Abstract

The Indian Judiciary, one of the most extensive and complex legal systems globally, continues to face systemic inefficiencies that hinder its ability to deliver timely justice. Among several forums, the Motor Accident Claims Tribunal (MACT) represents the challenges of procedural delays, bottlenecks, and the urgent need for process modernization. This research investigates these inefficiencies to develop a process-driven, technology-enabled framework that enhances judicial efficiency, accessibility, and transparency. Positioned at the intersection of law, technology, and management sciences, it demonstrates how engineering approaches can address longstanding legal challenges.

The research objectives are threefold. The first focuses on developing a comprehensive real-time legal process map for MACT cases to capture the end-to-end litigation flow from filing to disposal. This map reveals hidden complexities, redundancies, and decision points contributing to procedural delays. Using this process map, a simulator is used to verify results through analysis of input data. The second objective examines the factors influencing technology adoption within the judicial ecosystem, focusing on how legal professionals perceive and respond to digital tools for court modernization. The third proposes and validates an AI-driven legal framework that retrieves legal document information through question-and-answer mechanisms from structured legal databases, enabling professionals to make informed decisions. Specifically, the proposed Retrieval-Augmented Generation (RAG) architecture will efficiently process MACT case documents, providing contextual responses for litigants and judicial officers.

This framework integrates process mapping, simulation, technology adoption analysis, and a tailored AI-driven RAG system for MACT, representing a novel contribution to the Indian

legal system. Limited previous research has established or validated a cohesive, data-driven approach for enhancing tribunal efficiency.

This study combines insights and employs a mixed-methods approach, acknowledging the complexity of the research questions and valuing diverse perspectives throughout the investigative process. Process mapping for MACT uses qualitative inputs from court observations, expert consultations, and legal document reviews. The simulation model analyzes process delays and management possibilities that shape the operations of the court system. It also highlights the potential for optimized workflows, where digital tools reduce waiting times, pendency, and litigation costs. Further, technology adoption was assessed through stakeholder surveys and interviews, and Structural Equation Modeling (PLS-SEM) was used to measure the determinants of adoption. Results identified Ease of Use and Perception and Trust as key predictors influencing judicial acceptance of digital interventions. Additionally, the Legal Expert Gemini-Integrated System – RAG (LEGIS-RAG) model, a machine learning use case, benefits from the conventional legal retrieval methods, demonstrating superior accuracy, relevance, and user satisfaction, thereby validating intelligent query handling in practical applications.

This study offers both theoretical and practical contributions. Practically, the validated MACT process map serves as a diagnostic tool for courts, policymakers, and administrators. The simulation model identifies bottlenecks and supports targeted improvements, while SEM findings inform digital adoption strategies emphasizing trust-building, training, and user-friendly design. To support the modernization of court systems, the Retrieval-Augmented Generation architecture presents an opportunity to advance the development of an intelligent, domain-specific assistant, as demonstrated by the handling of legal case documents in MACT. Theoretically, the research enriches literature on legal process reform and technology adoption in developing judicial systems, presenting a replicable model for similar domains.

Aligned with initiatives such as India's e-Courts Mission Mode Project and the UN Sustainable Development Goals (SDGs 9 and 16), the study promotes innovation, justice, and institutional strength. It underscores the need for comprehensive reform that integrates technology with institutional capacity-building to address case backlogs, jurisdictional inconsistencies, and infrastructural gaps. Continuous training, digital infrastructure enhancement, and stakeholder engagement are vital to ensure sustainability and inclusivity.

Finally, this research contributes to the development of a responsive, citizen-centric, and data-driven judiciary. By integrating process-driven methodologies such as workflow analysis, systems modeling, and AI-based decision support, it offers innovative solutions to inefficiency and inaccessibility. The findings provide a roadmap for policymakers and judicial administrators to strengthen the foundation of law-technology integration, transforming India's judiciary into a more efficient, transparent, and accessible system for all.

Keywords: Motor Accident Claims Tribunal (MACT), Process mapping, Technology adoption, Partial Least Squares Structural Equation Modeling (PLS-SEM), Retrieval – Augmented Generation (RAG), Sustainable Development Goals (SDGs), Judicial Efficiency, Court modernization.