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| RESEARCH ARTICLE

The Role of Automation in Insurance: Improving Policy and Claim Management Systems

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| ABSTRACT

This technical article examines the transformative role of automation in modernizing insurance policy and claims management systems. It traces the evolution from batch-based legacy infrastructure to real-time microservices at State Farm, where the Data Access Service project handles over 50 million annual transactions. The transformation replaced monolithic Struts and DB2 systems with Spring Boot services and cloud-native architecture, achieving 98% success in automated renewals while reducing response times by 40%. Key technical innovations include optimized caching strategies, parallelized data access, and intelligent health checks maintaining 99.99% uptime. These improvements delivered tangible business benefits: accelerated claims processing, reduced manual interventions, enhanced customer satisfaction, and more reliable policy renewals. Beyond operational efficiency, these advancements contribute to broader societal trust in financial services by enabling faster emergency support and improving financial stability for both insurers and policyholders.

| KEYWORDS

Automation, Insurance Technology, Microservices, Policy Management, Claims Processing

| ARTICLE INFORMATION

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1. Introduction

Insurance technology is undergoing a dramatic shift from batch-based legacy processing to real-time microservices and automation. This transformation is fundamentally changing how insurers process policies, handle claims, and interact with customers. The modernization of backend systems has proven to improve not just operational performance metrics but also contributes to greater societal trust in financial services.

According to the Insurtech Global Outlook 2025, the insurance sector is witnessing unprecedented technological advancement, with global investment in insurtech reaching $7.1 billion across 377 deals in 2023 alone [1]. The industry's focus has notably shifted toward operational efficiency, with 67% of insurers prioritizing cost reduction through automation and 63% focusing on improving customer experience through digital channels. This represents the industry's strategic response to evolving market dynamics and changing consumer expectations in an increasingly digital landscape.

The transition to microservices architecture has delivered tangible performance improvements throughout the insurance value chain. Modern systems have reduced policy issuance timeframes by up to 80% and decreased claims settlement cycles from weeks to days or even hours in straightforward cases [2]. These efficiency gains directly translate to enhanced customer satisfaction, with digital-first insurers reporting Net Promoter Scores averaging 15-20 points higher than traditional competitors.

The societal impact extends beyond operational metrics, as digital transformation in insurance enables more personalized risk assessment and fairer pricing models. Advanced technologies like AI and machine learning now permit insurers to process unstructured data 60% faster than traditional methods, allowing for more accurate underwriting decisions [2]. Furthermore,

approximately 71% of insurance executives report that modernization efforts have improved transparency in customer communications, fostering greater trust in an industry historically challenged by perception issues.

2. Project Scope and Scale

The Data Access Service project at State Farm managed over 50 million policy transactions annually. These transactions encompassed a wide range of critical insurance operations including policy quotes, renewals, claim submissions, and payments—many of which were time-sensitive and had significant financial implications for both the company and policyholders.

State Farm's massive operational scale exemplifies the challenges facing major insurers in the digital age. As the largest property and casualty insurance provider in the United States, their mainframe systems were processing an extraordinary volume of business-critical transactions daily. This infrastructure supported not only customer-facing operations but also the complex backend processes necessary for actuarial analysis, risk assessment, and financial reconciliation [3]. The legacy mainframe environment handled these massive workloads but faced increasing pressure from business demands for greater agility and scalability—particularly during catastrophic events when claim submission volumes could surge dramatically.

The modernization journey, as documented in State Farm's cloud transformation initiative, involved transitioning these high-volume transaction processes from traditional mainframe architecture to more flexible cloud-based systems. This strategic shift aimed to enhance operational efficiency while maintaining the strict performance requirements necessary for time-sensitive insurance operations [3]. By implementing a comprehensive orchestration approach that bridged legacy and modern systems, State Farm created a hybrid infrastructure capable of handling their enormous transaction volumes with improved reliability and significant cost savings compared to their previous environment.

The financial implications of these transactions extend beyond the immediate operational concerns. Insurance transactions require sophisticated monitoring systems to ensure compliance with regulatory requirements while preventing potentially fraudulent activities [4]. For large carriers like State Farm, each transaction must be evaluated against complex risk models and legal frameworks that vary by jurisdiction, product type, and customer profile. Modern transaction monitoring systems must analyze patterns across millions of data points to identify potential issues requiring further investigation, with false positives creating significant operational challenges and customer friction [4].

The time-sensitivity of these transactions varies considerably across different insurance operations. Policy quotes require near-instantaneous processing to remain competitive in today's market, while claims processing follows strict timelines governed by state insurance regulations. Payment operations demand particularly robust oversight to comply with anti-money laundering requirements and other financial regulations [4]. To address these varied requirements, modern transaction systems implement risk-based approaches that apply appropriate scrutiny based on transaction characteristics, customer history, and regulatory requirements.

The scale of State Farm's transaction environment—processing over 137,000 daily operations across diverse product lines—demonstrates why legacy system modernization has become imperative for large insurers seeking to maintain market competitiveness. By transforming their transaction processing capabilities through cloud-native architectures and enhanced monitoring systems, State Farm has positioned itself to manage its enormous transaction volumes with greater efficiency and reduced operational risk [3].

Transaction Type	Volume (Annual)	Time Sensitivity	Financial Impact
Policy Quotes	12.5 million	High (seconds)	Medium
Policy Renewals	18.7 million	Medium (days)	High
Claim Submissions	8.3 million	High (hours)	High
Premium Payments	10.5 million	Medium (days)	Medium

Table for Section 2: Project Scope and Scale [3, 4]

3. Technology Transformation

Legacy monolithic systems built on Struts and DB2 were replaced with Spring Boot services and a modern cloud-native architecture. This shift represented a fundamental change in how insurance data systems were designed, deployed, and maintained, moving away from rigid structures toward more flexible and scalable solutions.

The insurance industry, like many financial service sectors, has historically operated on aging technological infrastructure. According to Deloitte's analysis of the financial services landscape, approximately 70% of insurers and banks continue to rely on legacy systems that average 20-30 years in age, with core processing platforms often dating back to the 1980s and 1990s [5]. These monolithic environments, built on technologies like Apache Struts and IBM DB2, have become increasingly difficult to maintain and adapt to changing market conditions. Organizations report that maintenance of these legacy systems typically consumes between 60-80% of IT budgets, creating a technological debt trap that constrains innovation and competitive responsiveness [5].

The fundamental challenges of these monolithic architectures stem from their tightly coupled design. When insurance companies needed to implement even modest changes to policy management or claims processing modules, entire application stacks required comprehensive regression testing—leading to deployment cycles measured in months rather than days. According to Deloitte's research on modernization initiatives in financial services, organizations that successfully transitioned away from monolithic architectures reported a 2-3x improvement in their speed to market for new products and services [5].

Spring Boot microservices architecture offers a compelling alternative approach that addresses these limitations through decomposition of complex systems into independently deployable services organized around business capabilities [6]. This architectural pattern enables insurance companies to implement changes to specific business functions—such as policy quoting, claims submission, or customer authentication—without risking disruption to the entire application ecosystem. Each microservice maintains its dedicated data storage, typically leveraging NoSQL or specialized relational databases optimized for specific workloads rather than relying on monolithic database systems like DB2 [6].

The cloud-native dimension of this transformation provides additional benefits through dynamic resource allocation and infrastructure automation. Rather than maintaining fixed-capacity data centers sized for peak loads, modern insurance systems can scale individual services elastically based on actual demand patterns. This capability is particularly valuable for insurance operations that experience significant seasonal variability or catastrophe-driven surge events. The leading patterns for microservices communication, including both synchronous REST APIs and asynchronous message-driven architectures, enable more resilient interactions between system components [6].

This technological transformation has profound implications for operational agility. Insurance companies implementing microservices report significant improvements in deployment frequency, with leading organizations achieving multiple production releases per day compared to quarterly or semi-annual update cycles in traditional environments. The isolated nature of these services also dramatically improves fault isolation and system resilience, as failures in individual components no longer cascade through entire application ecosystems [6].

4. Performance Objectives

One of the critical goals of the modernization initiative was maintaining 98% success in automated renewals while simultaneously reducing average response time by 40%. These metrics were carefully selected to balance efficient operations with reliable service delivery in a domain where failures could have significant consequences.

The insurance industry's digital transformation has been driven by both competitive pressures and changing customer expectations. Research published in ResearchGate's analysis of digital transformation in the insurance sector indicates that modern policyholders increasingly expect digital interactions to match experiences they receive from other service providers, with response time and process reliability serving as key differentiators in customer retention [7]. The study further reveals that insurance companies successfully implementing end-to-end digital renewal processes achieve customer satisfaction ratings 27% higher than those with fragmented or partially automated systems, directly impacting both retention rates and customer lifetime value metrics.

For established insurers, the technical challenges of maintaining high reliability while significantly improving performance are substantial. According to the research, approximately 65% of insurance digital transformation initiatives face implementation challenges when attempting to simultaneously improve both reliability and performance metrics [7]. The modernization approach needed to overcome traditional trade-offs between system stability and response times—a particularly difficult balance when handling the complexity of insurance policy renewals, which involve multiple integration points with payment systems, risk assessment engines, and regulatory compliance verification services.

The consequences of renewal process failures extend far beyond immediate customer frustration. As outlined in Science Direct's research on reliability engineering, system failures in critical financial transactions can trigger cascading impacts across multiple business domains [8]. The reliability engineering principles applied to insurance renewal processes employ systematic approaches for identifying failure modes, creating fault tolerance through redundancy, and developing recovery mechanisms that maintain service continuity. The research demonstrates that organizations implementing a formal reliability engineering approach can reduce critical system failures by 76% compared to those using traditional quality assurance methods alone [8].

The 98% success target for automated renewals reflects an understanding of the "error budget" concept from site reliability engineering—acknowledging that pursuing 100% reliability often leads to diminishing returns and innovation paralysis. The 40% response time improvement target was established based on performance engineering principles that correlate transaction speed with both customer satisfaction and operational efficiency [8]. By employing a mathematical approach to defining service level objectives (SLOs) for each component in the renewal process chain, the modernization initiative could optimize resource allocation toward the most impactful improvements.

This careful balancing of performance and reliability objectives represents a sophisticated application of digital transformation principles in the insurance sector. The approach recognizes that system performance must be viewed holistically across technical metrics, business outcomes, and customer experience dimensions [7]. The modernization initiative thus established measurement frameworks that connected technical indicators like response time and success rate to broader business metrics including renewal rate, customer satisfaction, and operational efficiency.

Performance Metric	Legacy System	Target Performance	Business Impact
Automated Renewal Success	93%	98%	Revenue stability, regulatory compliance
Average Response Time	4.7 seconds	2.8 seconds	Customer satisfaction, digital adoption
System Availability	99.9%	99.99%	Service reliability, reputation management
Manual Exception Rate	22%	7%	Operational efficiency, cost reduction

Table 2: Performance Objectives [7, 8]

5. Automation Implementation

Automation played a key role in both policy processing and incident management. The engineering team introduced several technical innovations to support this automation: caching strategies to reduce database load, parallelized data access to improve throughput, and intelligent health checks to maintain 99.99% uptime.

The implementation of distributed caching architectures represented a foundational element in the automation strategy. As demonstrated in recent research on insurance transaction processing optimization, multi-layered caching approaches can dramatically reduce the load on backend database systems while simultaneously improving user experience through faster response times [9]. The caching implementation followed a data-driven approach, with transaction pattern analysis identifying that approximately 70% of policy-related queries accessed a relatively small subset of the total data corpus. By implementing strategic caching for these frequently accessed data elements, the system achieved significant performance gains while optimizing memory utilization. The caching strategy incorporated sophisticated invalidation mechanisms to maintain data consistency across distributed system components—a critical requirement in insurance contexts where policy information changes can have significant downstream implications [9].

Parallelization techniques further enhanced the automation capabilities by decomposing complex insurance transactions into independently processable units. Modern insurance operations involve multiple integration points with both internal systems

and external services, including payment processors, regulatory compliance verification, and risk assessment engines. The parallelized architecture, as described in ACM's published research on transaction processing systems, enables these operations to execute concurrently rather than sequentially, dramatically reducing overall processing times [10]. This approach proved particularly valuable for complex operations like policy issuance and claims processing, which require coordinated updates across multiple data stores and integration with numerous external systems. The implementation leveraged asynchronous processing patterns and sophisticated orchestration mechanisms to manage these parallel workflows while maintaining transactional integrity—a foundational requirement in financial systems [10].

The reliability dimension of the automation implementation focused on intelligent health monitoring and automated recovery capabilities. The 99.99% uptime objective—representing the highest tier of availability outside of critical infrastructure systems—required sophisticated approaches to failure detection and remediation. The implemented health check systems moved beyond simple binary availability monitoring to incorporate predictive analytics that could identify potential system degradations before they impacted customer-facing services [10]. Machine learning algorithms analyzed patterns in system telemetry data to establish baseline performance profiles and detect subtle anomalies indicative of emerging issues. These capabilities were complemented by automated remediation workflows that could execute predefined recovery procedures without human intervention, significantly reducing mean time to recovery for common failure scenarios [9].

6. Business Outcomes

The technical optimizations directly translated into tangible business benefits: faster claims processing for policyholders, fewer manual escalations requiring human intervention, improved customer satisfaction scores, and more reliable policy renewal processes.

The modernization of insurance systems has fundamentally transformed claims handling capabilities, delivering substantial improvements in processing speed that directly impact customer experience during critical moments of need. According to Ramnath Balasubramanian et al., analysis of technology transformation in insurance, carriers implementing sophisticated automation solutions have achieved dramatic reductions in claims cycle times across all major insurance lines [11]. These accelerated processing capabilities address a persistent customer pain point in traditional insurance operations, where lengthy claims resolution periods often contributed to dissatisfaction and attrition. Advanced carriers are now leveraging AI-powered claims systems to automatically adjudicate straightforward claims with minimal human intervention, enabling "touchless" processing that delivers faster payments while freeing claims professionals to focus on more complex cases requiring specialized expertise [11].

The reduction in manual escalations represents a significant operational advantage that improves both efficiency and consistency. As documented in FlowForma's analysis of insurance automation, the elimination of manual handoffs throughout the policy lifecycle creates substantial efficiency gains while simultaneously reducing error rates [12]. Traditional insurance processes typically involved numerous manual interventions—from underwriting exceptions to policy endorsements and coverage modifications—each introducing potential delays and inconsistencies. Modern workflow automation tools now intelligently route exceptions based on predefined business rules, ensuring that human expertise is applied only where truly necessary. This targeted approach to human intervention preserves the judgment and expertise of insurance professionals while eliminating routine processing tasks that previously created bottlenecks [12].

Customer satisfaction improvements represent perhaps the most significant business outcome of these technical optimizations. Ramnath Balasubramanian et al., research indicates that carriers delivering exceptional digital experiences through modernized systems achieve substantially higher customer loyalty and retention compared to competitors relying on traditional processes [11]. The contemporary insurance customer increasingly evaluates their experience against digital leaders across industries rather than just other insurers, creating heightened expectations for speed, transparency, and convenience that only modernized systems can deliver.

The reliability enhancements in policy renewal processes demonstrate how technical improvements directly impact core business metrics. As FlowForma's insurance automation analysis indicates, renewal operations represent a critical touchpoint where system performance directly influences revenue stability and customer retention [12]. The implementation of automated validation checks, proactive renewal notifications, and streamlined payment processing has transformed what was historically a friction-filled process into a seamless experience. These improvements not only reduce lapse rates but also decrease the operational burden associated with renewal management, allowing insurers to maintain consistent premium income streams with lower administrative overhead.

Business Outcome	Before Modernization	After Modernization	Impact Area
Claims Processing Time	7-10 days	1-3 days	Customer experience, operational efficiency
Manual Escalation Rate	28%	9%	Staff productivity, processing costs
Net Promoter Score	+18	+41	Customer loyalty, market competitiveness
Policy Renewal Success	91%	98%	Revenue predictability, customer retention

Table 3: Business Outcomes [11, 12]

7. *Conclusion*

The modernization of insurance technology infrastructure through automation and microservices architecture represents a profound advancement with impacts extending far beyond technical metrics. By transforming legacy systems at State Farm into flexible, scalable platforms, the organization achieved remarkable improvements in transaction processing capabilities, system reliability, and customer experience. These technical enhancements translated directly into business value through faster claims resolution, reduced operational costs, improved customer satisfaction, and more consistent revenue streams. The societal implications prove equally significant—when insurers process claims promptly during emergencies, they provide essential financial support precisely when policyholders need it most. Similarly, when premium payments and renewals function seamlessly, both insurers and customers benefit from improved financial stability. This case demonstrates how thoughtful modernization of insurance systems contributes not just to corporate performance but to the fundamental social purpose of insurance: providing security and peace of mind during times of uncertainty.

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