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Leveraging Lean Six Sigma Principles for Operational Excellence in Radiology Workflow Optimization

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Abstract

Radiology departments play a very pivotal role in the diagnosis of and care for patients. However, these departments predominantly suffer from inefficiencies such as long waiting times, heavy workloads, and high diagnostic rates. These result from fragmented scheduling, manual processes, and limited decision-support tools. This study proposes a transformative approach through the integration of LSS methodologies with advanced hardware and AI-driven software to enhance operational efficiency and diagnostic accuracy. It integrates the Lean principles on waste removal, Six Sigma to reduce the variability of processes, and AI tools for automating workflows and decision support. Key interventions will be the adoption of automated image scanners, AI-powered diagnostic assistance, and centralized workflow management systems to optimize scheduling, machine utilization, and radiologist productivity. Pilot implementation of these solutions will be done and further refined, with tracking of key metrics including, but not limited to, patient wait times, diagnostic accuracy, and radiologist throughput, to measure impact. The expected outcomes are: a 30% reduction in patient wait times, a 20% increase in diagnostic accuracy, and improved radiologist productivity by minimizing administrative burdens. The use of AI aims at smoothing workflows to achieve more patient satisfaction and minimize errors and thereby improve the quality of care as a whole. In summary, these findings set forth a scalable model for radiology departments to drive toward improved efficiencies and outcomes, allowing for faster and more accurate diagnoses in an increasingly demanding healthcare environment. This research underlines the potential of combining LSS and AI in solving critical challenges in radiology and improving the delivery of patient care.

Keywords

Lean Six Sigma, AI-driven Software, Diagnostic Accuracy, Workflow Optimization, Patient Wait Times

Biographies

LaTasha Starr is a distinguished engineer, educator, and entrepreneur with extensive experience in systems engineering, aerospace, and industrial process improvement. Holding master's degrees in Industrial Engineering from the University of Texas at Arlington and Human-Centered Design

Engineering from the University of Washington, as well as a bachelor's degree in Aeronautical and Industrial Technology from Tennessee State University, she has built a career at the intersection of engineering, education, and innovation. With over a decade of experience at Lockheed Martin, Starr has held key roles in project management, business development, and space systems engineering. Her expertise in Lean Six Sigma (Master Black Belt) has driven process efficiencies across aerospace and defense sectors. In academia, she has served as an engineering faculty member at Cedar Valley College and a graduate research assistant at the University of Texas at Arlington, contributing to advancements in engineering education and research. As the founder and CEO of ESTe²M Builders, Starr is dedicated to inspiring the next generation of STEM leaders through hands-on learning experiences. Her work focuses on fostering confidence, creativity, and competence in young learners through innovative STEM education initiatives. With a passion for bridging industry and education, she continues to shape the future of engineering and technology.

Noah Noronha is a driven mechanical engineering student at Texas A&M University with a strong foundation in mathematics, physics, and computational analysis. With a 4.0 GPA across both Texas A&M and community college coursework, he has completed advanced studies in calculus, differential equations, and university physics. He has secured a Co-Op position with Trane Technologies as a Systems Engineer, an opportunity rarely offered to freshmen. His responsibilities will include HVAC systems analysis and optimization, further developing his technical and problem-solving skills. Additionally, he is an intern in NASA's NCAS program, gaining hands-on experience with aerospace engineering and research. Noah's research focuses on artificial intelligence and neurodiversity in STEM, collaborating with Texas A&M faculty on a machine learning training program for high-functioning autistic individuals. His work has been accepted for presentation at the 2025 ASEE Conference in Montreal, Canada. He is also pursuing Lean Six Sigma Green Belt certification, researching process improvement in the radiology field. His involvement with ASME, where he placed third in an engineering challenge, further reflects his commitment to innovation. Through his research and industry experience, Noah aims to bridge mechanical engineering with AI-driven optimization and system efficiencies.

Ibrahim Amin is a software engineering student at Texas A&M University with a strong foundation in programming, artificial intelligence, and process optimization. With a 4.0 GPA, he has gained expertise in Python, JavaScript, and cloud computing through coursework and certifications, further enhancing his ability to apply software engineering principles to real-world challenges. He is currently involved in a research project on artificial intelligence and neurodiversity in STEM, working alongside faculty at Texas A&M University. His research focuses on leveraging machine learning to support high-functioning autistic individuals in technical careers, utilizing natural language processing to develop personalized support tools. His work has been accepted for presentation at the 2025 ASEE Conference in Montreal, Canada. Additionally, Ibrahim is pursuing Lean Six Sigma Green Belt certification, researching the application of DMAIC (Define, Measure, Analyze, Improve, Control) methodologies to process improvements in the radiology field. His findings are expected to be presented at the North American Conference on Industrial Engineering and Operations Management in 2025. With prior experience in software debugging at Glennmore Technologies and a track record of building AI-based applications, Ibrahim is committed to integrating machine learning, process optimization, and software engineering to solve complex challenges in both industry and research.

David Kadari is a biomedical engineering student at Texas A&M University with a strong foundation in programming, artificial intelligence, and process optimization. With a 4.0 GPA, he has gained expertise in Python, JavaScript, and machine learning frameworks, equipping him with the technical skills necessary to tackle complex engineering problems. He is currently involved in a research project on artificial intelligence and neurodiversity in STEM, working alongside faculty at Texas A&M University. His research focuses on leveraging machine learning to support high-functioning autistic individuals in technical careers, utilizing natural language processing to develop personalized support tools. His work has been accepted for presentation at the 2025 ASEE Conference in Montreal, Canada. Additionally, David is pursuing Lean Six Sigma Green Belt certification, researching the application of DMAIC (Define, Measure, Analyze, Improve, Control) methodologies to process improvements in the radiology field. His findings are expected to be presented at the North American Conference on Industrial Engineering and Operations Management in 2025. With a passion for software development and AI-driven solutions, David is committed to integrating machine learning, process optimization, and software engineering to create innovative and impactful advancements in both research and industry.