

The artificial intelligence technologies contribution's for improving and supporting insurance companies

مساهمة تقنيات الذكاء الاصطناعي في تعزيز ودعم شركات التأمين

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Abstract :

This research paper aims at highlighting the contribution of artificial intelligence applications to improve the activity of insurance companies, their effective role which they play within insurance operations, the importance of using artificial intelligence in the work nature of insurance companies, and then analysis of the artificial intelligence's scale in the global insurance market. Additionally, it displays some global models on which artificial intelligence software has begun to be implemented.

The study concluded that AI technologies are essential for insurance companies to adopt due to their importance role in simplifying insurance operations and establishing the modern concept of their work, such as risk prevention and management. It also emphasized relying on automated chat programs for information distribution, making the process faster, error-free, and more efficient and effective.

Key words: Artificial Intelligence; AI Technologies; Insurance Operations.

JEL classification codes: G22; O33.

1. Introduction:

The rapid pace of global transformation and technological advancement has posed significant challenges in the realm of digital innovation. Accompanying this swift evolution is a worldwide shift toward harnessing the benefits of information technology to boost productivity, enhance efficiency, and elevate service delivery.

Artificial intelligence, in particular, promises a wealth of opportunities that can drive societal progress across multiple dimensions- economic, social, healthcare, educational, and beyond.

Thanks to the use of AI applications, insurance company activities have undergone a digital transformation and discovered new opportunities to improve insurance services by offering new insurance products at competitive prices, reducing risks and fraud, and lowering overall costs. Additionally, these technologies have enabled companies to expand their customer base amid intensifying competition, as they can now review vast amounts of data in a short time. Therefore, insurance companies in recent years have increasingly relied on AI technologies to complete their operations.

Through this research, we will attempt to clarify the role and importance of AI applications in insurance companies and the changes they have brought about. In light of the above, the following research problem can be formulated:

How can Artificial Intelligence applications improve the work of insurance companies?

Sub-Questions :

To address the central research problem, the following subsidiary questions have been formulated:

- What are the paramount applications of artificial intelligence?
- What services does artificial intelligence furnish to the insurance sector?
- To what extent do global insurance companies leverage artificial intelligence applications?

Study Hypotheses:

In response to the outlined research problem, the following hypotheses have been posited:

- The adoption of artificial intelligence, through its attendant applications and programs, represents an indispensable imperative for insurance companies.

- A multitude of artificial intelligence applications are pertinent to insurance companies, notably including cloud computing.
- Artificial intelligence exerts a direct and discernible influence upon the operational activities of insurance companies.

Study Objectives:

They can be summarized as follows:

- Providing an overview of artificial intelligence.
- Identifying the importance of artificial intelligence in the activities of insurance companies.
- Highlighting the contribution of artificial intelligence applications to the global insurance market.

Study Importance:

The significance of this study is manifested in the ensuing aspects:

- It elucidates the role of artificial intelligence applications in streamlining the operations of insurance companies, recognizing AI as a pivotal modern technology conducive to advancement, growth, and the augmentation of innovative prospects.
- It underscores the esteemed position that artificial intelligence commands within the global insurance market.

Study Methodology:

To address the study problem, its questions and to prove or disprove the proposed hypotheses, the descriptive and analytical approach was adopted in order to present the concept of artificial intelligence by identifying its main types and importance, and analyzing the scale of artificial intelligence in the global insurance market.

2.Theoretical framework of AI:

2.1. Definition of AI:

The term of artificial intelligence was firstly introduced in 1956 by John McCarthy, a mathematics professor at Dartmouth College. He referred to it as "the science and engineering of making intelligent machines." The development of AI progressed slower than expected, and has relied on changes in research trends over time, with phases of introducing new approaches and improving existing ones(Borges, Rodrigo F, Claudia A, Fernando J.B, & Mauro M, 2021, p. 102225).Since then, research on artificial intelligence has spread across various fields of knowledge. AI is increasingly reshaping services delivery by performing various tasks. It is a major

source of innovation, enabling innovative ways to integrate humans and machines for providing services, but it also poses a fundamental threat to human employment.(Ming-Hui & Rust, 2018, p. 155)

The simplified way to conceptualize AI is to think of it as a program or set of computer programs that enable significant improvements to computer programs and processes or machines over time. To date, no AI has reached human-level intelligence, commonly referred to as artificial general intelligence (general AI). However, a number of AI programs have surpassed human performance in specific tasks, including computational and predictive financial modeling.(Abid, 2022, pp. 412, 413)

The American Association for Artificial Intelligence (AAAI) defines artificial intelligence as “a branch of computer science focused on creating machines that can perform tasks that require human intelligence”.(Saeed, 2024, p. 171)

The various definitions of AI systems can be summarized into four categories based on two dimensions: the reasoning - behavioral dimension (human performance), and the rationality dimension. These categories are:(Artabaz, 2022, p. 1251)

- Systems that think like humans;
- Systems that behave like humans;
- Systems that think rationally;
- Systems that behave rationally.

AI systems must possess the following capabilities: natural language processing to communicate in natural language, knowledge representation to store information, automated reasoning using stored information to answer questions and draw new conclusions, and finally, machine learning to adapt to new conditions, discover patterns and interpret generalizations.

Generally, artificial intelligence is a branch of computer science that aims at creating intelligent machines capable of performing any task as fastly and accurately as possible.

2.2. Objectives of Artificial Intelligence:

Artificial intelligence aims to comprehend the nature of human intelligence through computer programs and systems capable of simulating human problem-solving or decisions making processes. Artificial intelligence fundamentally relies on the principles of induction and reasoning. Additionally, it seeks to develop software

systems that mimic or even surpass human intelligence in their performance. Therefore, artificial intelligence applications are designed to mimic the behavior of the human mind. (Gawas & Jamal Gawas, 2024, p. 1374)

The goal is to embed human knowledge within the computer in what is known as a knowledge bases, perform comparisons and analyses, and derive the best answers and solutions to various problems. This process closely mirrors how a human approaches new challenges in daily life drawing upon past experiences and expertise, anticipating potential outcomes, and applying reasoning skills to evaluate and select the most effective solutions available.(Bellita, 2022, pp. 19, 20)

2.3. Characteristics of Artificial Intelligence:

There are several characteristics unique to artificial intelligence systems, including the following:(Allay & Abdel Majeed, 2023, pp. 380, 382)

- **AI's ability to predict and adapt:**

AI utilizes the algorithms and data programmed into it to make decisions and future prediction. From these algorithms, AI learns solutions to the problems and decisions it encounters.

- **Capability of motion and perception**

With the emergence of Big Data, the expansion of the information society, and the integration of data and information, the field of artificial intelligence has undergone profound transformation since the term was first coined in 1956 by John McCarthy. AI has just entered a new phase, characterized by one of the most obvious features: empowering AI with advanced intelligent cognitive abilities. This include visual perception, speech recognition, auditory perception, information processing, and learning.

- **Possess full autonomy in decision-making without human intervention**

Artificial intelligence systems have become capable to recognize events and make independent decisions through unsupervised machine learning without human intervention. Artificial intelligence encompasses aspects of perception, understanding, interpretation, interaction, decision-making, behavioral adaptation, and goal achievement.

- **Cloud computing:**

One of the most important fundamental characteristics of artificial intelligence is its reliance on cloud computing. With the massive amount of data being generated every day, storing it in physical form poses a significant challenge. Therefore, AI capabilities within the business cloud computing environment make organizations more efficient and strategic.

2.4. Types of Artificial Intelligence:

The main types of artificial intelligence include the following elements:

- **Weak AI:**

Also known as "narrow AI," this type is designed to perform a single specific task or a limited set of tasks and does not have the ability to go beyond those tasks (Anid, 2024, p. 203). An example of this is Apple's "Smart Personal Assistant" application, which uses the internet as a powerful database to answer users' spoken questions and engage in conversations with real people. However, it operates in a narrow, pre-defined scope. This limitation is evident in the inaccurate results it produces when engaging in conversations that it was not programmed to respond to.(Al-Shaar, Al-Sarayreh, & Al-Adwan, 2024, p. 76)

- **Strong AI or General AI:**

It is characterized by its ability to gather, analyze information and accumulate experience through the situations it encounter, which gives it the ability to make independent and autonomous decisions. This type of AI resembles human intelligence across all areas, and examples of this include self-driving cars. (Marzouq & Mekki, 2024, p. 16)

- **Super AI:**

These are experimental models aiming to mimic human intelligence. Two basic models exist: the first attempts to understand human thoughts and the emotions influencing behavior, with a limited social interaction, and the second based on the theory of mind, where these models can express their internal states, predict the feelings and attitudes of others, and interact accordingly. They represent the next generation of super-intelligent machines.(Alasad, 2023, pp. 168, 169)

3. Artificial Intelligence in the Insurance Sector :

3. 1. Applications and Fields of Artificial Intelligence:

Artificial intelligence has several applications, including:

- **Artificial Neural Networks (ANNs):**

This technology resembles the neural networks in the human brain in principle. Therefore, training these networks on a specific task and observing the effect of training on performance and quality may reveal insights into various processes. This will save time and solve problems more efficiently, reducing the need for additional employees or administrators. (Menasria, 2024, p. 89)

- **Deep Learning:**

Deep learning is a branch of machine learning that mimics the function of neurons in the human brain by creating an artificial neural networks capable of analyzing large amounts of unstructured data such as languages and images. Data passes through multiple layers in the network for recognition, hence the term "deep learning." (Alasad, Ethical Concerns about the Negative Uses of Artificial Intelligence Technologies: Deepfake Technology as a Model, 2022, p. 376)

- **Machine Learning:**

Machine learning is a branch of artificial intelligence that allows systems to learn and improve from experience without explicit programming. These systems use big data and algorithms to learn how to perform specific tasks by recognizing patterns and relationships in the data. (Anid, 2024, p. 203)

- **Natural LanguageProcessing (NLP):**

This is concerned with developing programs and systems capable of understanding or generating human language. This means that the user of these programs enters data naturally, and the computer understands and extracts information from it. (Lakel & Gashi, 2021, p. 43)

NLP can enable large insurance companies to provide enhanced customer service and better purchasing experiences, especially for customers who are comfortable using the internet. Additionally, insurance companies may prefer to develop multi-channel chat interfaces to facilitate their customers' access to information about their policies or submit claims through chat messages. (Mazouz & Boufoula, 2024, p. 76)

- **Computer Vision:**

This field focuses on developing computer systems capable of extracting, analyzing, and understanding information from images and videos. (Artabaz, 2022, p. 1255)

- **Smart Robots:**

A robot is one of the most prominent forms of artificial intelligence. It focuses on building a physical structure that operates according to human logic. It can be programmed or connected to a computer to perform specific tasks. Robots come in many shapes and sizes to efficiently perform the required task for which they were designed. (Belkhaeir, 2024, p. 132)

- **Object Recognition:**

Object recognition is a subset of computer vision, involving the process of identifying and detecting an object or feature in a digital video or image. Object recognition can lead to significant improvements in how marketers understand, track, interact with consumers, and analyze their behaviors on a large scale in a way that aligns with their lifestyles. (Kumar, Srivastava, & Bisht, 2019, p. 83)

- **Virtual Assistants:**

Virtual assistants or digital services can engage in conversations with humans in natural language to accomplish tasks such as helping customers answer insurance-related questions, guiding them in purchasing simple insurance products, or conducting transactions. (Kumar, Srivastava, & Bisht, 2019, p. 84)

- **Expert Systems:**

It is one of artificial intelligence technology that relies on two core components: a knowledge base and a software modules that formulate logical reasoning and optimal decision-making for specific issue or problem, based on programmed inputs and desired outputs. AI uses expert system to replace human expert, applying machine logic instead of human intelligence. (Al-Saqa, 2024, p. 06)

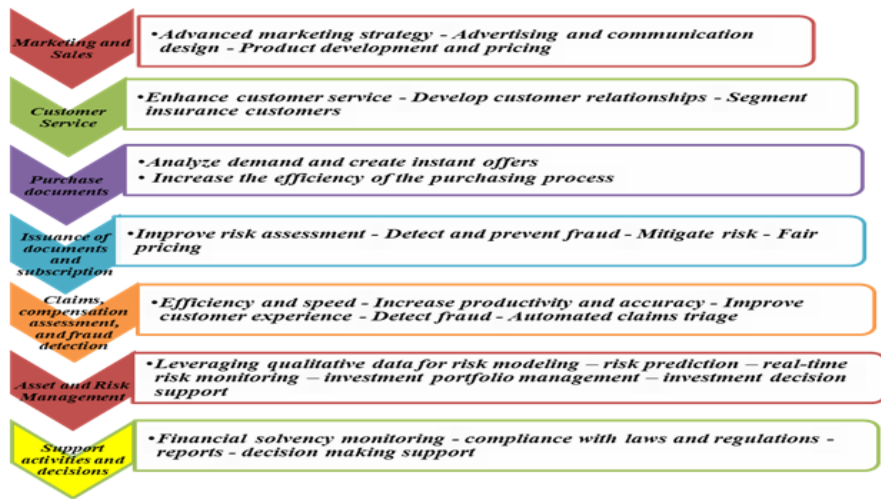
- **Predictive Analytics APIs:**

Predictive analytics encompasses diverse analytical and statistical techniques used to develop models that forecast future behaviors or events. These predictive models vary in form depending on the behavior or event they predict. Most models generate a score (a credit score, for example), where a higher score indicates a greater likelihood of a particular behavior or event occurring. This type of model is used to market products based on purchasing and underwriting patterns, detect fraudulent claims, and similar applications. (Kumar, Srivastava, & Bisht, 2019, p. 84)

3.2. The Importance of Insurance Companies Adopting Artificial Intelligence Applications:

Artificial intelligence applications have gained significant importance across various fields. For insurance companies, they represent an indispensable necessity, enabling them to achieve numerous benefits, as illustrated in the following figure:

Figure 1: The Importance of Insurance Companies Adopting Artificial Intelligence Applications



Source:(Khalil, 2024, p. 16)

3.3. Examples of AI applications in insurance companies :

Artificial intelligence has emerged as a transformative force in several fields, including the insurance sector, revolutionizing service delivery technologies, decision-making, and the accuracy of risk assessment. There are numerous examples of AI applications in insurance companies, the most important of which include:(Mazouz & Boufoula, 2024, pp. 76, 80)

▪ Car Insurance and Personal Insurance Policies

Some car insurance companies offer applicants the ability to track their driving behavior using Internet of Things (IoT) devices installed in their cars. These devices can be directly installed in the car or downloaded onto a smartphone that drivers can leave in their car while driving. IoT devices typically monitor driving behavior such as speed, driver condition while driving, and sudden stops. This data is then fed into a predictive analytics software that assigns a score evaluating the driver's risk level for the insurance company. Based on this information, the car insurance can decide

whether to accept the applicant as a client and determine the cost of their insurance policy. The insurance company can also adjust the current policy based on good or bad driving behavior, either reducing or increasing the insurance premiums the client pays accordingly.

An American company is offering an auto insurance program called Snapshot, which offers customers an IOT (Internet of Things) sensor that can be placed in cars to collect data on individual driving habits, such as how hard a driver breaks or how wide a turn they make. The company claims to use this IOT sensor data along with customer demographics to offer customers a personalized auto insurance rate.

▪ **Applications of Cloud Computing in the Insurance Sector**

Cloud computing has experienced tremendous growth recently and is increasingly adopted by insurance companies. Given its immense potential, insurance companies are considering building cloud technology strategies to stay ahead of competitors.

Cloud-based insurance solutions can provide social listening and higher conversion rates from opportunity to sale by managing targeted campaigns, optimizing opportunities, and leading engagement models. The cloud can also improve the claims experience by delivering better service and improved communication with end customers. This cloud capability is fueling the growth of the cloud-based digital insurance platform market.

Furthermore, to leverage the advantages of cloud-based platforms, many insurance companies are offering cloud-based solutions, while a few are updating features in their cloud-based digital platforms.

▪ **Blockchain Applications in the Insurance Sector**

Thanks to its ability to provide a public ledger shared among multiple parties, which may include many untrusted parties and processes, blockchain has the potential to eliminate errors and detect fraudulent and deceitful activities. Its decentralized digital repositories can independently verify the authenticity of customers, documents, and transactions (such as claims) by managing a complete historical data record. Thus, insurance companies will be able to verify and identify duplicate transactions or those involving or based on suspicious parties. Blockchain can address significantly shortcomings and errors caused by poor data quality in both the front and back offices of insurance companies.

4. Artificial Intelligence Applications in the Global Insurance Market:

The performance of the insurance sector has changed in recent years due to rapid advancements in AI technology, which has emerged as a powerful tool in various aspects of the insurance industry, such as risk reduction, fraud detection, claims processing, and customer service.

4. 1. Partnership Strategy with InsurTechCompanies :

Partnering with emerging technology companies is considered one of the most important tools for innovating insurance services, thanks to the use of modern insurtech technologies across various insurance company activities(Saidi & Fellag, 2021, p. 278). The following table shows the rate of investment in insurance technology worldwide:

Table 1: The percentage of investment in insurance technology in the world

The State	The Share	The State	The Share	The State	The Share
U.S.A	59%	France	03%	Spain	01%
Germany	06%	Canada	03%	Australia	01%
United Kingdom	05%	Brazil	02%	UAE	01%
China	05%	Japan	02%	Other Countries	08%
India	03	Sweden	01%		

Source:(Saidi & Fellag, 2021, p. 278)

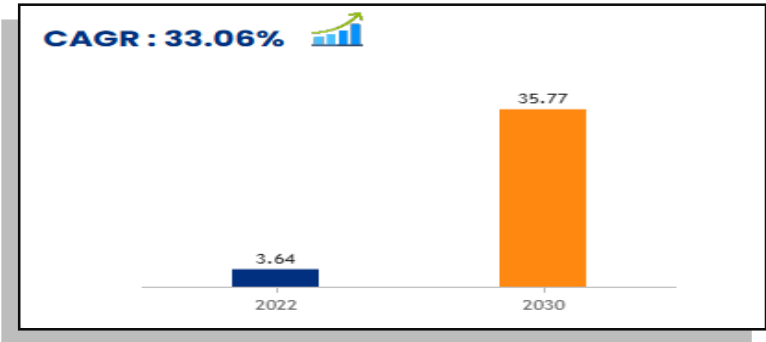
The table above shows that the United States ranks first globally in insurance technology investment, accounting for 59% of the total. Supporting digital transformation and increasing investments in advanced technologies such as the Internet of Things will increase demand for artificial intelligence in the insurance sector, further boosting market growth in the region.

4.2. Size analysis of the artificial intelligence in the global insurance market:

By 2030, the use of artificial intelligence in insurance operations is expected to increase, as illustrated by the following figure:

Figure 2: The size of artificial intelligence in the global insurance market

The unit: billions of United States dollars.



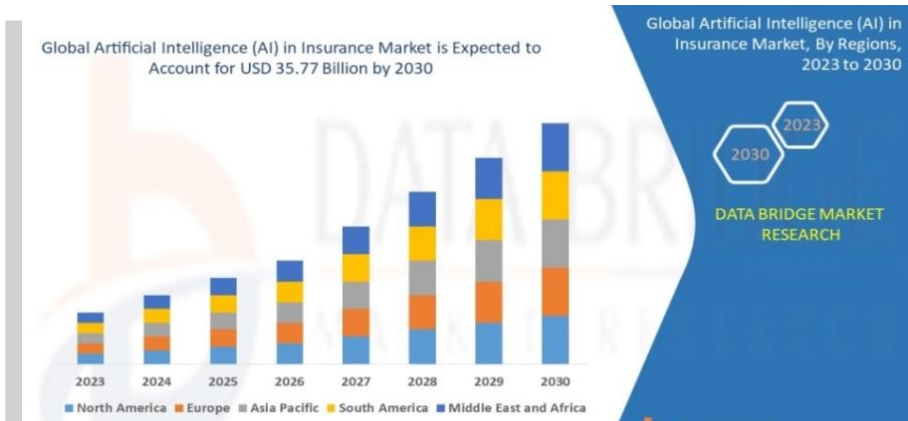
Source:(DataBridge)

<https://www.databridgemarketresearch.com/ar/reports/global-artificial-intelligence-ai-in-insurance-market>

From the previous figure, we note that the size of the artificial intelligence in the global insurance market was estimated at \$3.64 billion in 2022, and its value is expected to reach \$35.77 billion by 2030, with an annual growth rate of 33.06% during the forecast period (from 2022 to 2030).

The following figure shows the forecasts for artificial intelligence in the global insurance market by region:

Figure 3: Artificial Intelligence in the Global Insurance Market by Region for the Period (2023-2030)

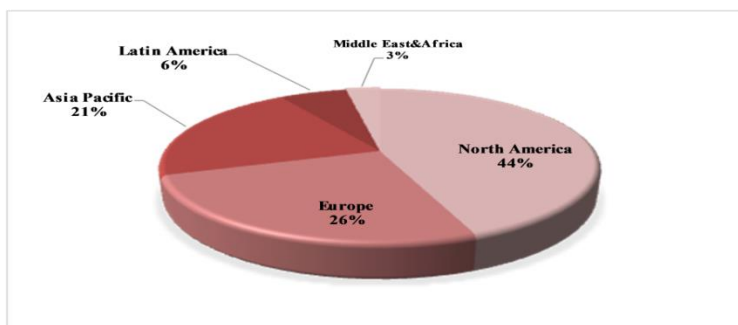


Source:(DataBridge, Market Research Market Analysis Study, 2022)

<https://www.databridgemarketresearch.com/ar/reports/global-artificial-intelligence-ai-in-insurance-market>

The ensuing diagram delineates the regional distribution of Artificial Intelligence's market share within the global insurance sector for the year 2023:

Figure 4: The regional allocation of Artificial Intelligence's market share in the global insurance sector for 2023



Source:(PrecedenceResearch, 2024)

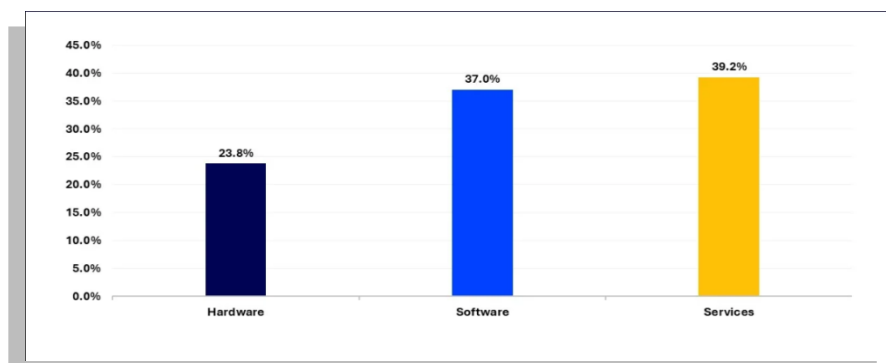
<https://www.precedenceresearch.com/generative-ai-in-insurance-market>

An examination of the figure above reveals that North America commanded the predominant market share in 2023, accounting for 44%. This ascendancy is attributed to pioneering insurance enterprises' concentration and formidable competitive capabilities. North America is projected to sustain its market leadership in the forthcoming years. Concurrently, the Asian region captured a 21% market share and is anticipated to exhibit the most accelerated growth trajectory from 2023 to 2034. This phenomenon is principally driven by an escalating number of policyholders and the proliferation of efficacious insurance services, particularly within the health insurance domain.

4.3.Applications of Artificial Intelligence in the Global Insurance Market:

Within the global insurance market, Artificial Intelligence is segmented into three principal categories: hardware, software, and services, as elucidated in the subsequent illustration:

Figure 5: Applications of Artificial Intelligence in the global insurance market for 2024



Source: (PrecedenceResearch, Artificial Intelligence Market, 2024)
<https://www.precedenceresearch.com/artificial-intelligence-market>

The preceding figure indicates that the services segment is poised to dominate the market in 2024, commanding a 39.2% share. This dominance is a corollary of the intrinsic ease of use and scalability afforded by Artificial Intelligence services during application deployment. Software applications constitute the second-largest segment, with a 37% share, encompassing predictive analytics programs, claims processing software, and fraud detection systems. Predictive analytics programs leverage Artificial Intelligence algorithms for data analysis and pattern identification, empowering insurance companies to make informed prospective decisions concerning pricing, underwriting, and meticulous risk assessment without requiring extensive prior expertise. The advantageous applications of Artificial Intelligence within insurance corporations include:

- Enhanced fraud detection and sophisticated credit analysis.
- Expedited and efficacious decision-making processes, executed in a timely fashion.
- Augmented product sales by deploying automated conversational interfaces, streamlining information dissemination to subsequent operational stages without human intervention.
- Optimized management of insurance claims, leading to a concomitant reduction in processing expenditures and temporal requirements.
- The escalating demand for artificial intelligence stimulates the generation of substantial market growth opportunities.

4.4. Global Practical Models:

Several international models have been implemented to apply artificial intelligence (AI) software, among the most notable are:(Alarki, 2024, p. 21)

a. Model One:

At one of the largest insurance companies in Turkey, a team of 50 individuals previously assessed each claim manually for signs of fraud, relying on irregular rules and personal experience. Before transitioning to an AI-driven solution, the company acquired predictive analytics software from Friss. According to a customer success story, the return on investment reached 210% within a single year of using the software.

With between 25,000 and 30,000 claims to be screened for fraud indicators each month—and a manual verification process that lasted approximately two weeks per claim—the company sought to expedite this procedure and enable the processing of a larger volume of claims. After implementing the program, the company gained the ability to assess fraud risk in real time. As highlighted in the customer success story by the software provider, the insurance company achieved \$5.7 million in cost savings through reductions in fraud detection and prevention.

b. Model Two:

At one of the largest life insurance firms in France, an AI-based fraud detection program was adopted. The company partnered with Darktrace, a UK-based firm, to deploy a solution capable of identifying and mitigating threats posed by sophisticated cybercriminals.

According to the software provider, the insurer's primary objective was to monitor its entire network and to contain emerging threats before they could escalate into significant issues. Given the company's complex infrastructure, stemming from multiple acquisitions with varying levels of integration, the insurer required a solution capable of adapting to highly diverse operational environments across its branches.

As reported in a published case study, the organization's Enterprise Immune System software is trained to observe user and network behavior, detecting patterns throughout the workday. Once familiar with each user's behavioral norms, it begins correlating data to

identify interrelationships between seemingly disparate user activities.

Darktrace's Enterprise Immune System is integrated with Antigena, the company's autonomous response solution, which actively intervenes against identified threats.

Antigena has been promoted as capable of disabling users within the company's operational network whose behavior aligns with trained indicators of data security threats, fraudulent claims activity, or pre-fraud behavior.

5. Conclusion:

Insurance corporations have increasingly adopted Artificial Intelligence applications to navigate the evolving technological landscape in the administration of their operations and to address fluctuating consumer requirements. This integration has substantially augmented their risk prediction and analysis capacity, alongside sophisticated data processing, facilitating judicious decision-making. Such capabilities are pivotal in the settlement of claims, identifying fraudulent activities, refining underwriting and pricing strategies, and other core insurance functions. Indeed, Artificial Intelligence furnishes indispensable support to insurance providers and policyholders by enhancing operational efficiency, efficacy, and the celerity of information exchange, while concurrently proffering solutions to a spectrum of challenges.

This research paper has culminated in several salient findings, chief among them:

- Artificial Intelligence technologies have been instrumental in establishing the contemporary paradigm for insurance company operations, encompassing risk prevention and management.
- Strategic partnerships within the domain of insurance technology serve to broaden the adoption of digitization and novel technologies, fostering the innovation of insurance products tailored to the preferences of the insured, accelerating claims settlement processes, and detecting fraudulent submissions.
- Reliance upon automated conversational programs for information dissemination has rendered associated processes rapid and error-free.
- Artificial Intelligence applications, including Natural Language Processing, Computer Vision, Machine Learning, and Deep Learning, have significantly amplified insurance companies'

capacity to expand their clientele and effectively market their services.

- North America exhibits pronounced dominance in the Artificial Intelligence segment of the insurance market, measured by revenue and market share, a consequence of the accelerated adoption of new technologies.
- Heightened apprehensions regarding cybersecurity and data privacy constitute the most substantial impediment to market expansion.

Study Recommendations:

- Concerted efforts should be directed towards broadening the utilization of Artificial Intelligence applications among diverse insurance companies to elevate service quality.
- The promulgation of legal and regulatory frameworks is imperative to ensure robust oversight of insurance technology and to fortify its resilience against cyber intrusions and electronic attacks targeting insurance companies' software infrastructure.
- It is essential to capitalize on the latest advancements in Artificial Intelligence applications to innovate insurance services while maintaining congruence with ongoing technological developments.
- Emphasizing the importance of algorithmic transparency within insurance companies and software firms that develop AI systems tailored for the insurance sector.
- The necessity of expanding the integration of artificial intelligence software in insurance operations. Among the key software providers contributing to this advancement are: *Amazon Web Services Inc., Avaamo, Cape Analytics LLC, IBM, Lemonade Inc., Microsoft, Osp Labs Pvt Ltd, Shift Technology, Trov Insurance Solutions LLC, and Wipro Limited.* These companies play a pivotal role in enhancing operational efficiency, delivering personalized customer services, and strengthening the competitive advantage of insurance firms through the deployment of advanced AI technologies.

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