

The Effect of Big Data on the Development of the Insurance Industry

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Abstract: *Big data is at the heart of the insurance industry through the uses it provides, where the year 2022 is considered the beginning of the “digital revolution” when humans were able to store more digital information in technological tools than ever before. Research results have shown the impact relationship between big data and various industries, including the insurance industry. Big data has improved all aspects of the insurance process, from pricing and underwriting to claims management and customer service to ultimately more effective risk management. Based on practical and theoretical practices in this framework, the question arises whether big data has brought about development in the insurance industry. Therefore, the purpose of this study was to gain a better understanding of the impact of big data on all aspects of the insurance industry. The research findings showed that the quantity and quality of data collected and used by insurance companies directly impact the services produced and developed. Big data enables insurers to identify patterns, trends and behaviors, allowing them to develop customized products and services. Also, by collecting and utilizing quality big data, insurance companies can provide more efficient and effective services, improving customer satisfaction and increasing profitability. Although big data is a lucrative opportunity for the insurance industry, it is also a threat as companies that need the means to access big data, technologies and skills will see their competitiveness drop significantly in the future. On the other hand, intermediary platforms, particularly GAFTA (Google, Apple, Facebook, Twitter, Amazon) that control the entire data value chain, can seek a large percentage of profits by providing the value chain to insurers, or the purchase of these platforms for vulnerable insurance companies, allowing them to dominate the insurance market.*

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Introduction

As is always the case in technological models, success in technological innovations closely follows the spread of technology, as the world is filled with internet and mobile phone connections in a short and quick period. The result has been the removal of spatio-temporal constraints in global communications and accumulated vast amounts of stored data, known as “big data”. Scientists had estimated that the year 2002 was the beginning of the “Digital revolution”, when humanity could stock additional digital information in technological gadgets more than ever before. In the late 1980s, less than 1% of data were in digital form, while in 2012, 99% of world information was in digital form when world technology for communication and storage of information increased from 25% to 35% annually (Hilbert, 2020).

On the other hand, advances in Artificial Intelligence have been spectacular. Not only has artificial intelligence replaced humans in many intellectual works, such as cancer diagnosis and speech recognition, but also become a necessary component of today's society's most important building blocks. Artificial intelligence has become imperative to address a range of distribution, product development, business process and decision-making problems, with big data seen as a game-changing tool that could revolutionize the way businesses operate in various sectors, including the insurance sector, where big data represents a new technical model for data generated at high speed and in large volumes. For this, every company must have capabilities for using big data to stay competitive in the face of intense competition to attract new customers and expand its business.

As global enterprises continue to become data-driven, with momentum and reliance on big data, the International Data Company (IDC) predicted that the technology of big data and the services industry would increase at an annual growth rate of 23.1% from 2014 to 2019, with \$48.6 billion in expenditures in 2019 (IDC, 2015). 2019 witnessed the emergence of the COVID-19 epidemic. This epidemic created concerns, despite concerns about the repercussions of COVID-19. The insurance industry witnessed an accelerating economic recovery and additional investments in digital technology in 2021 and 2022 due to the increased demand for insurance with growing risks. A redirection of insurance industry resources marked 2020 in response to the COVID-19 pandemic. In 2021, insurers focused on recovering from the pandemic and meeting customer expectations regarding digitization and personalization. In 2022 the industry will go even further with a focus on hyper-personalization and data-driven ecosystems (Carannante, D’Amato, Fersini, Forte, & Melisi, 2022). In parallel, consolidated insurance premiums for all lines rebounded by 3.3% for 2021 and 3.9% in 2022, compared to a decrease of 1.3% in 2020. Insurers’ investments in these technologies amounted to \$3.6 billion in 2021, and the insurance industry is expected to, Globally, it will exceed \$7 trillion in insurance premiums by mid-2022 (Services, 2022). Data is at the heart of the insurance industry. It is the raw material of various classification models used by insurance companies. It enables to fragment and classify insurers, get to know them better and offer them suitable products as needed, to estimate their current and future risks better and make appropriate decisions about them.

In parallel with the increasing reliance on big data as important company assets, efforts to research the impact of big data on the insurance industry have yielded positive results in all aspects of the insurance process. At the same time, Mullins' study demonstrated that the EU insurance industry, represented by the European Insurance and Occupational Pensions Authority had developed an ethical framework for artificial intelligence for the European insurance market (EIOPA, 2021). EIOPA's work has provided findings on big data analytics as a basis for analyzing the complex set of issues associated with using AI in insurance applications in all aspects of the insurance value chain in terms of ethics (Mullins, Holland, & Cunneen, 2021). A comparative study between the laws on insurance, the fight against discrimination, and the protection of data, whether they concern health, rental, and car insurance in Switzerland and the U.S./California systems, showed that big data plays a role in the individualization of insurance contracts (Thouvenin, Suter, George, & Weber, 2019). Therefore, although the individualization of mass insurance policies has become commercially attractive for the insurance market, analyses of insurance laws, anti-discrimination, and data protection in Switzerland and the USA/California show that there is a difference between the two legal systems. In parallel, and based on customers' personal information, this study has shown that the analysis of big data has a role in the individualization of insurance contracts in the insurance,

anti-discrimination and data protection legislation that allows it in both countries. Fraud detection is another impact of big data that previous studies have not neglected. Insurance companies are beginning to use big data analytics to reduce the burden of human investigation to detect fraud and interfere with the claim process (Chen et al., 2019). For this purpose, previous studies have focused on studying the most well-known machine learning algorithms for fraud prediction, such as Random Forest (Saldamli et al., 2020), and statistical models used in fraud detection, such as logistic regression, Bayesian networks, etc. (Joudaki et al., 2015). On the other hand, Zuboff highlighted the risks associated with big tech, especially big data (Zuboff, 2015). As a concrete example of these risks, Zuboff mentioned data held by Google, Twitter, or Facebook, which is linked to the personal data of individuals and organisations. Insurance companies can buy this data, and they would have the right to intervene in the personal lives of individuals to increase their revenues or reduce their costs. Moreover, Google, Twitter or Facebook can become insurance companies. These postures on who acquires the data without protecting privacy create high risks in the insurance industry. From the above, we have tried in this exploratory research to understand how big data works in the development of the insurance industry, clarifying the uses of big data in developing various operations related to the insurance industry.

Literature Review

1. Nature of Big Data. Data is aggregated information, facts, or statistics, which may be organized or unstructured, self-provided information, that are published reports, or that all internet search results. Much of what we do in the modern world has a digital impact, which can be analyzed and used to provide insights, and the volume of this data is growing exponentially by the day, as more data has been created in the last two years than in the history of the entire human race. However, at the moment, less than half a percent of all data are being analyzed and used (Regalado, 2013). Big data is currently being used in a lot of industries, including the insurance industry. This concept has emerged as a result of the tremendous development in technology and its uses. This development in data is apparent through the various traits referred to as the Vs of Data – Volume, Velocity, Variety, Veracity, Visualization, and Value. Volume refers to the massive amount of data being generated, while velocity is the rate at which this data is produced, transmitted, and processed. Variety encompasses the diverse and heterogeneous nature of these data flows, and veracity refers to the accuracy and reliability of the data. Visualization and value are also key aspects of this data. As for insurance issues, these ever-increasing volumes are explored, and disaggregated data are used to reveal trends, styles and linkages, particularly between human behavior and co-occurring events. Data has become a strong contributor to the effectiveness of the major global economies (Murray, Davis, Dunn, Hewson, & McNamee, 2014), as the improvement in reliable data and tools for its use leads to the creation of new opportunities in the economy. For example, increased data availability can facilitate the development of new products and services and greater efficiency and innovation in the economy (Commission, 2016).

2. Nature of the Insurance Industry. Insurance is a traditional way for society to protect against risk. Risks are the foundation of insurance and must be unplanned, future events, legal, beyond the control of the policyholder, and common enough to calculate probability (Berthel , 2018). By collecting numerous alternatives, insurance allows policyholders to share the impact of unexpected events. Such incidents include expenses for medical treatment in hospitals, expensive medical procedures, or property spoilage (cars and houses), or death or unemployment of policyholders. However, insurance is mainly a means of protecting against the undesirable financial effects of risks. Insurance, therefore, works by spreading the costs among a group of insurance policyholders (insurers) so that the minority's claims can be paid from premiums paid by the many others, i.e., the cost of claims arising from risk is divided among members of a group who have insurance to protect themselves (Berthel , 2018), it should be noted here that the amount of the premium paid by each individual depends on the potential financial value of danger that policyholder pays to the insurance group as a whole.

Methodology and Research Methods

The Relationship Between the Insurance Industry and Big Data. Big data has contributed to the development of the insurance industry in recent years and has become an essential part of the various traditional and new processes of this industry, and this relationship is manifested through:

1. The Evolution of the Volume of Information. The evolution of storage capacity shows the relationship between the insurance industry and big data, whereas information technology evolves the amount of data that insurance companies can use has grown exponentially. This situation results from various technological advances such as miniaturization, increased storage capacity, increased data reliability, more efficient computer marketing, etc. The digital age began in 2002 (over 50% digital) (Hilbert, 2017).

Since then, storage solutions have continued to diversify, as the evolution of storage conditions and capabilities has allowed new IT services to emerging: the Internet, social networks, cloud, and related devices (the Intranet), since 2000 the number of storage devices has reached saturation level at the threshold of 22-23 storage devices per person, and the total of ideally compressed global storage capacity grew at a compound annual growth rate (CAGR) of 28% per year between 2000 and 2007 (Table 1). It is five times faster than global GDP growth in the same years (Hilbert, 2014), and to meet the growing needs of storage and processing of big data, new platforms for big data, including NoSQL databases, have emerged as an open source (Lee, 2017).

Table 1. Evolution of the World’s Capacity to Store

		1986	1993	2000	2007	CAGR 1986-2007
Storage	MB optimal compression per capita (installed capacity)	539	2,866	8,988	44,716	23%
	% digital	0.8%	3%	25%	94%	

Sources: (Hilbert and López, 2011)

With regard to the data used, there are two types of big data. Companies regularly use organized data because they are easy to use after collection and classification, for example, demographic or economic data. The unstructured data, resources that are not regulated in a predetermined manner, such as videos, voice messages, social media content, and e-mail messages, have undergone a considerable upsurge in the current period. Therefore, it was noted that until recently, insurance companies' decisions were based on structured data. With widespread social media, a vast mass of unregulated data emerged on which insurance companies relied in their decision-making.

On the other hand, technological developments have encouraged the emergence of new data, as these data will directly impact products, the brand, and the perception of insurance companies about their use. However, it is not enough to collect information. Above all, it is necessary to know it and be able to use it; that is the goal. It should be noted that the authorities can restrict the use of part of the available data. Therefore, according to IDC (International Data Corporation), shortly, 33% of the digital society will contain information that can be used after analysis against 25% of what is today. Thus, the progress in collecting data from anyone has created additional pressure on insurance. They can no longer rely only on their internal data. However, they must use all sources of information to understand the risks around them better and to attract and retain customers. Thus, they must conclude that it is imposing a new approach on insurance companies to be proactive; they should be predicting instead of responding, where this strategy is only possible if they have enough data to enable them to continuously understand and monitor their customers' needs to deliver products specially designed for them.

2. Speed in Collecting and Using Data. Traditionally before big data were adopted, insurance companies collected data through intermittent processes before processing it to make it usable by their various departments and then programmed the processing of the information to be done at specified times and frequencies: once a week, once a month, etc. Today, with big data and since the advent of information technology in the industry, data is a key asset for insurance companies (Berthelé, 2018). New technologies have paved the way for the acquisition, sorting and use of information in a few seconds, whether organized or not. To save time, insurance companies must identify the priorities to be directed to their resources like sensors devices, related items, fraud detectors, mathematical models, and simulation programs. Figure 1 shows that the mass of data collected has multiplied by 50 during the period from 2010 to the end of 2020.

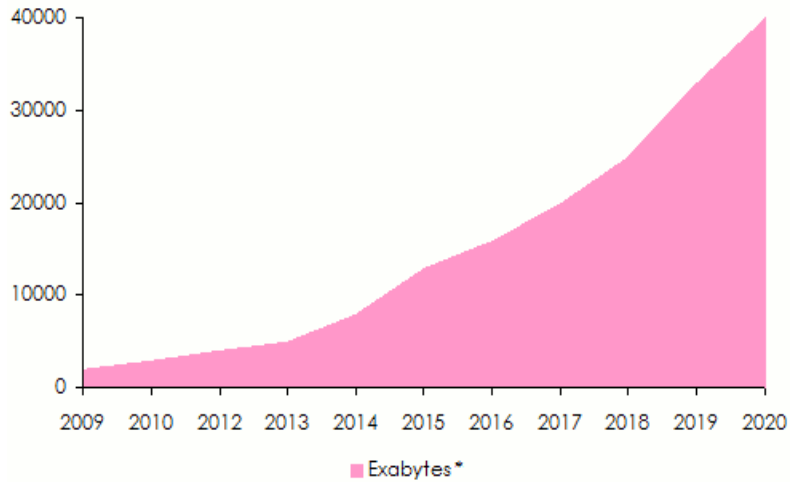


Figure 1. The Evolution of Data Collecting Speed Between 2010 and 2020

Sources: Data, 2012

Results

The insurance industry was one of the first to make extensive use of information technology, it is an ideal tool to execute many sequential, piecemeal tasks, and this adoption has profoundly changed the relationship between insurance companies and their customers (Berthel , 2018), according to a survey of insurance company executives, the primary use of big data today concerns pricing, subscription and risk selection, while marketing, distribution and product sales are not the current priority although big data have been used in this regard. Currently, the primary concern is the proper usage of big data and potential misuse. To make certain that all professionals adopt a moral perspective, the ethics ladder depicted in Figure 2 provides a method that allows for analysis across the value chain, beginning with the data sources, moving on to the algorithms used, and ending with the final products offered to clients. This structure recognizes the different connections along the ladder and permits relevant parties to be involved in decision making at the appropriate time.

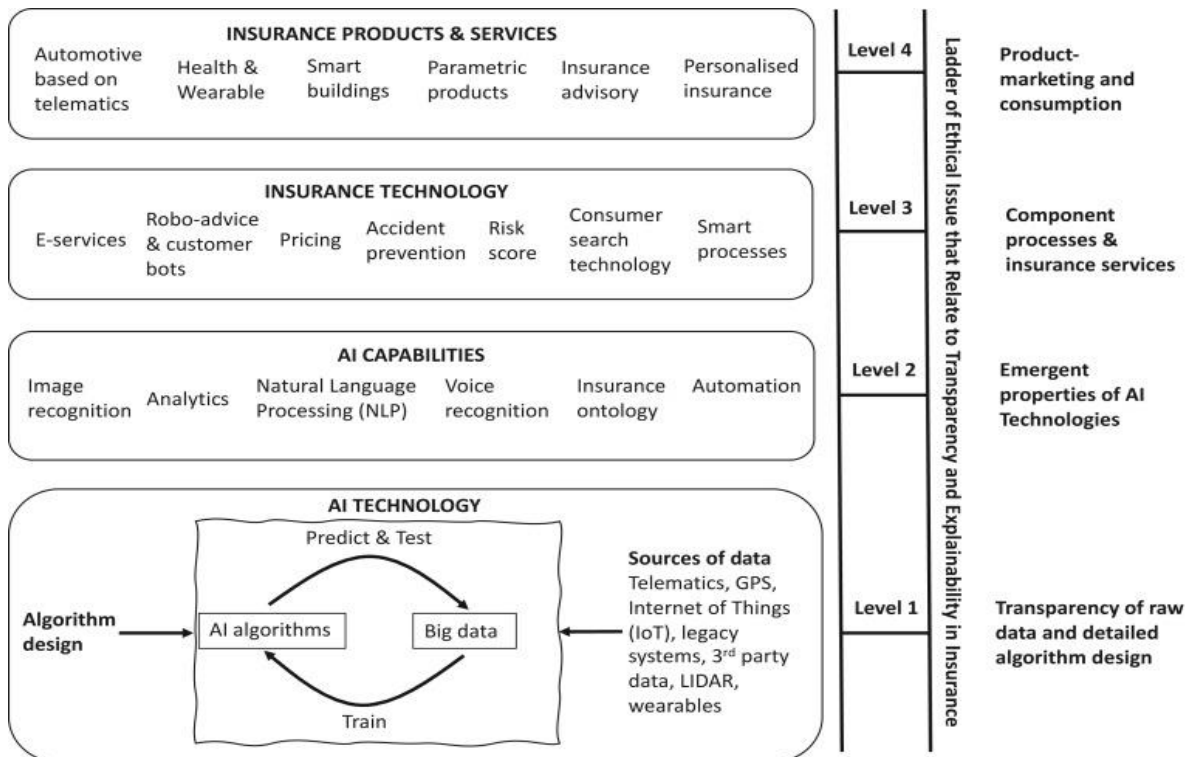


Figure 2. Ethical Hierarchy Model for AI and Big Data in Insurance Markets

Sources: (Mullins, Holland, & Cunneen, 2021)

Therefore, the uses of big data in the insurance sector manifest themselves in the following aspects:

1. Using Sensors and Connected Objects. Sensors and related items have evolved further in individuals' car insurance and health insurance. In car insurance, installing vehicle sensors allows policyholders to obtain custom prices. Analysis of speed, transit places, time intervals, and time of use results in pricing that is proportional to driving. This technology can inform the insurance company in real-time. Analysis of the data collected in this way allows good drivers to benefit from insurance discounts. In the case of health insurance for individuals, many insurance companies take advantage of technological advances to provide their customers with personal coverage based on their risk profile. The information used as the basis for pricing is provided by sensors placed on the body of the insured (watches, bracelets). These sensors make it possible to constantly monitor remote patients, directing them, if necessary, to the nearest or most appropriate medical services.

Another advantage of big data is that the collected information makes it possible to produce remote diagnostics, provide targeted treatments, detect diseases according to trends, and prepare preventive medicine to reduce risk and reduce mortality. Home insurance should soon follow the path of the car industry and health insurance for individuals. Home automation systems provide insurers with information about their customers' lifestyles because the main force to control, control and simplify everything in our daily lives and homes is in the hands of home automation (Barodawala, Makwana, Punjabi, & Bhatt, 2018). For example, they can detect fires and fight their spread. They can be proactive in remote monitoring, lighting and power usage management. These new technologies provide convenience and limit claims (Tayyaba, Khan, Ashraf, & Balas, 2020).

2. Big Data Contribution to Insurance Fraud Detection. The insurance industry is particularly vulnerable to fraud. For 54% of insurance companies, fraud is the number one threat, affecting all insurance companies and all branches. Insurance fraud is a deliberate act against an insurance company or insurance agent to obtain a financial benefit (Picard, 2013). This fraud can occur while participating in the contract when the insured conceals information likely to increase the risk premium rate. Insurance fraud can also occur during a claim by an insured who makes false statements to obtain compensation to which he is not entitled.

So, with new technologies, the insurance company has different means of validating the statements of the insured. When a claim occurs, the insurance company can verify whether the insured is at the event site using social networks from which it can refer to the geographic location data of mobile phones and e-mail. It can also know if the insured has contacted a third party involved in the incident. Some insurance companies use statistical models for predictive analysis to identify fraudsters. These methods rely on big data about observed behaviors between fraudulent and non-fraudulent customers. Based on the results of this analysis, it is then possible for them to design future behaviors to measure the probability of customer fraud. Other methods used by insurance companies, such as text mining, rely on big data to analyze the information collected on each customer.

The process relies on an analysis of the terminology used in claims for compensation because some words are used more commonly by fraudsters, and their discovery may be a sign of possible fraud (Lee, 2017). Finally, the abundance of information collected through big data enables improved rating and scoring techniques that insurance companies implement and prevent insurance fraud using the following technologies: business rules, anomaly detection, text mining, database searches and social network analysis. According to field practices, using big data in the insurance industry leads to several benefits, including higher fraud detection rates of 60%. Figure 3 describes a fraud detection method using a big data architecture. This model consists of three main components: data collection, fraud detection and user communication using ready-made software such as Hadoop.

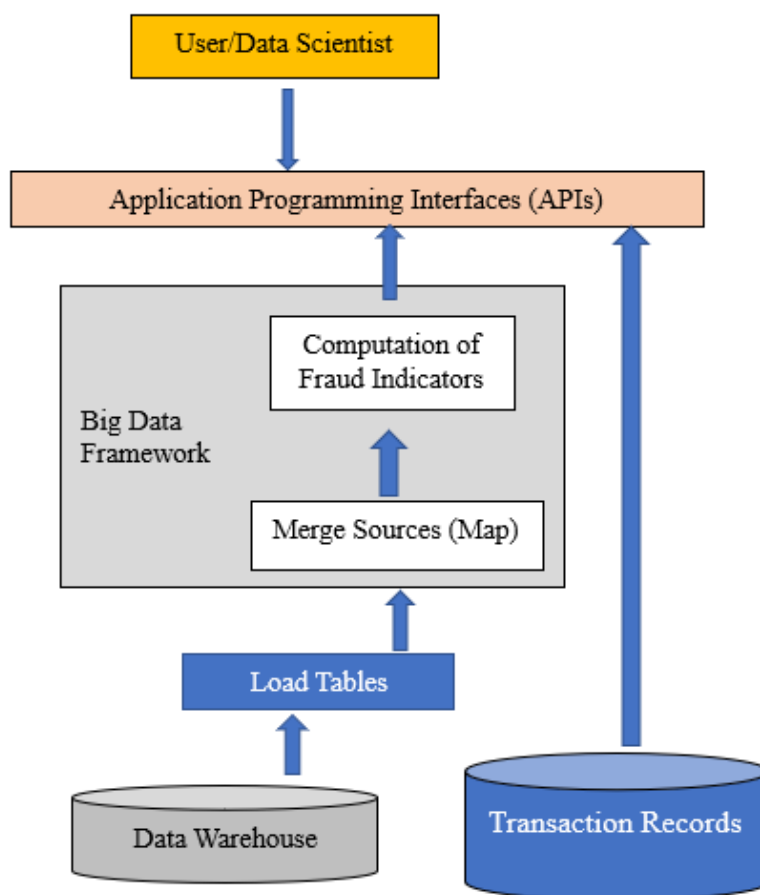


Figure 3. Big Data Architecture for Fraud Identification

Source: Jha, Sivasankari, & Venugopal, 2020

3. Using Big Data to Adjust Insurance Companies' Strategies. The collection of a great deal of big quantitative and qualitative data and the development of information technology systems associated with big data uses allows insurance companies to (Billot, Bothorel, & Lenca, 2018; International, 2017):

- Providing customers with better-fit guarantees, whereby insurance companies can set up automated analyzes in order to adjust coverage according to detected needs and respond accurately to different demands of policyholders (Berthel , 2018);
- Improve risk analysis and increase profitability, where the larger the sample of quantitative data, the more faithfully risk behavior is identified, the more accurately the price is determined;
- Achieve better stability of risk acceptable to the insurance company by reducing the random fluctuations due to advanced portfolio analysis;
- Make contracts anywhere using mobile applications available to subscribers. This facility represents a significant gain in productivity and enhances customer proximity;
- In addition to modifying existing products and safeguards, it is conceivable to develop safeguards for risks that are still considered uninsured because of the availability of new data sources. Finally, insurance for emerging risks (e.g., Internet risks) is also facilitated.

Insurance companies depend to a large extent on their distribution network, where the management of the latter is of the utmost importance by closely monitoring the performance of agents or intermediaries and by analyzing some basic information such as the rate of customer loss, the average risk volume, etc. The calculation of the commission of each intermediary is more appropriate for the production efforts of the intermediary. Finally, the strategy division within insurance firms will benefit from an increase in data-driven insights, allowing for data-informed decision-making based on more precise analysis with a broader scope. These data-supported decisions can cover a wide range, including creating new products and services, expanding into other market segments, and investigating new distribution methods.

4. Big Data and Customer Loyalty to Insurance Companies. Building customer loyalty is important because dedicated customers tend to do more than one transaction. Customers loyal will spend more because they already trust the brand. Customer loyalty helps the business sector to improve the brand image as the brand has already earned the trust of loyal customers, and they are more likely to share a positive experience than a new customer. It ultimately helps the brand retain more customers, improve customer loyalty, and mark loyalty (Dash, Kapoor, & Mangesh Dirash, 2018). Field experiences have shown that the more loyalty, the sales increase, and the customers with the best previous experience spent 140% more than they spent the least satisfied customers (Kriss, 2014).

The question posed by insurance companies is who the customers to be kept are, and which customers would prefer not to be in the insurance companies' portfolio? This question can be answered by extracting and analyzing available information from big data. IT systems for Insurance companies track the prices issued by competitors to their portfolio customers. They can also detect customers looking for more competitive prices. Similarly, when the insured person's status changes, computer systems make it possible to interact in assessing the new needs of insurance companies in terms of coverage. For example, when there is a change in the purchasing power of the insured: when the student enters the labour market when the employee gets a promotion or retires.

At present, sales analysis tools are well-developed. These tools provide customers with optimal coverage based on their profile and allow insurers to retain insurance policyholders who may switch to their competitors. Currently, sales analysis tools are well-developed. These tools offer customers optimal coverage based on their profile and allow insurance companies to retain policyholders likely to turn to their competitors. Research has shown that 84% of insurance companies using or considering AI aim to enhance customer satisfaction, while 76% of successful insurance companies utilize big data solutions. Additionally, 42% of customers trust their insurance provider to deliver good service, which helps to increase customer loyalty across all interactions. Most insurance companies engaging in or considering AI are focused on improving customer satisfaction, retention, and acquisition, which can contribute (see Figure 4).

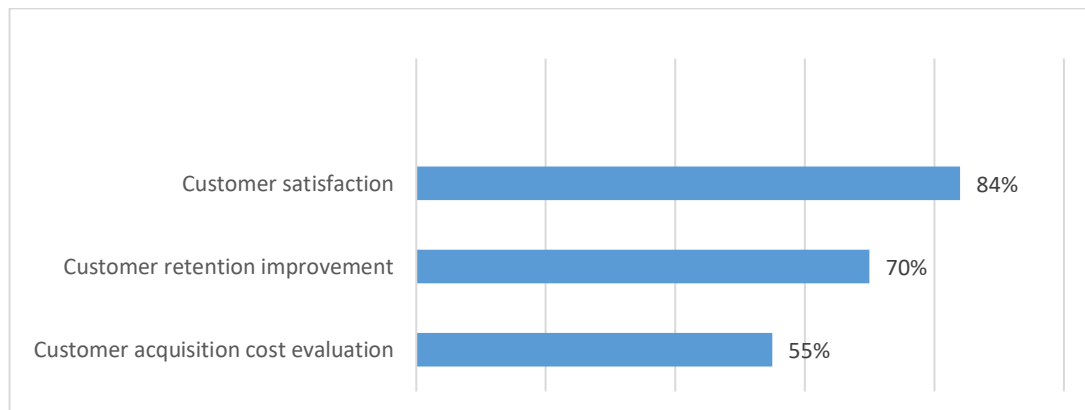


Figure 4. Top Three Value Drivers of AI

Source: IBM, 2019

Conclusions

The use of big data is no longer limited to a few industries or technology areas but is expanding to almost every industry, including insurance. However, all businesses, including insurance companies, need help integrating big data. Using proper tools to assess and understand big data will help companies access the expected gains of big data complementarity that favorably influence functions of the organisations, such as client attraction, and will place it within the broader technological transformation framework where big data has become part of the mainstream business practices of these companies.

While big data is a profitable investment for the insurance market, it risks destabilizing it. Companies that need the means to access big data and the technologies and skills needed by the workforce will see their competitiveness drop dramatically in the future. They risk being liquidated or selling to others. On the other hand, intermediary platforms, particularly GAFTA (Google, Apple, Facebook, Tweeter, Amazon) that control the entire data value chain (aggregation, storage technology, analysis, related expertise), can seek a large percentage of profits by providing the value chain to insurers, or by themselves become insurance

companies, or buying these platforms to vulnerable insurance companies allowing them to enter the insurance market.

Flow analyses of sensor-contained data monitor and interpret patients' physiological compartment changes and alert caretakers to provide immediate medical assistance. The flow of analyzes can also be helpful in an insurance industry where electronic transactions need to be monitored under financial regulations and require immediate action in the case of suspicious and fraudulent financial activities. Finally, there is a need for more practical research to address the challenges facing big data within the business sector, including the insurance industry, to motivate innovators and infrastructure development. This big data certainty, viewed as broad, complex, and complete by companies, is a reality that exists and remains in significant development.

The insurance industry is using new technologies such as big data and artificial intelligence to restructure itself and create a new roadmap for this industry's future. The scientific novelty of the results obtained in this research is to address and study the development possibilities of the insurance industry with the presence of big data by showing how this industry has benefited from the solutions provided by big data. The most important benefits of big data analytics are to improve fraud detection, build strong strategies, achieve customer satisfaction and loyalty, claims management and personalized services and pricing. Actual practices have shown that big data has greatly changed this industry. Actual practices have shown that big data has greatly changed this industry. According to SNS Telecom & IT, Big Data allowed 30% better access to insurance services, 40%-70% cost savings, and 60% higher fraud detection rates. Big data has brought additional benefits to customers and stakeholders. Big data has positively revolutionized the insurance sector; without it, insurance companies could lose billions of dollars.

Accordingly, if big data is a positive factor for insurance companies, as was explained in this research paper, however, it can have many negative effects, including:

- The confidential data and information of insurance policyholders are kept with insurance companies, some of which are personal to the policyholders' health, banking, and financial status. Therefore, this information can fall into the hands of malicious persons or hackers;
- Offering special prices can cause losses to the insurance industry because it contradicts the principle of risk pooling (risk pooling is the basis of insurance), and it cancels the pooling between the insureds who constitute a homogeneous group of risks;
- The use of big data for precise knowledge of risks and their permanent monitoring eliminates a large part of the risk, which is another basic principle of insurance. However, trying to acquire this level of knowledge is impossible due to the influence of the environment, the instability in the behavior of the insured, etc.;
- Both human and physical investments in collecting and processing information are important, but the return on these investments is not yet guaranteed;
- Big data has proven to be important; insurance companies that cannot adapt to it risk liquidation. Moreover, this new technology has enabled new competitors like Google, which by its nature has access to user data, and has the financial and technical means to differentiate itself from competitors and prove its existence.

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