

Using System Dynamics Modeling to Improve the Financial Performance of Rural Hospitals

C. Kalpani Dissanayake

Assistant Professor, Business & Economics,
Penn State University-Brandywine,
25, Yearsley Mill Rd, Media, PA, USA
ckd5250@psu.edu

Olufunke Oladimeji

Assistant Professor, Physics and Astronomy,
College of Charleston, Charleston, SC, USA
oladimeji0@cofc.edu

Dinesh R. Pai

Associate Professor of Supply Chain Management, School of Business Administration,
Pennsylvania State University, Harrisburg, PA, USA
drp18@psu.edu

Abstract

Rural hospitals are a crucial component of the US healthcare system as more than half of all US hospitals located in hospital regions considered as rural. Rural hospitals are faced with many challenges including low patient volumes, geographic isolation, hindrances for attracting and retaining skilled employees, and the lack of access to capital compared to their urban counterparts. Further, rural hospitals are typically more vulnerable to the effects from its rural operating environments such as: the declining population; economic stagnation; disproportionate number of elderly, poor, and underinsured residents; and high rates of chronic illness. These issues directly impact the financial performance and stability of the rural hospitals threatening their survival. Nonetheless, it is critical to maintain the rural hospital network, as one in five Americans rely on their services. This research is thus having the objective of formulating a methodology to identify systemic issues related to the financial performance of rural hospitals. The findings lead us to systematically arrive at improvement recommendations. We use Pennsylvania hospital data from 2000-2020 to demonstrate the methodological application. Initially, we identify if the Pennsylvania rural hospitals are having significantly different performances than the urban hospitals. As part of our methodology, we employ descriptive, statistical, and visual analyses to apprehend the rural hospital performance over the two-decades, and to unveil potential causal relationships. Then, we use the system dynamics (SD) modeling and analysis approach to verify and explain the significant causal relationships. The methodological demonstration ends with the recommendations for improving rural healthcare hospital systems, which are based on the SD model analysis results.

Keywords

System Dynamics Modeling, Rural Healthcare, System Dynamic Model Analysis

Biographies

Dr. Chamila Kalpani Dissanayake received her Ph.D. in Systems and Engineering Management from the Texas Tech University (TTU). She is PMP certified, has earned an MBA, and her current research interests are in the use of analytical and statistical tools for problem solving in supply chains, and health care systems. Kalpani is also interested in research related to teaching pedagogy and the integration of project and supply chain management tools for improved organizational performance.

Dr. Olufunke Oladimeji is an assistant professor of engineering at the Physics & Astronomy department at the College of Charleston. She received her bachelor's degree in Computer Engineering from Covenant University, Nigeria and her master's degree in Interdisciplinary Studies from Texas Tech University. She also completed her doctoral degree in Systems and Engineering Management at Texas Tech University. Her interest is in Performance Measurement and System Dynamics. She is a member of American Society for Engineering Management and the Institute of Industrial and Systems Engineers.

Dr. Dinesh Pai is an Associate Professor of Supply Chain Management at the School of Business Administration, Penn State University at Harrisburg. He earned his Ph.D. in Management from Rutgers University, NJ. He has several years of managerial and technical experience in the areas of marketing and operations. His research interests are in the areas of supply chain management, health care operations, business analytics, and performance evaluation.