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Evaluating The Data Analytics For Finance And Insurance Sectors For Industry 4.0

[1]Surendranadha Reddy Byrapu Reddy
Sr. Analyst, Information Technology, Northeastern University, Lincoln Financial Group, Atlanta, GA USA
E-mail: suri.byrapu@gmail.com

Abstract: The insurance industry relies heavily on statistics, despite the absence of a physical good or service being sold. A financial, risk, consumer, producer, and actuarial database would be created by such an industry. In prior decades, these sectors gathered structured data that they augmented with product and policyholder details. However, semi- and unstructured data represent a massive untapped resource. This will also prevent the insurance from making the most of the information it collects. Despite the striking similarities between healthcare delivery and insurance funding, life insurer problems have hampered the field for the better part of a century. Organizations that need both unstructured and structured data to flourish can find the optimal places to store both types of data according to research. The insurance industry may make better use of data with the help of applied analytics. The insurance industry is also discussed in relation to big data adoption techniques such as training, research, collaboration, and implementation. Several models of the data adoption and transformation methods that contribute to the insurance sector's extraordinary data analysis and forecasting abilities are shown in this article, which delves into the data transformation practises of the insurance business. Healthcare delivery systems need to be overhauled for "Big Data Analytics" to be of any real use. The purpose of this study is to investigate the ways in which modern data management has changed the insurance sector, as well as the traits and applications that have paved the way for the emergence of cutting-edge tools and the expansion of the economy.
Keywords: Insurance, Industry 4.0, Transformation, Financial data, economics.

1. Introduction

1.1 The fourth industrial revolution

"Industry 4.0," also known as the Fourth Industrial Revolution, is the result of broad adoption of cutting-edge technology like smart robotics, cloud computing, artificial intelligence, big data, the Internet of Things, 3D printers, and many more. Components of the value chain are brought together and incorporated into the automation system as part of Industry 4.0. Therefore, intelligent and autonomous machine interactions allow for faster, more efficient, and more successful industrial development. Therefore, these changes will influence people's daily routines, careers, and worldviews whether or not they like it. Because of the importance of the financial system to people's daily lives, these revolutionary changes will also have an impact on it.

In the context of global technological and behavioural changes and trends reshaping applicable models, advanced organizations, regulatory institutions, practitioners of technological ecosystems, and effective coordination models are required to enable favourable interaction in corporate financial management and ensure greater flexibility when integrating technology and digital transformation internally and externally. FinTech and Blockchain technologies can help with the financial services sector's required reform. Adaptation is crucial for success in today's workplace due to rising international competition, a more complex work environment, and the possibility of 24/7 work due to the use of the internet and mobile devices.

Majeed and Rupasinghe [5] have contributed to the field by proposing a conceptual framework for process automation utilising RFID and BAPI technologies to reorganise corporate information technology within the context of Industry 4.0. Wang et al. [6] offer a fog nodes deployment technique based on space-time characteristics (STC) to decrease computer reaction time and more evenly distribute work load across production lines, thereby increasing the efficiency of intelligent manufacturing.While many articles have discussed the dangers of Industry 4.0, very few have examined whether or whether implementing the technology might boost a company's bottom line [7-10]. Therefore, it is difficult to determine how far along a company is on the road to Industry 4.0. Understanding how the level of Industry 4.0 maturity affects financial results is crucial for optimising the implementation of Industry 4.0 and its impact on corporate financial performance.

1.2 Industry 4.0 Technology at the heart of industry: a boon to productivity

Globally, established industries are undergoing fast change as a result of the digital transformation, which is being hastened by the ever-evolving nature of technology. It is generally agreed upon that there have been four major industrial revolutions in human history. The first industrial revolution was sparked by the steam engine, the second by electricity and mass production, the third by programmable logic systems and the idea of digitalization, and the fourth by systems that bridge the gap between the physical and digital worlds. The paradigm change brought on by the integration of production and information systems in the current wave of technological development is sometimes referred to as "Industry 4.0" (I4.0). In the words of BDC's senior economist and VP of research, Pierre Cléroux: "at its core, Industry 4.0 is about being able to monitor and control your machines and equipment in real time by putting sensors at every step of the production process."

The terms "cyberphysical systems," "big data," "cloud computing," "Internet of Things," "intelligent factories," "intelligent products," "Internet of Services," "machine to machine," and "artificial intelligence" are frequently used while discussing Industry 4.0 [1]. In addition, the company must and can benefit from bringing almost all of its processes into the 21st century by using ICTs (Information and Communication Technologies).These developments are expected to yield substantial efficiency and performance enhancements. They were made to better facilitate productivity, cooperation, information sharing, and movement. In today's increasingly cutthroat economic climate, falling behind the curve could spell the difference between success and failure. Being flexible in the face of change is crucial.

2. Literature Review

More than six trillion United States dollars worth of income was generated by the insurance industry worldwide in 2022. A sum that is greater than the combined Gross Domestic Products of the ten largest economies in the world, including Japan, Germany, the United Kingdom, India, Italy, France, and Canada, and that generates twice as much revenue as the oil industry does (Hassani et al., 2020).

Due to this, actuarial science is today considered to be of significant importance and can be applied in a wide variety of settings. To put it another way, the insurance sector is extremely reliant on risk assessment, which is achieved through the utilisation of methods that are rooted in mathematics and statistics (Frees and Huang, 2023).

The significance of this study question is highlighted by the insurance industry's growing reliance on cutting-edge technology like big data, artificial intelligence, and machine learning. There is a term for these innovations: "disruptive technologies." Insurers may benefit from big data since it can help them gain a deeper understanding of their clients and so streamline their operations. As a result of more information being readily available, insurance premiums could be more accurately calculated. The level of precision of policy pricing is another area in which big data may aid insurance companies. According to Hassani et al.'s research from 2020, this can result in reduced expenses and increased levels of customer satisfaction.

The insurance business stands to gain from the use of big data in a number of ways, including improved risk assessments, claims administration, underwriting, retention, and customer satisfaction. Machine learning and artificial intelligence are frequently used in the insurance industry to analyse massive data sets. The automation of data processing, the discovery of patterns, and the enhancement of data quality are just a few of the ways in which these technologies might help the insurance industry. The concept of "big data" provides a conceptual backdrop for the insurance industry's application of big data, as massive, complex datasets are now more accessible than ever before, and as insurers must use these datasets to extract meaningful insights and produce sustainable commercial value. Both organised and unstructured data, including personal information, are used by insurance companies (Keller et al., 2018).

A 2018 study by SNS Telecom and Information Technology (IT) confirmed the meteoric rise of big data's application and forecasted spending of $3.6 billion by 2021 (Telecom SNC & IT, 2018). The study's findings also show that by using big data, costs can be cut by 40-70%, insurance packages can be made more accessible to more people, and fraud can be detected 60% more often.

Another study from 2018 (Corbett et al., 2018) indicated that 74% of insurance firms in their sample agreed that using big data and analytics has improved their organisations' competitiveness. This second survey

involved a much smaller sample size of insurance companies. There are many different kinds of insurance that can greatly benefit from big data analysis. Insurance against natural disasters (disasters like hurricanes, tornadoes, earthquakes, floods, and fires), human-caused climate change, and malicious cyberattacks are only a few examples.

The term "big data" is used to refer to datasets that are so large and complex that conventional analysis techniques are ineffective.In recent years, big data has emerged as a major player in several sectors, including the insurance industry. By putting this information to use, insurance firms have been able to reduce expenses, boost profits, and strengthen relationships with customers (Banu, 2022; Rana et al., 2022). Artificial intelligence (AI) and machine learning (ML) are frequently mentioned in conversations about big data. Big data is essential for the successful use of AI and ML technologies.

By focusing on how big data and machine learning can be applied to auto insurance, Hanafy and Ming 2021 advanced the field. They started off by saying that innovative approaches are desperately needed to deal with the rising tide of vehicle insurance claims, both in terms of frequency and severity. Machine learning (ML) is a method that can be used to solve this issue because it makes use of large datasets to predict future trends. In order to better serve their clients, auto insurers who put in the time and effort to deliver stellar service have begun to acquire and utilise machine learning techniques to gain a deeper understanding of their data.

3. Research Methodology

3.1 Financial technologies (FinTech)

It is commonly accepted that the term "Fintech," a portmanteau of "finance" and "technology," first appeared in the 1980s and 1990s in the English-language trade press. Only after the 2007 financial crisis did the term "fintech" become commonly used outside of the financial industry to represent cutting-edge, albeit young enterprises that are reimagining financial and banking services through the use of digital, mobile, artificial intelligence, etc. technologies. New prospects and products in the financial sector are all thanks to technological advancements, which have also shaken up the industry's traditional participants.

The latter pave the way for FinTechs to enter markets traditionally dominated by larger, more established firms. Financial services are only one of many industries that have been affected by the widespread use of mobile applications and the increased speed of Internet access made possible by advances in computer programming and engineering. The primary pool of customers for FinTechs continues to be mobile and digital payment systems. Many other technologies, such as APIs, AI, personal finance, retail investments, corporate investments, P2P (peer-to-peer) lending, mass finance, asset management, money transfer, critical data and analysis, and critical data and analysis, are essential to the success of financial platforms, insurance technology, regulatory technology, blockchain and cryptocurrency technology, robotic assistants, and next-generation banking.

Financial technology firms are rapidly expanding their global footprints. FinTech (https://bariskirenci.wordpress.com) offers small and medium-sized businesses (SMEs) greater flexibility in a variety of settings, such as payment systems, credit solutions, asset management, and insurance services. Some of the answers that were found in these fields represent slight improvements, while others presage a significant shift in the direction that the field as a whole is heading in. KPMG claims that "2015 is the year when Fintech became mainstream," with significant investments from VC firms in Fintech startups being followed by similar moves by large, established banks.In that year, investors put $47 billion into business startups. Customers also undergo changes as a result of technological advancements. Customer expectations are evolving as a result of the influx of millenials into the labour market. As the idea of the digital consumer grows in importance in both production and consumption, businesses must adapt their offerings accordingly.

3.2. Participants and Procedures

In order to test the hypotheses, this research employed a survey methodology. Since Industry 4.0 was designed from the ground up for use in production facilities and assembly lines, this research is concentrated on the manufacturing sector. Eight hundred and thirty-four people were chosen at random from the Ministry of Economic Affairs' database and contacted for this study. From the original pool of 834 businesses, 230

responded positively to the invitation to take part in the study of Industry 4.0. There was a total of 110 responses, or a 47.83% response rate. Human resource managers from each of the 110 participating organisations were asked to participate in this survey. Each business has tasked an Industry 4.0-savvy manager with assessing the company's present level of Industry 4.0 development. The survey questions were evaluated by academic and industry specialists to ensure they were well-organized, clear, and comprehensive before being sent out to participants. The surveys use known item scales gleaned from a thorough assessment of literature in the disciplines of Industry 4.0, supply chain management, and organisational science.

3.3. Measures and Analysis

Industry 4.0 has reached its full potential. created a set of ten indicators that can be used to determine how far along a company is in its transition to Industry 4.0. There could be indicators like "In1: Choose the best description of the product development phase in the company," "In3: Choose the best description of work-order management in the company's production system," and "In5: Choose the best description of materials inventory management (raw materials and work in progress) in the company's production system." Evaluation of achievements in the direction of Industry 4.0 has a Cronbach's alpha of 0.95.

To be more precise, the Industry 4.0 maturity model takes an average of each indicator's score. A company is considered to be operating in the first generation of industrialization if its production system is best described through oral communication (i.e., managers provide employees with verbal explanations of their work orders) rather than written communication (i.e., managers provide employees with written work orders). Communication between humans and machines (also known as programming) is an essential component of the third generation of industry. Between the third and fourth (or 3.5) generations of industry, machines communicate with one another, while in the fourth generation, workers use cloud-based intranets to talk to one another.

3.4. Model selection

The next step, following the cleaning of the data and the separation of it into training and testing sets, is to select the appropriate models to train on. The correct classifiers must be chosen in order to solve this classification problem. Both of the datasets that were used in the research were considered to be examples of "binary classification" data. This research employed a wide variety of classification strategies, including but not limited to Logistic Regression, Random Forest, Decision Tree, Support Vector Machine, Gaussian Naive Bayes, Bernoulli Naive Bayes, Mixed Naive Bayes, and K-Nearest Neighbours.

3.5. Model training

After the models that are going to be used in training have been selected, the models are then trained using the training data, with the models initially making full use of all of the features that are available to them in the training data. After that, classification algorithms are used, but solely on the features that were chosen using the aforementioned procedures.

3.6. Model evaluation and comparison

Finally, we compare the models and the feature selection methods to determine the most effective combination for the two datasets. In the analysis, the models are assessed with respect to four criteria: precision, recall, F1 score, and accuracy. We don't focus on just one performance indicator but instead use all four.

4. Results And Study

An increased engagement from the private sector, enhanced distribution capabilities, and significant increases in operational efficiencies have all contributed to an impressive growth rate for the insurance industry in India during the past two decades. This growth has been fuelled in large part by the country's rising middle class.

In the month of March 2023, the private life insurance sector had a substantial growth in premiums, with growth of 35% on a year-on-year basis and growth of 20% for the fiscal year 2023.

When compared to the year before, life insurance companies brought in 18% more money in premiums during FY23. According to the latest information provided by the IRDAI, life insurers brought in Rs. 3.71 lakh crore (about US$44.85 billion) in first-year premium in FY23. When compared to the Rs. 3.14 lakh crore (US$ 37.96 billion) collected in FY22, this is an increase.

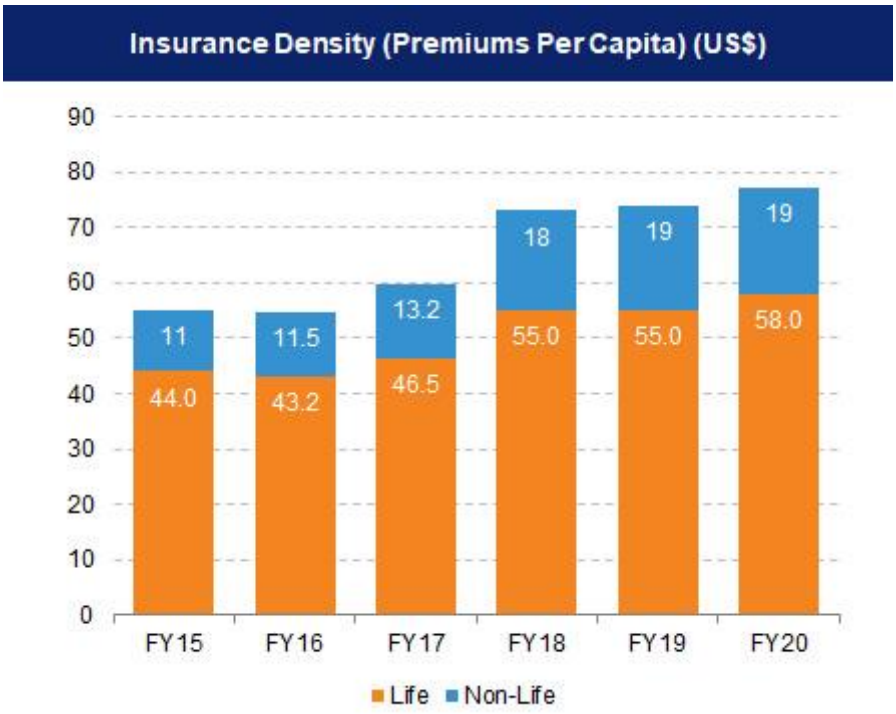

Fig 1: Insurance Density.

To no one's surprise, the mammoth state-owned insurance company LIC was the sole contributor of more than 60 percent of the total new business premium collection. Figure 1 demonstrates that the insurance company brought in close to Rs. 2.31 lakh crore (US$ 27.93 billion) in premiums during the fiscal year FY23. Compared to the Rs. 1.99 lakh crore (US$24.06 billion) it earned in FY22, this is a significant gain.

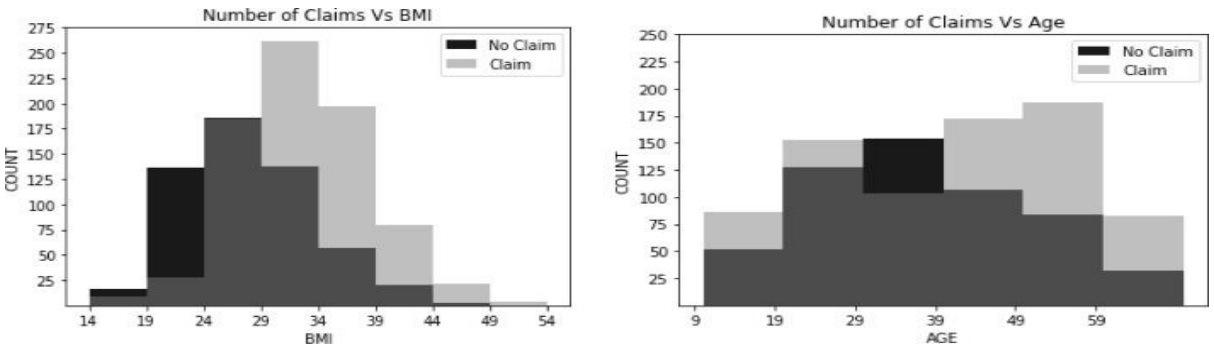

Fig 2: A graphical depiction of how many claims are submitted according to the age of the beneficiary and how many claims are submitted relative to the beneficiary's BMI.

Claims filed by policyholders with a BMI between 14 and 24 are the least likely, those with a BMI between 24 and 29 are neutral, and those with a BMI greater than 29 are the most likely, as shown in Figure 2. It is also abundantly obvious that those who are between the ages of 29 and 39 make up the biggest proportion of claim-free policyholders.

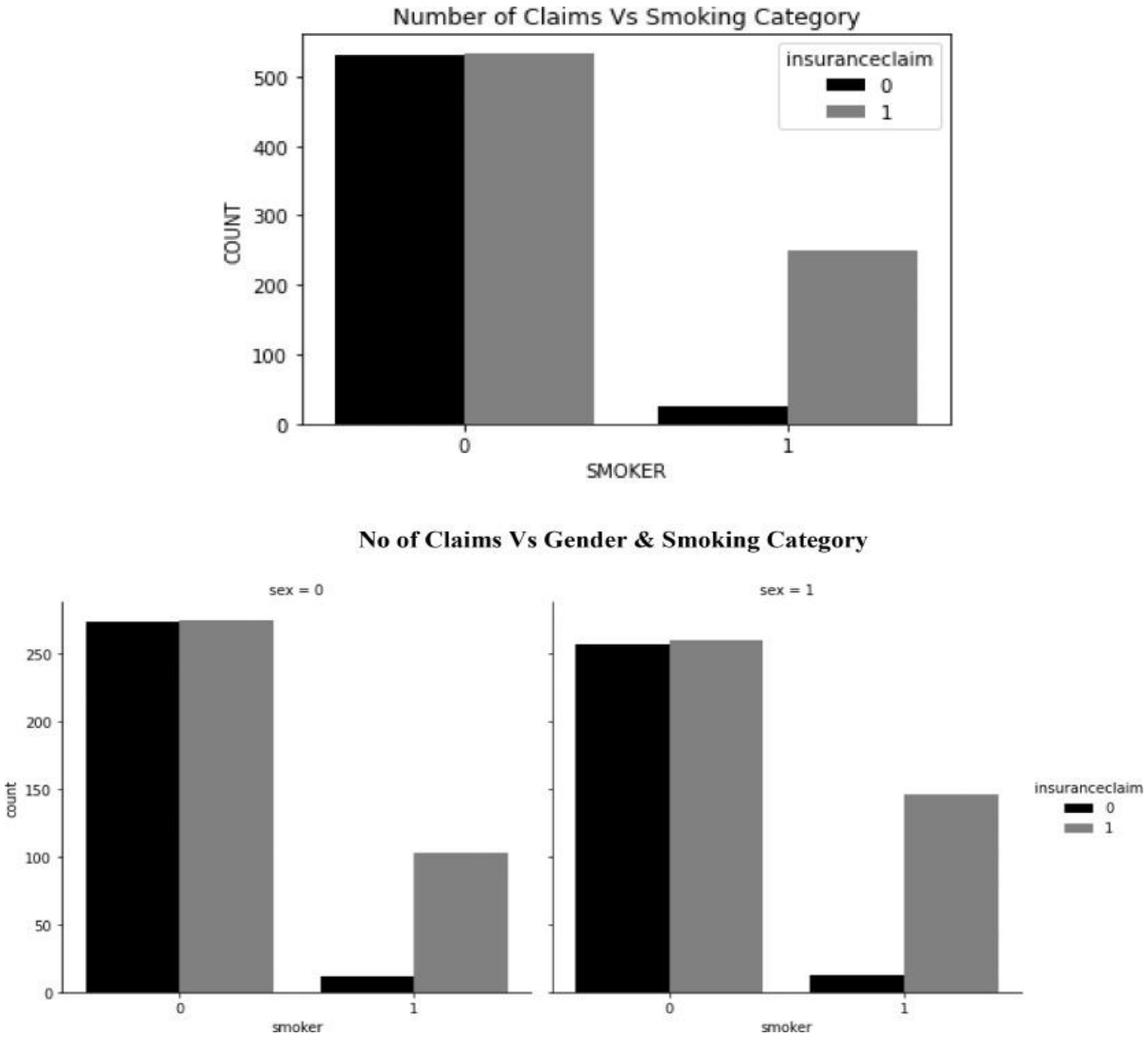

Fig 3: The correlation between the policyholders' smoking status and the number of claims submitted is depicted graphically, as is the correlation between the policyholders' smoking status and the number of claims filed for both female and male policyholders.

Figure 3 shows that while smokers are more likely to file a claim, non-smokers are agnostic about doing so, and that the sex of the policyholder has no bearing on the matter. Policyholders who smoke, regardless of gender, are more likely to submit a claim.

Table 1: The findings from both convergent and discriminant analyses of validity

Construct	Mean	Min	Max	SD	CR	AVE	ASE
Industry 4.0 maturity	2.58	1	4	0.66	0.91	0.64	0.02
Financial performance	4.98	3	7	0.94	0.86	0.74	0.21
Customer performance	5.23	4	7	0.74	0.83	0.60	0.33
IBPP	5.21	4	7	0.77	0.80	0.64	0.40
SCP	5.29	4	7	0.74	0.89	0.68	0.38

The AVE values in Table 1 vary from 0.60 to 0.74, well above the minimum acceptable value of 0.50. All the constructs' convergent validity is further validated by this finding.

5. Conclusions

In spite of the numerous advantages that may be gained from utilising insurtech, only 28% of large companies actively look for cooperation opportunities with insurtech startups, and even less than 14% take part in active incubation programmes or initiatives. It is challenging for new insurance technology businesses to maintain their existence for an extended period of time because there are so few partnerships available. The viability of applying this methodology on a larger scale is called into doubt as a result of this. Because most of its resources are already being spent on policy distribution, it might be difficult for a startup insurance firm to invest in areas like underwriting, claims to service, and regulatory compliance. This is because a large portion of a firm's resources are committed to the marketing and sale of policies.

References

[1] Hermann, M., Pentek, T., Otto, B.: Design principles for industrie 4.0 in Production, Automatisation and Logistic
[2] Karsal, E. (2016). Better Than One Cloud, Multiple Clouds.
[3] [3] Oktay Fırat, S. Ü. (2016). Determining What is Industry 4.0 Transformation and Expectations, Global Industrialists Magazine.
[4] Şahin, M. (2016). Industry 4.0 Age Begins: Your New Competitors Robots and Artificial Intelligence.
[5] Duman, A. A. (2016). Smart Factories: New Production Era with 4.0.
[6] Karaçallık, D. (2018). Effects of Digital Transformation on Fintech Systems.
[7] Ercan, O. (2018a). Open Banking and Card Payment Systems.
[8] [8] Azimova T., Mollaahmetoglu E., (2017), "Innovation in financial markets and its impact on savings." Journal of Business Economics and Finance.
[9] Ercan, O. (2018b). Accelerated Development of FinTec.
[10] Şişmanoğlu, E., Yaşar Akçalı, B. (2017). "Revolution in the Digital World: Bitcoin, Eurasian Academy of Sciences Eurasian" Business & Economics Journal, Vol.1, pp.33–52
[11] Hassani, H., Unger, S., Beneki, C., 2020. Big data and actuarial science. Big Data and Cognitive Computing 4, 1–29.
[12] Frees, E.W., Huang, F., 2023. The discriminating (pricing) actuary. North Am. Actuar. J. 27, 2–24.
[13] Keller, B., Eling, M., Schmeiser, H., Christen, M., Loi, M., 2018 Big Data and Insurance: Implications for Innovation, Competition and Privacy. www.genevaassociation. org.
[14] Telecom SNC & IT, 2018. Big Data in Insurance.
[15] Corbett, P., Schroeck, M., Shockley, R., 2018. Analytics: the real-world use of big data in insurance. Executive Report. IBM Institute for Business Value.
[16] Banu, A., 2022. Big data analytics-tools and techniques-application in the insurance sector. Big Data: A Game Changer for Insurance Industry. https://doi.org/10.1108/ 978-1-80262-605-620221013.
[17] Rana, A., Bansal, R., Gupta, M., 2022. Big data: a disruptive innovation in the insurance sector. Big Data Analytics in the Insurance Market. https://doi.org/10.1108/ 978-1-80262-637-720221009
[18] Hanafy, M., Ming, R., 2021. Machine learning approaches for auto insurance big data. Risks 9, 1–23.