulated to assess overall performance (efficiency and resilience). Simulations demonstrate the tradeoff and identify system drivers of performance. A policy to improve resilience without degrading efficiency is modeled. Results show that simultaneously improving efficiency and resilience is possible, and innovative managerial strategies that focus on adapting service delivery methods can mitigate the adverse impacts of resilience on efficiency.