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Optimizing Medical Supplies Warehouse Locations in Muscat for Enhanced Healthcare Supply Chain Efficiency

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Abstract

In healthcare, the location and capacity of warehouses are crucial to ensure timely delivery of essential medical supplies, reduce transportation costs, and manage demand fluctuations. This project addresses the challenge of determining the optimal number, capacity, and locations of medical supplies warehouses in Muscat, Oman, considering real-world constraints such as transportation costs, warehouse costs, and fluctuating demand. Using a discrete location optimization model and CPLEX solver, we developed a cost-effective solution that balances proximity to healthcare facilities with logistical efficiency. The solution includes both rental and newly constructed warehouses in key locations like Ghala, Mabailah, and Khoudh. Sensitivity analyses demonstrated that demand variations significantly impact warehouse decisions and costs, highlighting the importance of accurate demand forecasting. Our proposed strategy enhances supply chain responsiveness and reduces costs, contributing to a more efficient healthcare system in the region.

Keywords

Warehouse Optimization, Healthcare Logistics, Supply Chain Efficiency, Discrete Location Model, Sensitivity Analysis.

Biographies

Majid Al Jahdhami is an industrial engineering student at Sultan Qaboos University. He completed internships at OPAZ, National Pharmaceutical Industries (NPI), and Reem Batteries & Power Appliances. He has worked on various course projects where he developed skills in Linear Programming and CPLEX, SolidWorks, AutoCAD, decision analysis, project management tools, and team leadership. He aspires to work in the Oil & Gas industry and is also interested in factory operations.

Abdullah Al Kindi is an Industrial Engineering student at Sultan Qaboos University. He has gained significant experience through internships at FNSS, the Medical University Hospital, and Nama Water Services. He contributed to projects focused on Agile methodologies, quality improvement, and project management, which enhanced his skills in process optimization and teamwork, preparing him to tackle industrial engineering challenges.

Abdallah Al Madhani is an Industrial Engineering student at Sultan Qaboos University. He has experience in project management, production planning, and quality management through internships at ENOC Lubricants and the HEFD terminal. His hands-on experience has developed his skills in data analysis, facilities planning, and ergonomics. Proficient in tools like SAP, Excel, CPLEX OPL, and Python, Abdullah consistently applies innovative solutions to enhance efficiency and productivity in industrial settings.

Salah Al Balushi is an Industrial Engineering student at Sultan Qaboos University. He has completed a training program in the Operations Department at Vale Oman Pelletizing Company. Engaging in operational problem-solving and decision-making processes, he gained valuable insights into industry challenges and reinforced his technical and

analytical skills, positioning him for future leadership roles.

Dr Hakan Gultekin is an Associate Professor in the Department of Mechanical and Industrial Engineering at Sultan Qaboos University, Muscat, Oman. He earned his B.Sc, M.Sc, and Ph.D. in Industrial Engineering from Bilkent University, Türkiye, and completed his Post-Doctoral Fellowship at the University of Liege, Belgium. He has received various awards and recognition, including the Best Teacher Award in 2023, Project Performance Awards in 2015 and 2019, and the Young Researcher Career Development Award from the Scientific and Technological Research Council of Türkiye. He is a member of several professional societies, including the Industrial Engineering and Operations Management Society, the Operational Research Society of Türkiye, the European Chapter on Combinatorial Optimization (ECCO), and the EURO Working Group on Project Management and Scheduling. His research interests include scheduling, optimization modeling, and the development of exact and heuristic algorithms, particularly for problems in modern manufacturing systems, energy systems, transportation and logistics, and communication systems.