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Corporate Risk Management Strategies Using Big Data and Predictive Analytics

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Abstract

Digital transformation has brought significant changes in the corporate risk management landscape. The application of Big Data and predictive analytics provides new opportunities for companies to identify, monitor and control risks more effectively and efficiently. This research aims to examine the implementation strategy of Big Data and predictive analytics in corporate risk management through the literature review method. The results show that the integration of these technologies can improve early detection of risks, accelerate data-based decision-making, and automate the risk mitigation process. However, successful implementation is strongly influenced by the readiness of technological infrastructure, human resource competence, data governance, and management commitment. With the right strategy, companies can build an adaptive, responsive and highly competitive risk management system in the digital era.

Keywords *corporate risk management, Big Data, predictive analytics, strategy, digitalization.*

INTRODUCTION

The development of information and communication technology (ICT) has brought fundamental changes in the world of business and organisations. Massive digitalisation is pushing companies to adapt to an increasingly dynamic and uncertain environment. This digital transformation not only presents new opportunities, but also raises a variety of complex and multidimensional risks, thus demanding a more adaptive and innovative risk management strategy (Power, 2014).

Corporate risk management is one of the main pillars of good corporate governance. In the digital era, the risks faced by companies are no longer limited to conventional aspects such as finance or operations, but extend to cyber risk, data privacy, and reputational risk due to the rapid spread of information through digital media (Gupta & George, 2016).

Increased reliance on digital technology has significantly changed the business risk landscape. Companies now have to face data security threats, cyber-attacks, system failures, and third-party risks that can disrupt operational continuity. Therefore, digital risk management has become an urgent need for any organisation that wants to survive and thrive amidst global competition (Kshetri, 2014). Big Data and predictive analytics are emerging as strategic solutions to risk challenges in the digital age. Big Data enables companies to collect, store and analyse large volumes of data, both structured and unstructured, from multiple sources in real-time. Meanwhile, predictive analytics utilises algorithms and artificial intelligence to identify patterns, trends and potential future risks (Baridah et al., 2025).

The integration of Big Data and predictive analytics in risk management gives companies a competitive advantage. With in-depth data analysis, companies can conduct early detection of potential threats, estimate the impact of risks, and design more effective

mitigation strategies. This also accelerates the data-driven decision making process (Dewi & Dewayanto, 2024). However, the utilisation of advanced technology in risk management also presents new challenges. One of them is the limited digital capabilities of human resources, both in terms of data literacy and mastery of analytics technology. Investment in training and digital skills development is a key factor for companies to optimise the benefits of Big Data and predictive analytics in risk management (Reyhan & et al., 2023).

In addition to technology and human resources, the success of digital risk management is also strongly influenced by organisational culture and visionary leadership. Organisations that encourage innovation, cross-functional collaboration, and data-driven decision-making tend to be more adaptive in dealing with unexpected changes and risks. Digital transformation demands fundamental changes in a company's business systems and processes. Information systems play a central role in supporting automation, business process optimisation, and data integration across work units. With an integrated system, companies can monitor and control risks more systematically and efficiently (Aulia., 2024)

Risk management strategies based on Big Data and predictive analytics must also pay attention to regulatory and compliance aspects. Companies must ensure that data management is carried out ethically and in accordance with applicable regulations, such as personal data protection and information security. Regulatory compliance is one of the determinants of successful implementation of digital risk management strategies (Arifulsyah., 2023)

In the financial, manufacturing and public service sectors, the application of Big Data and predictive analytics is proven to improve the effectiveness of risk management. Examples include fraud detection, compliance monitoring, operational disruption prediction, and real-time credit scoring. Case studies in various industries show that companies that adopt these technologies tend to be more resilient to crises and market changes (Mahendra & Soewito., 2023)

The literature also highlights the importance of a holistic approach to risk management in the digital age. In addition to technology, companies must strengthen governance, pay attention to stakeholder engagement, and build sustainable organisational learning mechanisms. Thus, companies can continue to innovate and adapt amid the dynamics of the global business environment (Mara & Sipahutar., 2020)

This research aims to identify and analyse effective corporate risk management strategies through the use of Big Data and predictive analytics. The literature review is used to explore concepts, best practices, and challenges faced by companies in integrating digital technology into the risk management system. The research results are expected to provide theoretical and practical contributions to the development of resilient corporate risk management strategies in the digital era.

METHOD

This research uses the literature review method, namely by collecting, examining, and analysing various relevant literature sources such as scientific journals, books, industry reports, and previous research results that discuss Big Data-based corporate risk

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management strategies and predictive analytics. The analysis process is carried out systematically to identify concepts, trends, best practices, and challenges of implementing these technologies in risk management, so that a comprehensive and in-depth synthesis of knowledge can be compiled in accordance with the research objectives (Eliyah & Aslan, 2025) ; (Petticrew & Roberts, 2020).

RESULTS AND DISCUSSION

The Role of Big Data in Corporate Risk Management

Big Data has revolutionised the corporate risk management approach by providing data analysis capabilities in large volumes, at high speed, and from multiple sources. Data generated from financial transactions, digital activities, social media, and IoT sensors provide a more comprehensive and real-time picture of risk than traditional methods. One of the main advantages of Big Data is its ability to increase the speed and accuracy of risk identification. With advanced analytics, companies can detect early signs of operational, financial, or market problems before the risk develops into a major threat (Mikalef et al., 2018).

Big Data enables more efficient fraud detection. The system can analyse transaction patterns in real-time to find suspicious activity, allowing companies to take immediate preventive action and reduce potential losses due to fraud. In credit risk management, Big Data plays an important role in predicting the likelihood of default. By analysing transaction history, payment behaviour, and external data, financial institutions can assess the risk profile of potential borrowers more accurately and objectively (Pangestu & Ikasari. , 2023)

Risk portfolio analysis has also become more dynamic thanks to Big Data. Companies can evaluate the interconnectedness of various risk factors simultaneously and adjust risk management strategies in real-time, especially in the face of market volatility or sudden changes. Big Data supports data-driven decision making in risk management. Information generated from big data analysis helps management formulate more appropriate, efficient and cost-effective risk mitigation policies (Seddon et al., 2017). Automation of risk identification and mitigation processes becomes possible with Big Data. The use of algorithms and analytics software allows previously manual and time-consuming processes to become faster, more accurate, and less prone to human error (Wamba et al., 2015).

Big Data also helps in continuous risk monitoring and control. With a real-time monitoring system, companies can immediately find out changes in conditions that have the potential to cause risks and immediately make adjustments to strategies (Nazhifa & Fatima, 2023).

Companies can better manage operational risks through data analysis from various internal and external sources. Logistics data, customer behaviour, and media opinions can be integrated to map operational risks that were previously difficult to detect (Syahputra & Santoso, 2024).

Big Data drives operational optimisation and cost reduction in risk management. Operational data analysis can identify inefficiencies, potential savings, and opportunities for process improvement, allowing companies to allocate resources more effectively. The main

challenge in utilising Big Data for risk management is data quality and security. Inaccurate or unprotected data can lead to new risks, such as analysis errors or leakage of sensitive information (Kohli & Melville, 2019).

Overall, Big Data has become a key enabler in modern corporate risk management. With its ability to identify, evaluate, monitor and control risks proactively and predictively, Big Data provides a competitive advantage to companies that are able to manage it well.

Predictive Analytics for Risk Identification and Mitigation

Predictive analytics is a data analysis approach that utilises historical and current data to predict future events, including potential risks that a company may face. By combining statistical techniques, mathematical modelling, and machine learning, predictive analytics is able to identify hidden patterns that are not visible through conventional methods (Delen & Demirkan, 2013).

In the context of risk management, predictive analytics serves as a key tool to detect and anticipate risks before they actually occur. Predictive models can project market trends, anticipate consumer behaviour, and identify potential threats that are not yet visible to the naked eye. Statistical techniques such as regression analysis, Monte Carlo simulation, and probability distributions are the main foundation in building predictive analytics models for risk. With these techniques, companies can estimate the likelihood of risk occurrence and calculate its potential impact, so that mitigation measures can be more measurable and effective (Provost & Fawcett, 2013).

Predictive analytics provides the ability to perform early detection of fraud risks, loan defaults, and operational disruptions. For example, in the financial industry, predictive models are used to assess credit risk by analysing historical payment data and customer behaviour, allowing banks to minimise losses due to bad debts. In addition, predictive analytics are also very effective in anticipating market fluctuations and regulatory changes. By monitoring data trends in real-time, companies can immediately adjust their business strategies to reduce the negative impact of unexpected external changes (Sivarajah et al., 2017).

Predictive models built with machine learning and deep learning enable the analysis of large amounts of complex data. Neural networks, decision trees and logistic regression are some of the commonly used techniques to find nonlinear relationships between risk variables and produce more accurate predictions. The main benefit of predictive analytics in risk mitigation is its ability to provide real-time answers. With trained models, companies can receive early warnings and recommendations for immediate action when unusual risk patterns are detected (Grover et al., 2018).

Predictive analytics also assists companies in developing risk scenarios and contingency planning. Through the simulation of various possibilities, companies can prepare more mature responses to various worst-case scenarios, thereby increasing business resilience. The use of predictive analytics in customer segmentation and individual risk assessment allows companies to tailor mitigation strategies more specifically. This is

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important in industries such as insurance, where the risk of each individual or group can vary greatly (Chen et al., 2012).

The implementation of predictive analytics encourages more data-driven decision-making and reduces reliance on intuition alone. Thus, management decisions become more objective, measurable, and able to improve the company's competitiveness amid business uncertainty.

Although it offers many benefits, the integration of predictive analytics in the risk management system also faces challenges, such as data quality, selection of the right model, and the need for competent human resources in the analytics field. Companies need to ensure that the data used is valid and the models built truly represent business conditions (Mara & Sipahutar., 2020)

Overall, predictive analytics has become a vital component in modern risk identification and mitigation strategies. With its ability to proactively anticipate threats and provide data-driven recommendations, predictive analytics helps companies remain adaptive, resilient and competitive in the uncertain digital age.

Implementation Strategy of Big Data and Predictive Analytics in Risk Management

The implementation strategy of Big Data and predictive analytics in risk management starts with an organisation's commitment to adopt data technology thoroughly in its business processes. This commitment must be supported by the vision of top management that places data-driven risk management as the company's strategic priority.

A crucial first step is to build a robust and scalable data infrastructure. This infrastructure includes hardware, software, and data storage and processing systems that can handle the huge volume, variety, and velocity of data from various sources, both internal and external. Integration of data from various sources is the main foundation. Data coming from financial transactions, logistics, customers, social media, IoT sensors, and external reports must be processed and cleaned to make it suitable for analysis. The process of data cleansing is very important to ensure the quality and accuracy of the information generated (Kshetri. , 2014)

Once the data is consolidated, the company needs to develop a predictive analytics model that matches the characteristics of the risks faced. These models can be machine learning, predictive statistics, or AI-based algorithms that are able to recognise risk patterns from historical and real-time data (Manyika et al., 2011).

The implementation of predictive analytics should be geared towards early detection of risks. With the right model, companies can identify potential threats such as fraud, default, operational disruption, or market risk before they develop into major problems. Automation of the risk identification and mitigation process is an important strategy in operational efficiency. With the help of Big Data and predictive analytics, many processes that were previously manual can now be automated, reducing human error and accelerating responses to risks (McAfee & Brynjolfsson, 2012).

Data-driven decision making is becoming the new culture in organisations. Every decision related to risk mitigation is based on insights generated from data analysis, not just

intuition or past experience. Risk monitoring is conducted in real-time and continuously. Big Data-based monitoring systems allow companies to continuously monitor key risk indicators (KRIs) and immediately make adjustments to strategies if anomalies or significant changes in risk profiles are detected (Sagiroglu & Sinanc., 2013)

The implementation strategy should also include training and competency development of human resources. The availability of experts in data science, analytics, and risk management is key to the successful adoption of this technology. Training and certification programmes need to be conducted on an ongoing basis. Cross-functional collaboration is necessary, given that data and risks are spread across all lines of business. Risk, IT, operations, finance, and compliance teams must work together to build an integrated and responsive risk management system (LaValle et al., 2011).

Companies need to develop strong data governance policies and procedures. This includes privacy management, data security, and compliance with applicable regulations, considering the risk of data leakage and legal violations are the main challenges in the implementation of Big Data. Evaluate and measure the effectiveness of the strategy periodically. Companies should assess whether the implementation of Big Data and predictive analytics actually improves risk detection, reduces losses, and accelerates decision-making (MyCarrier Telkom, 2022).

Case studies in various sectors show that the implementation of Big Data and predictive analytics can improve operational efficiency, reduce downtime, and prevent major losses due to undetected risks. For example, in the manufacturing and logistics sectors, predictive analytics can minimise machine downtime and optimise supply chains (Abbasi et al., 2016).

The main challenges in implementation are technological complexity, investment costs, and limited competent human resources. Companies should prepare mitigation strategies to overcome these obstacles, such as partnering with technology consultants or making gradual investments. Successful implementation is also highly dependent on the readiness of the organisation's culture to change and innovate. Organisations that are adaptive and open to digital transformation are better able to maximise the benefits of Big Data and predictive analytics in risk management (Calabretta et al., 2016).

Overall, the implementation strategy of Big Data and predictive analytics in risk management should be holistic, covering technological, human, process and governance aspects. With an integrated and sustainable approach, companies can build a risk management system that is proactive, adaptive, and able to face business challenges in the digital era.

CONCLUSION

The application of Big Data and predictive analytics in corporate risk management provides significant advantages in identifying, monitoring and controlling various types of risks more quickly, accurately and proactively. With the ability to process data in large volumes and at high speed, companies can detect risk patterns that were previously difficult

to identify, as well as conduct early detection of potential threats that can disrupt operational and financial stability.

This technology integration also encourages the transformation of organisational culture towards data-driven decision-making, automation of risk mitigation processes, as well as improving the efficiency and effectiveness of risk management. However, successful implementation is highly dependent on the readiness of technology infrastructure, human resource competence, good data governance, and management commitment in supporting innovation and cross-functional collaboration.

Overall, a corporate risk management strategy based on Big Data and predictive analytics is an important foundation for companies that want to remain resilient and competitive in the digital age. This approach not only increases resilience to increasingly complex business threats, but also opens up opportunities to create added value through more adaptive, responsive and sustainable risk management.

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