International Journal of Economics, Commerce and Management
United Kingdom ISSN 2348 0386 Vol. 12, Issue 10, Oct 2024

https://ijecm.co.uk/

ANALYZING THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE INSURANCE SECTOR: RECENT DEVELOPMENT IN MODERN CONTEXT

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Abstract

Artificial Intelligence (AI) is revolutionizing business operations across various sectors, and the insurance industry is no exception. This study delves into the transformative effects of AI on key areas within the insurance sector, including underwriting, claims processing, risk management, and reinsurance. By leveraging AI, insurance companies can significantly enhance operational efficiency through automation, data analytics, and predictive modeling, leading to faster decision-making, reduced costs, and improved customer experiences. However, companies that fail to adopt AI technologies risk losing market share and jeopardizing their long-term sustainability. The study also examines how insurers are balancing short-term profitability with long-term liability management, especially as AI enables more precise risk assessments and pricing models. We explore how companies are integrating AI to improve operational oversight, ensuring that risk exposure is managed effectively while maintaining competitiveness in an increasingly tech-driven market. Ultimately, this research offers valuable insights into the strategic implications of AI adoption for the insurance industry, highlighting both the opportunities and risks associated with this technological evolution, and provides a framework for understanding its impact on industry dynamics and long-term success.

Keywords: Artificial Intelligence, underwriting, claims, risk-management, reinsurance

INTRODUCTION

Artificial Intelligence (AI) refers to the capability of machines, particularly computer systems, to exhibit intelligence. As a field within computer science, AI involves the creation and examination of methods and software that enable machines to understand their surroundings, learn from experiences, and make decisions to achieve specific goals (Hyman, 2014). The 21st century has witnessed a surge in AI adoption, driving significant changes in automation, data-driven decision-making, and the integration of AI into diverse sectors of society (Alhazmi et al., 2024). This trend is reshaping job markets, healthcare, government, industry, education, and even areas like propaganda and disinformation. Such widespread influence prompts critical discussions about AI's long-term impacts, ethical considerations, and associated risks, leading to calls for regulatory frameworks to safeguard and maximize the benefits of this technology (Alqahtani et al., 2024). In the insurance industry, AI and related technologies are poised to revolutionize every aspect, from distribution and underwriting to pricing and claims management, with advanced data analytics enabling near real-time policy transactions and decision-making (Abu Al-Haija & Houcine, 2023; Jannadi, 1996).

UNDERWRITING AND PRICING

Underwriters play a crucial role in evaluating the risk a potential policyholder brings to an insurance pool (Hughes, 2023). They must decide whether to accept the risk, determine the appropriate level of coverage, establish the terms and conditions, and calculate a suitable premium. Key factors influencing this assessment include the overall claims experience for similar business types, the characteristics of the average policyholder, and how the proposer compares to this average. Underwriters often seek reinsurance for several reasons: to protect against significant single-event losses (such as those from an earthquake), to safeguard the company's capital, to mitigate risks when entering new markets (like a life insurer starting a marine or aviation portfolio), and to share heavy or hazardous risks (Abbas et al., 2018). The risk assessment process involves both qualitative aspects—specific risks associated with the proposed coverage—and quantitative aspects—the magnitude of the risk. Insurers are mindful of potential losses from individual risks, with strategies varying based on whether the business involves property or liability. For property risks, insurers monitor accumulations and calculate the Estimated Maximum Loss (EML), which represents the worst-case financial impact of a loss (Abu Al-Haija & Houcine, 2023). If the EML exceeds acceptable thresholds, reinsurance or coinsurance is sought. Looking ahead to 2030, the underwriting landscape is expected to undergo dramatic changes (Hughes, 2023). Traditional underwriting processes for personal

and small-business insurance across life and property-casualty sectors will largely be automated. Advanced machine learning and deep learning models, supported by internal and external data sources, will streamline underwriting decisions. These models, driven by data from carriers, reinsurers, and other sources, will allow insurers to provide quick, bindable quotes tailored to individual risk profiles (Abbas et al., 2018). Regulators will need to ensure transparency in AI-based models, focusing on traceability and appropriateness of data usage. They will test model outcomes against approved bounds to confirm the accuracy of pricing and underwriting algorithms. Public policy will also impact the use of sensitive data, such as health and genetic information, potentially limiting underwriting flexibility and increasing anti-selection risks. Price will continue to be a central factor in consumer decisions, but insurers will innovate to stand out beyond just pricing (Daghistani et al., 2019). Proprietary platforms will enhance customer experiences and offer unique features, leading to differentiated insurance offerings. While some markets may see intense price competition and slim margins, others will benefit from unique products and expanded margins. In regions that embrace change, real-time pricing based on dynamic risk assessments will empower consumers to influence their coverage and pricing through their actions.

CLAIMS PROCESSING

The primary role of claims personnel is to handle claims efficiently and equitably, ensuring that claims are resolved with minimal waste and avoiding unnecessary overpayments, a problem known as leakage (Wahab et al., 2007). They must also accurately estimate the final costs of outstanding claims and differentiate between legitimate and fraudulent claims. When a significant claim is received from a commercial customer, the typical process involves verifying the claim details against the application, assessing the value of the loss, appointing a loss adjuster, and ultimately settling the claim (Almalki et al., 2022). It is the insured's responsibility to prove the validity of their claim, including demonstrating that an insured peril occurred and providing evidence of the loss amount. By 2030, while claims processing remains a core function for insurers, automation will dominate much of the process. Advanced algorithms will manage initial claims routing, enhancing efficiency and precision (Abboud & Karam, 2022). Traditional methods of first notice of loss will be replaced by IoT sensors and data-capture technologies like drones. Automated systems will often handle claims triage and repair services, with examples including auto accidents where policyholders use streaming video to document damage, which is then analyzed to generate loss descriptions and estimates (Attia et al., 2024; Wahab et al., 2007). Vehicles with autonomous features will direct themselves to repair shops, while a replacement vehicle is

dispatched if needed. In residential settings, IoT devices will proactively monitor critical risk factors such as water levels and temperature, alerting both tenants and insurers to potential issues before they escalate. Automated customer service applications will handle most interactions through voice and text, following adaptive scripts that interface with claims, fraud detection, medical services, policy management, and repair systems. As a result, many claims will be resolved within minutes rather than days or weeks. Human claims management will focus on complex or unusual claims, disputed cases where human negotiation is essential, claims related to systemic risks from new technologies (such as cybersecurity breaches in IoT systems), and random manual reviews to ensure the accuracy of automated decision-making (Alqahtani et al., 2024; Mufti, 2000). Claims organizations will increasingly prioritize risk monitoring, prevention, and mitigation. IoT and other data sources will be used to track risks and trigger automatic interventions when certain thresholds are exceeded (Alqahtani et al., 2024). For large-scale catastrophe claims, insurers will use integrated IoT, telematics, and mobile data to monitor affected areas in real time, provided that communication infrastructure remains intact. In the event of power outages, insurers will utilize data aggregators that compile information from satellites, drones, weather services, and policyholder data to pre-file claims accurately. This pretested system will enable rapid and reliable loss estimations, with detailed reports provided to reinsurers to expedite the flow of reinsurance capital.

RISK MANAGEMENT PROCESS

Risk management involves identifying, analyzing, and economically controlling risks that could threaten an organization's assets or earning capacity. In the context of AI, risk management becomes more specialized and systematic, focusing on identifying, mitigating, and addressing risks associated with AI technologies. This process incorporates a blend of tools, practices, and formal AI risk management frameworks to minimize potential negative impacts of AI while maximizing its benefits. AI and machine learning (ML) are increasingly integrated into the financial sector to automate processes, enhance customer experiences, and streamline operations in both front and back offices (Abbas et al., 2018). Their advanced predictive capabilities and ability to analyze large volumes of data make them valuable for risk management. For instance, AI and ML are used to improve credit assessments, investment decisions, and business-related decision-making by offering more accurate forecasts compared to traditional regression models. These traditional models often fail to capture non-linear relationships and macroeconomic effects, especially under stressed conditions. In contrast, machine learning models excel at identifying these complex relationships and providing more precise predictions. Moreover, ML algorithms, when combined with Big Data analytics, can

process extensive datasets and extract numerous variables, leading to more robust risk models. These models benefit from a rich set of features that cover a wide range of risk factors, enhancing their effectiveness in stress testing. Effective risk management also relies on appropriate granularity and segmentation, which ML algorithms support by considering a multitude of attributes in segment data. Unsupervised ML algorithms can employ both distance-based and density-based clustering approaches, resulting in improved model accuracy and explanatory power.

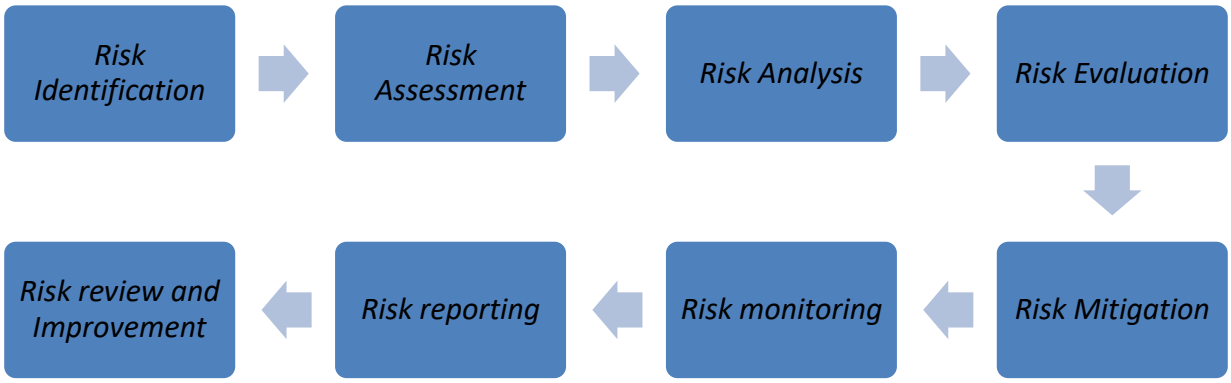

Figure 1: Risk Management Process

This chart represents the cyclical and iterative nature of the risk management process, highlighting both traditional methods and AI/ML-enhanced approaches at each stage. Risk Identification-Traditional Methods: Surveys, historical data analysis, expert judgment. AI/ML Tools: Predictive analytics, anomaly detection. Risk Assessment-Traditional Methods: Risk matrices, qualitative and quantitative analysis. AI/ML Tools: Advanced forecasting models, scenario analysis. Risk Analysis-Traditional Methods: Regression models, statistical analysis. AI/ML Tools: Non-linear modeling, feature extraction. Risk Evaluation-Traditional Methods: Risk prioritization, impact analysis. AI/ML Tools: Real-time risk scoring, dynamic risk evaluation. Risk Mitigation-Traditional Methods: Risk avoidance, risk reduction strategies. AI/ML Tools: Automated risk controls, predictive risk mitigation. Risk Monitoring-Traditional Methods: Periodic reviews, manual oversight. AI/ML Tools: Continuous monitoring, real-time analytics. Risk Reporting-Traditional Methods: Reports, dashboards. AI/ML Tools: Data visualization, automated reporting. Risk Review and Improvement-Traditional Methods: Lessons learned, process audits. AI/ML Tools: Adaptive learning, feedback loops.

IMPLEMENT AND MONITOR RISK MANAGEMENT PROGRAM

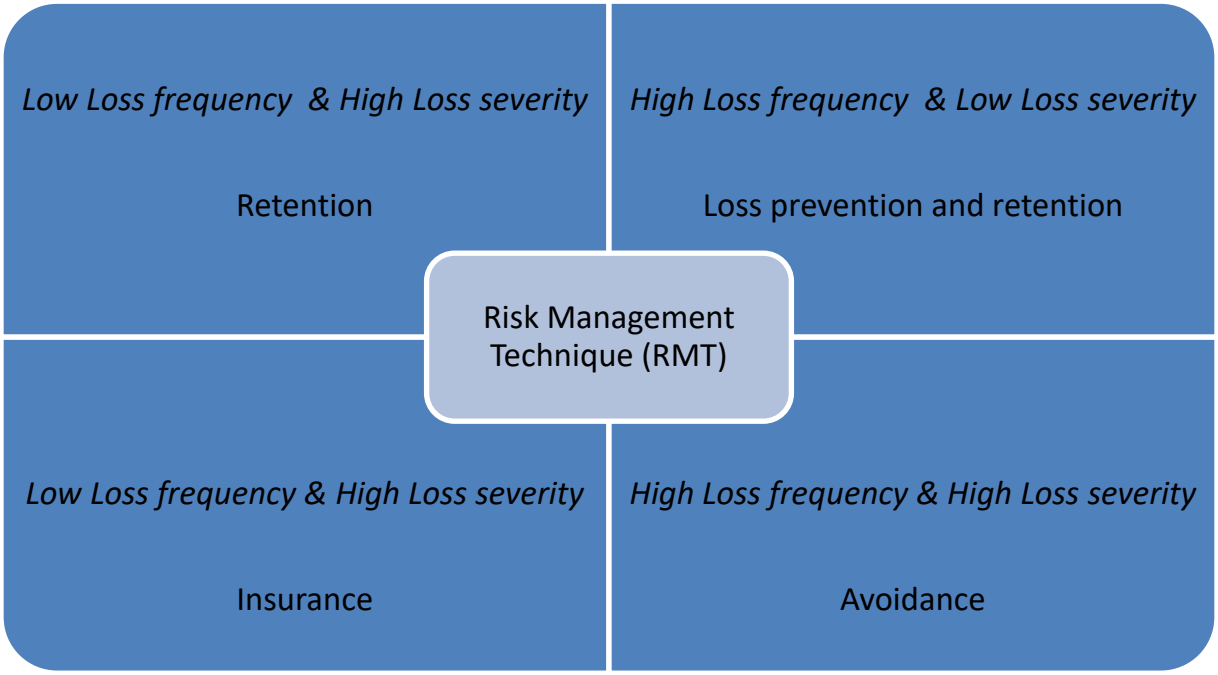

Figure 2: Risk management Technique

Important loss exposures- property loss exposures, liability loss exposures, business income loss exposures, human resource loss exposures, crime loss exposures, employee benefits loss exposures, foreign loss exposures, reputation and public image of the company. The second step in the risk management process is to analyze the loss exposures. This steps involve an estimation of the frequency and severity of loss. Loss frequency refers to the probable number of losses that may occur during some given time period. Loss severity refers to the probable size of the losses that may occur. Loss prevention and retention means that the firm retains part or all losses that can result from a given loss. Avoidance example explains that the pharmaceutical firm that markets a drug with dangerous side effects can withdraw the drug from the market. Insurance is a risk transfer mechanism. Importance of risk management-It reduces the potential for loss by identifying and managing hazards, Its gives shareholders a greater degree of confidence in a company's ability to manage its risks, It provided a disciplined approach to quantifying risks, The decision to transfer risks (for example, by insurance) is an important final stage in the risk management process. Non-insurance transfer is a methods other than insurance by which a pure risk and its potential financial consequences are transferred to another party. Contracts, leases, and hold-harmless agreements are examples of non-insurance transfer. Examples-A company's contract with a construction firm to build a new

plant can specify that the construction firm is responsible for any damage to the plant while it is being build. A firm's computer leases can specify that maintenance, repairs, and any physical damage loss to the computer are the responsibility of the computer firm. A publishing firm insert a hold-harmless clause in a contract, by which the author, not the publisher is held legally liable if the publisher is sued for plagiarism.

INSURANCE PRODUCTS DISTRIBUTION

The insurance purchasing experience is evolving rapidly, driven by advancements in technology and data analytics. Here's an overview of the key developments: Accelerated Purchase Process: AI-Driven Risk Profiling: AI algorithms now create detailed risk profiles based on individual behavior, significantly reducing the time required to complete insurance purchases (Peltier et al., 2023). Whether for auto, commercial, or life insurance, the process can now take minutes or even seconds. Instant Quotes and Policy Issuance: Auto and home insurance carriers have long offered instant quotes, and their ability to issue policies immediately is expanding as telematics and Internet of Things (IoT) devices become more prevalent. Pricing algorithms continue to improve, allowing for faster and more accurate policy issuance (R.A. et al., 2023). Simplified Life Insurance: Life insurance carriers are experimenting with simplified issue products, though these are generally limited to healthier applicants and tend to be more expensive than fully underwritten policies. However, as AI advances, we can expect a new wave of mass-market instant issue life insurance products (Heins, 2023). Enhanced Payment and Processing- Smart Contracts: Blockchain technology facilitates instant payments through smart contracts, streamlining the payment process and reducing customer acquisition costs for insurers. By eliminating or significantly simplifying contract processing and payment verification, insurers can offer faster and more efficient services(Singh, 2021). Commercial Insurance Innovations- Data-Driven Quotes: The integration of drones, IoT, and other data sources allows AI-based cognitive models to generate bindable quotes for commercial insurance more proactively. This combination of data sources accelerates the underwriting process and improves accuracy. Usage-Based and Customizable Coverage: Dynamic Insurance Products: Usage-based insurance (UBI) products, which adjust based on individual behavior, are becoming more common. The traditional "purchase and annual renewal" model is giving way to a continuous cycle where insurance products adapt dynamically to an individual's changing needs. Micro Coverage Elements: Insurance products are increasingly disaggregated into micro coverage elements, such as phone battery insurance or flight delay insurance. Consumers can now customize their coverage and instantly compare prices from various carriers, tailoring their insurance to specific needs. Adaptation to Modern Lifestyles:

Flexible Coverage for Shared Assets: As living arrangements and travel habits evolve, new insurance products are emerging to address these changes. UBI models are becoming standard for shared assets, including pay-by-mile or pay-by-ride insurance for car sharing and pay-by-stay insurance for home-sharing services like Airbnb. Evolving Role of Insurance Agents: Reduced Number of Agents: By 2030, the number of insurance agents is expected to decrease significantly due to retirements and technological advancements. Remaining agents will rely heavily on technology to boost productivity. New Agent Responsibilities: The role of insurance agents is transitioning to process facilitators and product educators. Future agents will manage comprehensive portfolios of coverage across various aspects, including experiences, health, life, mobility, personal property, and residential needs. Technology Integration: Agents will use smart personal assistants and AI-enabled bots to enhance their efficiency and find optimal deals for clients. These tools will support a larger client base and make interactions more personalized and efficient. Agents will conduct a mix of in-person, virtual, and digital interactions, with each interaction tailored to the precise needs of the client. This shift in the insurance landscape reflects a broader trend towards automation, customization, and efficiency, driven by technological advancements.

INSURANCE FRAUD DETECTION AND PREVENTION

Insurance fraud is a major issue for the insurance industry, manifesting in various forms such as fabricating a loss event that never occurred, deliberately creating an insured event, or exaggerating the impact of an actual insured event (Alqahtani et al., 2024). Claims handlers are crucial in identifying and addressing fraud, though detection methods can differ based on the type of insurance involved. To combat fraud, several industry bodies work to reduce its incidence and raise awareness of its detrimental effects(Wang & Pan, 2022). For example, AXA, a leading life insurance company in France, has implemented AI-driven fraud detection technology. Partnering with the UK-based startup Darktrace, AXA adopted a solution designed to detect and manage threats from sophisticated cybercriminals. Darktrace's solution, known as the Enterprise Immune System, monitors and analyzes patterns of behavior across AXA's entire network. The software learns the normal behavior of employees and their interactions throughout the workday, enabling it to detect deviations that may indicate potential fraud or security threats. This system also includes Antigena, Darktrace's autonomous response software, which can take immediate action against detected threats. Antigena is capable of isolating users whose behavior is flagged as suspicious, thereby protecting the network from potential data breaches and fraudulent activities.

GLOBAL ANALYSIS OF AI'S IMPACT ON THE INSURANCE INDUSTRY

Global AI in Insurance Market Size: The AI in insurance market was valued at $3.64 billion in 2020 and is projected to grow at a compound annual growth rate (CAGR) of 24.05% from 2021 to 2030, reaching $45.74 billion by 2030 (Allied Market Research). AI Penetration in the Insurance Industry: According to Deloitte, over 80% of insurance executives believe that AI will significantly transform their business, with large insurers investing in AI to stay competitive. Regional Insights: The adoption of AI in the insurance sector is led by North America, followed by Europe and Asia-Pacific (Talha et al., 2024). The United States has the highest concentration of insurance companies utilizing AI, driven by investments in insurtech startups and partnerships with AI service providers. China and India are emerging markets where AI-driven insurance solutions are rapidly gaining traction. Key Applications of AI in Insurance**-**AI impacts the insurance value chain, offering solutions that improve efficiency and accuracy: Underwriting: AI enables insurers to automate and enhance underwriting processes using big data and machine learning (ML) (Talha et al., 2024; Akmal et al., 2023). For example, automated underwriting systems reduce human error and processing time. According to a report from McKinsey, automated underwriting can improve productivity by up to 30% to 50%, and early AI adopters have reported savings of up to 70% on their underwriting expenses. Claims Processing: AI speeds up claim processing through automation, reducing manual interventions and improving customer satisfaction. An Accenture survey found that 75% of insurance companies using AI in claims processing experienced significant improvements in efficiency. For instance, AI-based systems at Progressive and Allianz can process claims in seconds using image recognition and natural language processing (NLP). Fraud Detection: AI has revolutionized fraud detection by identifying patterns and anomalies in data that humans may overlook. Fraud detection models based on ML can reduce false positives, improving fraud prevention accuracy by up to 50%. According to Coalition Against Insurance Fraud, fraud costs the insurance industry nearly $80 billion annually in the U.S. alone, and AI-driven systems can help mitigate these losses. Personalized Insurance Products: AI enables usage-based and on-demand insurance offerings. By analyzing customer behavior and risk factors, insurers like Lemonade and Metromile have developed dynamic policies that adapt to real-time conditions. Insurers using AI to personalize services have reported a 15-30% increase in customer satisfaction. AI's Impact on Operational Efficiency and Costs. AI-driven automation and analytics are estimated to reduce insurance operational costs by 30-40% in the coming decade, with robotic process automation (RPA) playing a key role in processing tasks such as policy renewals and customer service. According to PwC, AI could reduce combined operating ratios (COR) in the insurance sector by up to 6-10%, translating into billions of dollars in cost savings

globally. AI also improves employee productivity. Insurers using AI tools for risk modeling and data analysis are seeing 50-60% productivity gains, allowing staff to focus on more complex, value-added activities. AI-Driven Insurtech Innovations-The rise of Insurtech companies is reshaping the insurance landscape, and AI is at the forefront of this innovation. According to CB Insights, global investment in insurtech reached $7.1 billion in 2021, with many startups leveraging AI to develop disruptive solutions. Examples of AI-powered Insurtech's include: Lemonade: An AI-based insurance platform offering homeowners and renters insurance with seamless claims processing via AI chatbots. Tractable: An AI company that uses computer vision to assess vehicle damage in accidents, allowing insurers to settle claims faster. Consumer Expectations and AI-Powered Customer Engagement. Chatbots and Virtual Assistants: AI has transformed customer interactions through chatbots and virtual assistants. Insurers such as GEICO and State Farm use AI-powered chatbots to answer customer inquiries, file claims, and provide policy information. By 2025, 40% of insurance companies expect AI chatbots to handle most customer service requests (Gartner). Customer Experience: A Capgemini report found that 74% of insurance customers expect AI to make their insurance interactions more personalized, faster, and transparent. Additionally, AI tools for predictive analytics help insurers anticipate customer needs, resulting in improved retention rates. Challenges and Ethical Considerations-Bias in AI Algorithms: There is growing concern about AI algorithms perpetuating bias, particularly in risk assessment and underwriting. Regulatory bodies, such as the European Union and U.S. state insurance commissioners, are increasingly focused on ensuring fairness and transparency in AI-driven insurance processes. Data Privacy: AI requires vast amounts of personal data to function effectively. Insurers must navigate global privacy regulations like GDPR in Europe and CCPA in the U.S. to ensure customer data is used responsibly.

CONCLUSION

Artificial Intelligence (AI) has profoundly reshaped business operations across various sectors, with the insurance industry being a key beneficiary of this transformation. This study has explored the significant impact of AI on critical areas such as underwriting, claims processing, risk management, and reinsurance, revealing that AI adoption enhances operational efficiency by streamlining processes, improving accuracy, and accelerating decision-making. AI-driven technologies, such as machine learning and predictive analytics, provide insurers with powerful tools to better assess risks, optimize pricing, detect fraud, and deliver personalized services to customers. These innovations not only drive operational improvements but also create competitive advantages in an increasingly digital marketplace.

However, the rapid pace of AI advancement presents a critical challenge for companies that fail to adapt. Insurance companies that are slow to adopt AI technologies risk losing market share to more agile competitors who leverage AI to enhance efficiency, reduce costs, and provide superior customer experiences. Our analysis highlights the importance of embracing AI as a strategic imperative for insurers to maintain their market position and ensure long-term sustainability. Companies that fail to innovate in response to the AI revolution may find themselves at a competitive disadvantage, potentially facing reduced profitability and market relevance in the future.

In addition to enhancing operational efficiency, AI adoption in the insurance industry requires a careful balance between short-term profitability and long-term liability management. AI's ability to perform real-time data analysis and improve risk assessments allows insurers to make more informed decisions about policy offerings and pricing. However, as insurers increasingly rely on AI algorithms for decision-making, there is a growing need to address concerns related to algorithmic bias, fairness, and transparency. Ensuring that AI systems are designed and implemented in an ethical and accountable manner is critical to maintaining customer trust and regulatory compliance.

Moreover, while AI presents numerous opportunities for innovation and efficiency, it also brings with it significant challenges. Ethical concerns surrounding data privacy, the potential for biased algorithms, and the impact of automation on employment are critical issues that must be addressed for AI to fully realize its potential in the insurance sector. Insurers must navigate these challenges by implementing robust governance frameworks, ensuring data privacy, and investing in systems that promote fairness and transparency. Regulatory bodies are also expected to play a crucial role in shaping the future of AI in insurance by establishing guidelines that promote the responsible use of AI technologies.

As AI adoption continues to grow, the insurance industry is poised for ongoing transformation over the coming decades. The global market for AI in insurance is expanding rapidly, with companies leveraging AI technologies to not only improve operational efficiency but also enhance customer experiences and develop more personalized products. By automating routine tasks, AI allows insurers to focus on more complex decision-making processes, driving innovation in product development and customer engagement. The ability to offer tailored products and services based on individual customer needs further enhances the value proposition for both insurers and their customers.

AI has already begun to reshape the insurance industry, driving efficiency, innovation, and improved customer experiences. The strategic implications of AI adoption are profound, offering insurers the opportunity to enhance their competitive positioning, streamline operations,

and manage risks more effectively. However, realizing the full potential of AI requires addressing challenges related to ethics, data privacy, and regulatory compliance. As AI technologies continue to evolve, insurers must remain vigilant in their approach to AI integration, ensuring that they harness its transformative power while mitigating risks. Those that succeed in embracing AI will be well-positioned to thrive in an increasingly complex and competitive landscape, while those that fail to adapt may struggle to keep pace with the industry's rapid evolution. Ultimately, the insurance industry stands at the cusp of a new era, where AI will continue to shape its future, driving innovation and transformation for years to come.

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