

Levchenko Anna
Onikiienko Nadiia
Makovetska Iryna
Zavhorodnii Artem
Gruzd Maryna
Ovcharuk Olena

Levchenko A. Modeling Public Sector Performance as a Dynamic Queueing System: The Impact of Server Attrition and Service Rate Optimization through Training / A. Levchenko, N. Onikiienko, I. Makovetska et all. // SSRN, 2026.

Summary

Traditional static models of capacity planning in public administration often fail to capture dynamic service network complexities. This study transitions from linear capacity frameworks to a multi-server queueing paradigm, utilizing a fluid approximation model to simulate the dynamics of the active server pool and system throughput. Calibrated with empirical data from 200 public sector managers and 10 case studies, the model demonstrates how server attrition degrades operational capacity over time. Statistical analysis reveals a strong positive correlation between service rate optimization via training and overall throughput ($r = 0.72$, p less than 0.01). Multiple regression shows that service rate optimization ($\beta = 0.45$) and onboarding ($\beta = 0.30$) are critical predictors, explaining 68% of the throughput variance ($R\text{-squared} = 0.68$). The fluid model illustrates that strategic, adaptive management - specifically attrition mitigation and training - is essential to prevent queue saturation, sustain public service throughput, and support regional socio-economic growth.

Keywords: Queueing theory, public administration, capacity planning, service management, mathematical modeling, fluid approximation.