

# Utilising Big Data Analytics in the Insurance Industry for Optimal Business Insight: A Literature Review

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## Abstract

*Organisations and insurance companies are not utilising business data and analytical methods to gain full advantage of accurate representation of risk, which can lead to further risk such as underinsurance, overpriced policies, and inaccurate claims assessment. Many companies organise their own insurance and risk management internally and rely on external experts such as insurance companies, brokers, and underwriters to help determine requirements. As part of this set up, there is a reliance on data derived from the organisation to inform policy placement, pricing of insurance policies and to accurately represent risk. The nature for enhancing the operational efficiency of insurance products using Big Data Analytics (BDA) is found to be a common concept in the insurance industry. The research work relating to insurance risks and cyber security is still in its infancy. Therefore, the research aim is to investigate how best to derive business insight from the insurance and risk division of an organisation using Big Data Analytics (BDA). The research considered security metrics for risk, control and mitigation based on the organisation's reaction to cyber risk for data accuracy. This paper reviews research previously conducted in the area with the aim of understanding which Big Data Analytics (BDA) methods are currently used and in which areas of the insurance industry. The findings show that Big Data Analytics (BDA) methods such as predictive analytics, artificial intelligence, machine learning and random forest regression are utilised in areas of insurance such as underwriting, claims and pricing.*

*Keywords: Analytics, Big, Data, Insurance, Risks*

## 1. Introduction

The nature for using Big Data Analytics (BDA) is a common concept in the insurance industry. Many organisations rely on insurance 'experts' such as brokers and underwriters to assess insurance and risk requirements but the implementation process varies by organisation. Data is required by insurers to place and price insurance within areas such as renewals, pricing, claims, risk management and underwriting. Although, the research in Big Data Analytics and Cyber Security for insurance business processes is still in its infancy, its real-world application in the

insurance industry can help to assist with data efficiency, effectiveness, and capability for deriving existing business insight which appears to be growing in popularity.

This paper reviews Big Data Analytics (BDA) that are currently used within the specific areas of the insurance industry to determine which methods of Cyber Security initiatives can be useful. This research will help to promote the understanding of the contemporary subject and will inform and justify future research.

Various emerging technologies including Artificial Intelligence (AI), Robotics and Blockchain and Internet of Things (IoT), have been deployed in two thirds of businesses based on risk management and underwriting. InsurTechs are keen to understand the commercial value that can be driven from emerging technologies and draw up use cases to ensure the insurance industry understands how these tools work [1].

Artificial intelligence has been used by InsurTechs in data driven areas of insurance to derive quick and accurate insight in areas such as sales, products and pricing, distribution, risk management, underwriting, claims and benefits management. It has been predicted that within the Insurtech sector the emergence of intelligent process automation (IPA) and robotic process automation (RPA) can be used within several areas of insurance [2].

On this note, it can be said that the Internet of Things (IoT) and Blockchain are seen as potential areas to focus on and therefore, these new forms of technological methods are required to be fully understood and hence, further exploration of the research area is required before breaking into the industry.

In terms of a notable case study, it is noted that a property and casualty insurance company had an issue with fraudulent claims and so invested in and implemented advanced predictive analytics software to isolate the false claims which then helped speed up the processing times for genuine ones. This led to spotting 88% of fraudulent claims which meant the claims process was shorter and there were less losses [3].

In contrast to the above success story, based on research conducted in EMEA, although insurers have made investment in data analytics, there has been no notable increase in value added to businesses. The

research study concluded by Deloitte [4] indicated that although insurers wish to become more data driven, they are faced with challenges such as lack of interest in data analytics from the organisation, which is likely caused by gaps identified in expertise of data analytics that has resulted in minimal data solutions being implemented into business processes.

The above-mentioned examples have introduced the ways in which Big Data Analytics (BDA) has the capacity to provide enhancements to the overall efficiency of areas within the insurance industry, thus beginning to justify the relevance of this topic, whilst also noting potential challenges for cyber security. The below section will build upon this further by analysing a selection of research that has been conducted and focuses on specific types of Big Data Analytics (BDA) in various areas of insurance.

## 2. Literature Review

According to Ellili et al. [5], no previous bibliometric analysis in the research area had taken place, thus creating the opportunity for similar studies to fill the research gap.

Ventakesh [6] pointed out that data analytics provides insurance companies with the opportunity to collate structured and unstructured data that leads to growth. This point emphasises the positive connotations of using data analytics in the industry, however, the research focuses on the use of social media as a platform which may not be a viable option to those within industry unless they have the relevant skill sets.

Stanković and Stanković [7] stated that Big Data Analytics (BDA) is being implemented due to the availability of large amounts of data in areas of insurance such as underwriting, pricing, product design, claims processing, management of distribution and marketing. It is interesting to note that the research emphasises that there can be benefits derived from adoption of new technologies and that they can assist competitive advantage, but not only that, consideration has been made to potential associated risks.

In terms of specific areas of insurance where researchers have noted the use of data analytics in the insurance industry, this can be found in abundance, particularly in the past few years. Several specific areas of Big Data Analytics (BDA) have appeared in research, and as outlined and analysed in the below paragraphs, begins firstly with artificial intelligence.

McKinsey and Company [8] stated that artificial intelligence can assist with underwriting, whereas Bhardwaj and Agarwal [9] indicated that artificial intelligence can help improve decision making and understanding. Zafiris and Cheng [10], informed that artificial intelligence helps to create advantage. The noted emphasises that artificial intelligence has a place in the insurance industry within underwriting and with improving overall efficiency, however a more detailed analysis would be beneficial.

The next area for consideration is predictive analytics. The research work of Duck Creek [11]

noted that predictive analytics can also assist with underwriting and additionally with claims whilst reducing issues with costs which leads to increased profitability. Fang et al. [12] stated that the Big Data Analytics (BDA) method random forest regression can also lead to an increase in profitability.

Although briefly mentioned above, claims can be assisted through use of predictive analytics research in work presented by Duck Creek [11] and additionally, through machine learning to ensure more accurate loss reserves of claims as presented by Baudry and Christian [13]. Mitzgier et al. [14] considered data analytics in relation to Business Interruption (BI) insurance and how this could lead to a more targeted analysis of data that can be derived from BI losses to assist with claims.

In addition to the above, Islam et al. [15] investigated how interactive visualisations could be used for insurance claims analysis. This research informs that guidelines have been formed to help the insurance industry incorporate this into practice.

Moving on to the specific type of insurance policy that insures cyber risks, Sun and Lu [16] considered the use of a generalised linear mixed model using predictive analytics for assessing data breach incidents in Cyber research. The severity and frequency of cyber losses was considered as part of this model to aid insurers with the pricing of cyber policies and organisations with the development of risk mitigation strategies. This research has noted several uses for both the insurance industry and organisations, thus potentially bridging a gap between the two.

Having considered above some of the research that has already been conducted in the field, it can be noted that Katsu [17] stated that research about Big Data Analytics (BDA) is viewed to be insufficient and dispersed. In this study they investigated how the research of Big Data Analytics (BDA) can improve the effectiveness of organisations and considered the types of jobs that Big Data Analytics (BDA) can address. It was found that there is certainly a connection between Big Data Analytics (BDA) and effectiveness.

Research on data analytics may not always be deemed to be advantageous and as such, limitations should be considered. As mentioned earlier on in the paper, it can be said that all insurers appreciate the use of Big Data Analytics (BDA) for this reason. Huang [18], pointed out that there are various ethical considerations in relation to machine learning. It is thought that there will be other considerations that an insurance company or related organisation should consider before using data analytics and a relevant due diligence process should be undertaken.

## 3. Review Methodology

In terms of research strategy, literature reviewed involved accessing sources that would have the potential to answer the broader and specific research aims, namely related to literature conducted about Big Data Analytics (BDA) within the Insurance

industry. The literature conferred was selected via valid sources such as renowned peer reviewed journals, conference, and white papers. All references cited have been listed. Sources selected were deemed credible and provided some insights into the subject area.

Once suitable literatures had been selected and narrowed down for use within this paper, the relevant findings were analysed and presented. It can be noted that it would have been impossible and unrealistic to refer to more sources in a paper of this length, so research was strategically chosen that provided a good introduction and starting point to assist the direction of future research.

The discussion section has provided an analysis of the sources outlined within the literature review and findings section, addressing areas for further research and the conclusion succinctly summarises the research paper overall.

#### 4. Findings

From the research literature assessed, it was found that there are specific types of data analytics that can be used by insurance companies, and these have been listed in Table 1. There are four types of data analytics considered and reviewed by relevant researchers in this field.

Table 1. Types of Data Analytics used by Insurance Companies and Literature Assessed

Types of Data Analytics in Insurance Companies	Literature Assessed
Artificial Intelligence	[9] and [10]
Predictive Analytics	[11] and [16]

Random Forest Regression	[12]
Machine Learning	[13]

As noted by the literature reviewed in Table 2 below, it was found that there are various areas of insurance in which data analytics has been proven to be utilised.

Table 2. Areas of Insurance utilising Big Data Analytics (BDA) and Literature Assessed

Types of Insurance Area	Literature Assessed
Underwriting	[7], [8] and [11]
Claims	[7], [11], [13], [14] and [15]
Pricing	[16]

Based on the research identified, Big Data Analytics (BDA) has been noted to have advantages such as improving decision making and understanding by creating advantages for cost reduction and for an increased profitability.

The Figure 1 summarises the more specific findings omitting general findings relating to Big Data Analytics (BDA) overall. The four boxes in the middle of the image show the Big Data Analytical (BDA) methods identified from the research findings and the adjacent boxes show the types of insurance that can be assisted by these methods, and or the advantages. Although not included in the below image, it can also be noted that Big Data Analytics (DBA) can be used in other areas of insurance including product design, and marketing.

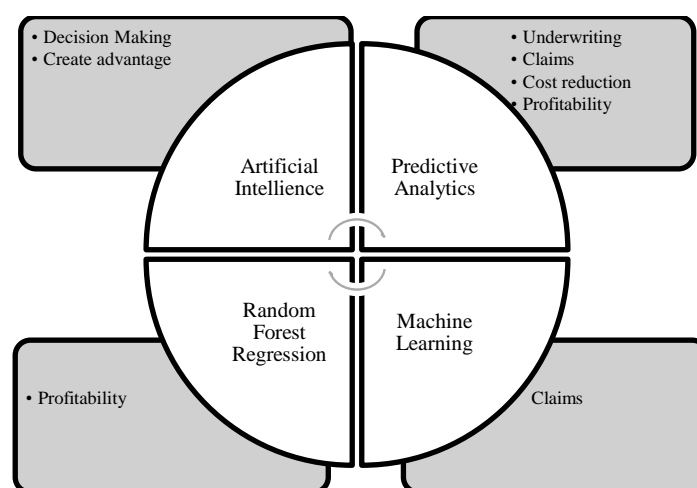


Figure 1. Illustrated Summary of Big Data Methods

Additionally, advantageous is that data analytics can lead to competitive advantage. There are findings that were omitted from the image above hence providing knowledge to the research limitations in this paper. The above image focuses on both sets of research findings that are related to Big Data

Analytics (BDA) although, they are not all specific methods of BDA.

In terms of potential limitations of Big Data Analytics (BDA), it was earlier pointed out that it can be viewed as an ‘insufficient and dispersed’ method. However, it is worth noting that based on the research

papers explored on Big Data Analytics (BDA) the area is viewed positively overall.

## 5. Discussion

Although this research topic is being more regularly investigated by scholars in the field, to some extent it does still appear to be in its infancy and some gaps have been identified in relation to specific cyber insurance contexts. It is hoped that more research will become available as time goes on and the topic will gain popularity with both scholars and practitioners.

It is apt to point out that all research identified and presented as part of this paper came from credible sources such as peer reviewed journals and as such it can be stated that research obtained and presented in the findings can be considered useful. When initially planning the more specific aims and outcomes for this research paper, it was hoped that there would be some research available to analyse within the insurance areas of renewals, claims, policy placement and pricing. It was however found that some research in these areas was not available, or in short supply and most of the research, at least right now lies in the areas of claims and underwriting. It would be advisable for future researchers to consider identifying or conducting research in the areas of policy renewals and pricing, as there is clearly a gap, and from knowledge of what is required in these areas in terms of data, these areas could certainly or potentially benefit from Big Data Analytics (BDA).

It is interesting to note that out of the four main data analytical methods identified from the literature reviewed in this paper (Artificial Intelligence, Predictive Analytics, Random Forest Regression and Machine Learning), predictive analytics appears to be the most favourable and serves a purpose in both claims and underwriting. It is felt that it would be useful to further explore why this is from looking in more detail at predictive analytics as a concept. From looking at recent articles in the insurance industry it can at least be noted that analytical tools overall are gaining popularity in the field, as earlier stated by a research work above. It was reported that insurers in the Middle East, Africa and Europe are beginning to invest heavily in advanced analytics. This point positively helps to justify further research and investigation by both scholars and practitioners within the insurance industry.

At this point in time, based on the literature reviewed, it can be stated to insurance companies that underwriting and claims can be assisted by Big Data Analytics (BDA) and as outlined, predictive analytics is a popular one to try. However, it can also be pointed out that based on non-scholarly research, artificial intelligence could be a step ahead and already appears to be making traction in industry. Notably, one of the major insurers Hiscox has recently announced that it plans to automate some of its underwriting processes using artificial intelligence by collaborating with Google [19]. This evidences

that this field is growing, and it is seen that insurance companies are collaborating with big names in the technology industry, which further justifies the relevance of this research paper.

In terms of overall perception of Big Data Analytics (BDA) in the insurance industry, several advantages have been outlined and the general sense is that the area is perceived to be positive. A small number of limitations were presented which should be considered by scholars wishing to conduct future research, or by companies considering implementing Big Data Analytics (BDA) in their organisations. From reading up on the subject via alternative sources, it can be said that although data analytics can be viewed as challenging based on the need of cyber security requirements, more insurance businesses may become plagued with different challenges such as theft and fraud. The research idea can in fact be alleviated by creating data insight focusing on cyber security for Big Data Analytics (BDA).

As an overall summary, the literature research presented has successfully provided an initial introduction to the subject area. Although it can be deemed preliminary at this stage, there is scope to use this as a base to conduct further research. In addition to exploring scholarly research, it has been useful to also consider industry articles to help back up points and to also justify the need for further research. It is interesting to see how quickly this field is developing and how Big Data analytics has the potential to drive the insurance industry forward and together with cyber security perceptions, by alleviating cyber risks, threats and cyberattack issues, will create a more efficient and secured business environment.

## 6. Conclusion

To conclude, this paper has successfully attempted to determine how Big Data Analytics (BDA) is utilised in the insurance industry by assessing current literatures in the field, backed up in part by industry news. Using the literature review approach has successfully helped to provide an overview of the current school of thought in this area, addressing where the gaps lie and outlining what this topic area has in store for the future in terms of required research.

Overall, it can be stated that based on what has been presented within this paper, insurance companies are currently positively benefiting from Big Data Analytics (BDA) in several areas of operations. It is recommended that if insurers were considering using any of the noted methods in Table 1, then there is a requirement to look at more in-depth case studies and to seek expert advice before implementation.

Further research will be conducted in this area to prepare for a more in-depth research analysis of this project.

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