

We propose a rigorous experimental design methodology tailored for evaluating operational improvements in dynamic service systems. Our approach integrates fractional factorial designs with sequential testing procedures to efficiently identify key process parameters that influence system performance. Through a series of controlled experiments in a simulated call center environment, we demonstrate the effectiveness of our design in isolating interactions between staffing levels, customer arrival rates, and service protocols. Statistical analysis confirms that the optimized configurations can reduce customer wait times by up to 30% while maintaining cost efficiency. This work provides a robust blueprint for practitioners seeking to implement evidence-based improvements in complex operational settings.