How Big Data and Big Data Analytics Mediate Organizational Risk Management

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Abstract

Technological advancement has exposed companies to various risks. With the adoption of technological infrastructures in many companies, various processes have been rendered vulnerable to different forms of threats. Evidence from the current empirical studies on organizational management indicates effective risk assessment is a crucial aspect in any organization. Global technological advancement has equally redefined risk assessment and management strategies. Global leading technology companies such as Apple Inc., Amazon Inc., and Google are leveraging modern technology to unlock hidden data to aid in risk assessment and management. As evidenced in this research report, the use of big data has revolutionized risk assessment in many companies across the world. Big data technology has enabled organizations to collect, store, and assess huge information to aid in risk assessment and management. The processes of risk identification, assessment, mitigation, monitoring, and reporting have been redefined due to the adoption of big data analytical technology. As a result, this research reviews the specific roles played by big data in organizational risks management. The research carries out a comparative case study analysis among three companies that utilize big data in risk management. Specifically, the roles of big data technology in risk management at Apple Inc., Amazon Inc., and at Google are identified. Results from this comparative analysis are used in formulating recommendations for various organizations that desire to adopt big data analytical technology in risk management.

Keywords

Big Data, Project Management, Risk Management, Big Data Analytics

1. Introduction

Over the years, organizations have been implementing various risk assessment strategies to identify and prevent threats that hinder competitiveness. Risk assessment has been a central aspect in many organizations based on its ability to identify factors undermining performance. The proliferation of digital technology has redefined the need for risk assessment in many organizations. The incorporation of technological infrastructures has influenced many organizations to prioritize risk assessment due to various threats. The advent of digital technology has exposed many organizations to several risks. Arguably, unlike in the analogue era, organizations are currently utilizing modern technology to formulate effective risk assessment tools. Presently, technological risk analytic and data mining tools such as big data have been adopted to help organizations identity, assess, mitigate, monitor, and report the progress of various threats. Global-leading technology companies such as Apple Inc., Amazon Inc., and Google rely on data mining tools such as big data in assessing and managing risks. While several data mining techniques are used by organizations in risk assessment, the use of big data has proved to be effective because it unlocks hidden information enabling an organization to make accurate and data-driven risk management decisions.

1.1. Background

Organizations in the current world have adopted digital technology in almost all of their processes. Apart from leading to efficient, reliable, and accurate product and service delivery, technological adoption has led to the collection of information (Dicuonzo et al., 2019). Also known as big data, the collected information has been valuable in enabling organizations to formulate customer-centric business models. Guided by the importance of data in the contemporary world, Almeida (2017) argues that risks assessment can effectively utilize big data technology.

Big data has been a crucial aspect of risk management because it has helped organizations collect, store, evaluate, and apply data originating from different sources. The approach adopted in big data analytical strategies has enabled many organizations to detect, assess, mitigate, monitor, and report all forms of risks that might hinder continuous operations (Shabbir & Gardezi, 2020). A study conducted by El Khatib et al. (2022a) indicated that the disruptive technologies of big data management present opportunities that can be leveraged to improve the quality of service delivery in healthcare, indicating the benefits of big data analytics on organizational management. Defined as structured and unstructured software that is used in collecting information during the daily operations of an organization, big data has proved to be a vital risk assessment tool due to its ability to unlock some hidden information.

According to Tang and Karim (2017), the effectiveness of risk analytics is determined by the ability of an organization to carry out a holistic assessment. This process should assess and determine some of the hidden risks that might affect

seamless operations. According to El Khatib (2015), effective project management measures combine risk assessment strategies and value engineering for practical cost estimation, indicating the need to utilize big data for accurate analysis. Notably, adopting data-driving analytical strategies enables organizations to unlock some hidden and crucial information that leads to the formulation of an effective risks assessment strategy. Guided by the vital roles played by big data in risk management, it is essential to carry out research that will provide a practical application of this data-driven technology in preventing various organizational threats.

1.2. Research Problem

Technological advancement has exposed several organizations to numerous risks. Some of them include:

- Cybersecurity risks, such as data breaches, malware, and phishing attacks.
- System and infrastructure risks include vulnerabilities in cloud technology, poorly written code, outages, and service disruptions.
- The reputational risk from media coverage or customer complaints of poor customer service or data misuse.
- Regulatory and compliance risks, such as the failure to meet industry standards.
- Legal and financial risks, such as litigation cases or liability for damages.
- Operational risks, such as resource management and workforce challenges, or communicating with stakeholders in the digital space.

Apart from fostering efficient, reliable, and convenient products and services provision, the digital technology being used by organizations has exposed them to several risks. Unlike in the analogue era, the increased risks facing organizations have led to the demand for the formulation of a more accurate and data-driven strategy that can effectively assess and manage various risks. An increase in technological risks faced by organizations has led to the demand for a more effective management strategy (Tang & Karim, 2017). As a result, this research focused on solving the current challenge of increasing cases of technological risks faced by organizations by analyzing the roles played by big data. Therefore, organizational management must be informed on the implementation and management of various information technologies as they expose organizations to both risks and benefits (El Khatib & Al Falasi, 2021). Specifically, this research reviews the use of big data analytical technology in solving various risks faced by organizations. With reference to the application of big data technology in leading companies, this research formulates effect strategies that should be utilized by organizations to identify, assess, mitigate, monitor, and report various risks.

1.3. Research Objectives

The primary objective of this research was "*To determine the roles played by big data in organizational risks management*". Other objectives of the research were

"*To determine the practical applicability of risks assessment in leading organizations*" and "*To determine how big data is used in risk identification, assessment, mitigation, monitoring, and reporting*". Achieving these objectives was effective in solving the research problem and enabling the researchers to identify the critical roles played by big data in organizational risk management.

1.4. Research Questions

The whole of the research process aimed at answering the following four questions:

1) What is the role of big data in organizational risk management?

2) How is big data applied in the management of risks at Apple Inc.?

3) How does Amazon Inc. utilize data mining technologies such as big data to assess and mitigate various risks?

4) How does Google utilize big data in risk management?

Notably, answering the above four research questions was vital in enabling the researchers to formulate effective risks management strategies that organizations can utilize to overcome various risks. Specifically, the questions were significant in analyzing the practical application of big data technology in organizational risk management in the contemporary world.

1.5. Significance of the Research

Despite the existence of literature on the use of big data in achieving effective customer management, there is a dearth of data detailing the role of big data in organizational risk management. In effect, this research was vital in filling the existing gap by analyzing how big data is utilized in assessing and managing organizational risks (Dicuonzo et al., 2019). Literature from this research will be vital in filling the existing research gap. Researchers will build on the findings of this study to carry out further analysis on the application of data mining technologies in organizational risks management.

Moreover, this research is very important because it formulates strategies that can be applied by organizational management and the risks management departments in the course of assessing and managing various threats (El Khatib et al., 2022b). Guided by the advent of digitalization in many organizations, the findings of this research will be used as a guide that will influence the adoption of big data analytical technology in risk assessment and management. Notably, carrying out this study is vital in identifying the roles and benefits of using big data mining technology in organizational risks management.

Lastly, the comparative case study analysis approach adopted in this research was vital in enabling the researcher to solve the current problem of technological risks being witnessed in various organizations. The adoption of digital technology in many organizations has exposed many processes to various risks. These risks can only be solved by adopting a data-driven risk management strategy (Shabbir & Gardezi, 2020). Adopting big data analytics fosters the aspects of ac-

curacy during risk identification, assessment, mitigation, monitoring, and reporting. As a result, the comparative case study analysis carried out in this research was vital in creating practical applicability of big data in organizational risk management.

1.6. Theoretical Novelty

The study is significant because it helps to understand how advanced analytics tools can enable risk managers to monitor, detect and predict emerging risks that can affect their organizations. It also shows how big data analytics can be applied to organizational risk management activities. Specifically, the study presents insights on different organizations on the opportunities and challenges of using big data and analytics to improve the organizational risk management decision-making process. It provides some concrete guidelines and recommendations on assessing and managing the impact of big data and analytics on organizational risk management activities. Additionally, this study contributes to the literature and could inform future research on big data and risk management.

2. Literature Review

Technological advancement in the contemporary world has influenced scholars to carry out studies to identify the roles played by big data in organizational risks assessment and management. Evidence from the studies by Kumari (2018) indicates data mining technologies such as big data analytics have revolutionized organizational risk management. On the other hand, Shabbir and Gardezi (2020) postulate that the application of big data analytics in risks management has enabling organizations to uncover critical data that has led to the formulation of a more accurate and applicable risk management strategy. The studies by Tang and Karim (2017) justify the use of big data technologies in organizational risk management by holding that this approach enables managers to make accurate and data-driven decisions. Literature from the current studies identifies various roles played by big data analytics in enabling organizations to assess and manage different risks. Some of these roles are discussed in the subsequent sections.

2.1. Big Data Analytics Is Used in Fraud Prevention

Studies by Dicuonzo et al. (2019) analyzed the role of big data analytics in preventing various forms of frauds experienced in organizations. Evidence from this study indicated that big data analytics have the capability of detecting different forms of fraud. This is attributed to the ability of technological solutions that provide real-time data analysis, an option that has been exploited in disease management through wearable devises (El Khatib & Ahmed, 2019). Organizations in the contemporary world experience various forms of financial frauds caused by employees and other stakeholders. However, Jin and Wagman (2021) suggest that big data analytics enables an organization to collect big volumes of

data that detect and prevent any form of fraud in an organization. In this regard, organizations should consider adopting big data analytics to prevent the rising cases of fraud.

2.2. Big Data Analytic Help Organizations to Manage Various Risks Associated with Third Parties

Most organizations outsource different services from third-party companies. According to Choi et al. (2018), some of these third parties end up causing significant risks to organizations. For instance, an organization outsourcing technological services such as cloud computing from third-party providers' risk facing challenges related to cybersecurity (Choi et al., 2018). On the other hand, an organization that deals with different vendors is always prone to several risks originating from these third-party suppliers (Kumari, 2018). As explained by Kumari (2018), risks originating from third parties can easily lead to the collapse of an organization. Big data analytics has been crucial in enabling organizations to collect a huge volume of data that can easily detect any form of external threat. The collected data has been utilized in assessing threats from third-party companies and formulating effective mitigation strategies (Kumari, 2018). Results from the studies by Jin and Wagman (2021) indicate that organizations that depend on big data analytics have well-established risk management approaches that prevent any form of external threat.

2.3. Big Data Analytics Have Been Vital in Reducing High Customer Churn Rates and Preventing High Employee Attrition

Customers and employees are two vital stakeholders in any organizations that determine its growth and development. According to Dicuonzo et al. (2019), organizations that achieve customer loyalty and retention register continuous growth and development due to the increased sales. On the other hand, Cole, Nelson, & McDaniel (2015) hold that employees are a driving force that ensures continuous operations in any organization. In this regard, increased customer churn rates pose critical risks that might result in the collapse of an organization. As explained by Cole, Nelson, & McDaniel (2015), the increased customer churn rate reduces the total market share of an organization rendering it uncompetitive. A study by El Khatib and Shurab (2016) indicated that reliance of digital technology strategies, such as online self-service impact customers positively as they are involved in the service delivery process. Similarly, high employee attrition leads to low-quality service delivering hindering an organization from meeting its objectives.

Consequently, the research by Almeida (2017) concludes that the adoption of big data analytics prevents the risks associated with increased customer churn rates and employee attrition. By applying big data analytics, organizations collect numerous information based on different customer segments. The company counters the risks of high customer churn rates by identifying various factors that

hindering customer satisfaction (De Mauro et al., 2018). Additionally, high attrition rates among employees can be easily detected, analyzed, and manipulated by using big data analytics. The adopted big data analytics identify the specific needs of employees and formulates ways of fostering retention.

2.4. Big Data Analytics Foster Operational Assessment and Enables Organizations to Manage Various Forms of Digital Risks

Big data technology enables organizations to collect, store, analyze, and apply big chunks of data in the course of assessing and managing different forms of risks. Operational risks are some of the common threats facing organizations in the contemporary world. Companies experience different risks originating from different organizational processes (De Mauro et al., 2018). Ineffective management of these risks threatens the stability of any organization. In this regard, the adoption of big data analytics has proved to be effective in handling various operational management threats. According to El Khatib et al. (2022c), reliance on the digital technologies also contributes to improvement of service quality dimensions, including reliability and security, which are integral components of risk management. Similarly, research by Vassakis et al. (2018) revealed that adopting digital technology has led to the existence of several risks in the contemporary world. However, Jin and Wagman (2021) established that relying on big data analytics has proved to be effective in dealing with various threats associated with digitalization. Notably, organizations should consider adopting big data technologies in achieving accurate, data-driven, and appropriate risk assessment and management.

3. Methodological Approach

3.1. The Research Design

The methodological approaches adopted in any research determine the effectiveness and viability of the research findings, conclusions and recommendations. As explained by Schoonenboom and Johnson (2017), the methodological approaches adopted in any research are equally important in determining the accuracy of the collected data. This research adopted a hybrid research strategy that collected both qualitative and quantitive data. The hybrid or mixed-method research design adopted a case study analysis. The comparative case studies aimed at determining the specific roles played by big data in organizational risk management. As evidenced below, qualitative and qualitative secondary data was collected from the case studies on how Apple Inc., Amazon Inc., and Google utilize the data mining technology of big data analytics in managing various forms of risks.

3.2. Case Study Analysis

Guided by the developed research design, researchers carried out a comparative

analysis that reviewed the application of big data analytics in risk management in Apple Inc. Amazon Inc., and at Google. The comparative analysis aimed at establishing the specific roles played by big data analytics in assessing and managing various risks.

3.2.1. Case Study 1: The Role of Big Data in Risk Management at Apple Inc.

The utilization of big data has proved to effective in managing various forms of risks at Apple Inc., as explained by PathakJan (2021) Apple Inc. adopts a Siri voice recognition big data technology that collects, stores, analysis, and applies the collected data. According to PathakJan (2021) Apple Inc. has been relying on its big data collection and analytical strategy to improve counter various risks. Just like other leading technology companies, Apple Inc. utilizes the big collected data to identify, assess, mitigate, monitor, and report various risks. For instance, internal risks associated with financial transactions, employee attrition, high customer churn rates, and threats posed by third-party organizations (Apple Inc. 2021). Besides, research on the company's approaches to design development and mitigation of market threats from competitors indicates that Apple significantly relies on data analytics and technological development strategies (El Khatib, 2014).

As the leading technology company, Apple Inc. has shifted to the use of data mining analytics to accurately assess and manage various risks. The *Siri* voice recognition technology utilized by this company in collecting big data has been essential in detecting different forms of risks and formulating mitigating strategies before occurrence. As explained by Sun et al. (2020), apart from enhancing customer relationships management, the big data analytics used by Apple Inc. have been vital in formulating recovery strategies that foster continuous growth and development. Similar to the risks management strategies used by both Amazon Inc. and Google, Apple Inc. has been utilizing this big data technology in unlocking some of the hidden information that threatens seamless operations in the company.

3.2.2. Case Study 2: The Role of Big Data in Risk Management at Amazon Inc.

The business model adopted by Amazon Inc. has exposed it to numerous risks. As a company that relies mostly on third-party vendors, Amazon Inc. is always vulnerable to various risks. However, the company has been utilizing effective data mining technologies to detect, assess, mitigate, monitor, and report various forms of internal and external risks (Amazon Inc., n.d.). Ranked among the global leading technology companies, Amazon Inc. collects, stores, analyses and applies big data in all of its business processes. The cloud computing technology adopted by Amazon Inc. utilizes the *AWS* big data software to assess and manage different forms of risks, essential in collecting, storing, processing, and applying big data (Amazon Inc., n.d.). According to Sean (2021), the application of big data at Amazon Inc. has been vital in mitigating risks associated with busi-

ness strategy, compliance and regulatory risks, financial risks, and other operational risks.

Big data solutions have been shown as effective solutions to work flow and cost management, explaining its relevance to Amzon Inc. (Opulencia et al., 2018). As the leading e-commerce platform in the world, the big data collected by Amazon Inc. has been vital in enabling it to make accurate and data-driven risks management decisions. Just like Apple Inc. Amazon Inc. has been utilizing big data analytics to prevent various forms of internal and external fraud, lower retention and churn rates from employees and customers, respectively. Moreover, big data analytics used at Amazon Inc. have been vital in managing third-party risks and mitigating threats associated with operational processes.

3.2.3. Case Study 3: The Role of Big Data in Risk Management at Google

Google is the global-leading technology company that offers different products and services. As a global leading technology company, Google faced both internal and external risks that require effective management approaches. According to Sun et al. (2020), technological advancement has led to the adoption of big data analytics at Google. Apart from enabling the company to offer customer-centric products and services, the big data analytics adopted by Google Inc. has been essential in assessing and managing various forms of risks. Google collects big data using different software. The collected data is then stored, analyzed, and applied in managing different forms of risks (Google, n.d.). Google has prioritized the use of big data in risk assessment by identifying risks at an early stage and crafting effective mitigation strategies. According to Sun et al. (2020), the use of big data at Google has enabled this company to prevent risks associated with fraud and those originating from third party companies. Just like Apple Inc. and Amazon Inc., the use of big data at Google has been vital in mitigating operational risks that threaten the competitiveness of this company. Notably, big data has proved to be effective because Google is among companies that detect and manage different forms of risks at an early stage (See Table 1 for comparison of roles of big data in Apple Inc., Amazon Inc., and Google).

4. Results and Discussions

It is evidenced from the comparative case study analysis that big data plays vital roles in organizational risk management. Guided by the data collected in this research, big data analytics is an essential data mining technology that is used in leading organizations such as Apple Inc., Amazon Inc., and Google to detect, assess, mitigate, monitor, and report various risks. As evidenced in the concepts developed in the literature review, big data analytics plays the following risk assessment and management roles.

Firstly, big data analytics collects large sums of data that are used in detecting and preventing any form of internal and external fraud. As evidenced in a study by Almeida (2017), big data technologies have been essential in detecting any form of internal and external fraud in organizations. The detected threat is

Table 1. The similarities and difference in the role of big data analytics in Google, Apple Inc., and Amazon Inc.

	Similarities	Differences
Roles of Big Data in risk management in Apple Inc., Amazon Inc., and Google	• All three companies use big data to manage risk. They use data to prioritize risks, identify trends in customer behavior and buying patterns, determine customer satisfaction, and analyze how their products perform.	• Apple Inc. uses Big Data to analyze and manage risk in different ways, such as identifying potential growth areas, reducing customer churn, and predicting branding strategies, among other applications.
	• Additionally, they all use data to measure and mitigate cyber-attacks, frauds and other dangerous activities.	• Amazon uses Big Data to enhance customer experiences and manage risk more effectively. It includes understanding customer behaviors, identifying data patterns, detecting fraud, and managing legal risk.
		• Google Inc. uses Big Data to manage risk in various ways, such as helping identify security threats, developing marketing and operational strategies, and providing deep insights. Additionally, Google can leverage Big Data to identify potential growth areas, reduce customer churn, and discover fraud.

quickly analyzed, and accurate data-driven mitigation strategies are implemented (El Khatib et al., 2022d). Secondly, evidence from this research showed that organizational risks associated with third-party service providers or vendors could effectively be management by big data technologies. According to Dicuonzo et al. (2019), technological adoption in many organizations has led to increased outsourcing. Leading companies like Amazon Inc. rely heavily on external vendors and other third-party product and service providers. Such companies are always exposed to several risks that can be effectively mitigated by big data analytics. The data mining technology of big data collects large sums of data that can easily detect and manage risks associated with third-party companies and customers.

Thirdly, evidence from this research shows that big data analytics has been vital in reducing employee attrition rates and countering the increasing customer churn rates. As stated by Shabbir and Gardezi (2020), employees and customers are vital stakeholders in any organization. Any risks that prompt either employees or customers to lose interest or loyal in an organization causes detrimental effects (Tang & Karim, 2017). In this regard, the adoption of big data analytics enables organizations to assess various factors that lead to increased rates of employee attrition and craft effective mitigation strategies. Similarly, big data technologies are used to collect data on different customer segments. The collected data is analyzed to determine factors leading to the increased rates of customer churns. Effective strategies are equally established to mitigate these challenges.

Lastly, results from this research showed that adopting big data analytics is

crucial in assessing and managing risks associated with organizational processes and other digital threats. As stated above, technological advancement has led to increased demand for digital technology. Most of the organizational processes are currently executed using digital technology (Cole, Nelson, & McDaniel, 2015). Despite being effective in fostering the aspects of reliability, convenience and efficiency, digitalization has caused numerous risks in many organizations (De Mauro et al., 2018). Many of the organizational processes have been exposed to both internal and external risks caused by digital technology. However, big data analytics has been crucial in enabling companies to counter risks associated with organizational processes and other digital infrastructures. As evidenced in this research, big data analytics detect, analyze, mitigate, monitor, and report different forms of risks associated with organizational processes and digital technology.

5. Conclusion and Recommendations

It is evidenced from this research that organizations have been implementing various risk assessment strategies to identify and prevent threats that hinder competitiveness. The effectiveness of these strategies has been based on their ability to timely identify, analyze, mitigate, monitor, and report various risks facing organizations. With the growth of digital technology, the demand for data mining software such as big data has been on the rise. As shown in this research, big data has been vital in enabling organizations to craft customer-centric business models. Apart from helping companies customize their products and services in various markets, big data has been vital in organizational risk management. It is shown that big data analytics enables organizations to identify and mitigate various forms of risks. As a result, while several data mining techniques are used by organizations in risk assessment, the use of big data has proved to be effective because it unlocks hidden information enabling an organization to make accurate and data-driven risk management decisions.

Guided by the findings of this research, it is vital for companies to consider utilizing big data analytics in solving various risks associated with organizational management. Implementing big data risks management strategies will enable organizations to make data-driven decisions in the course of solving various threats. Additionally, big data technologies will be essential in enabling organizational managers and risk management officers to detect risks at the early stages and utilize accurate mitigation strategies.

5.1. Recommendations

It is recommended that companies consider utilizing big data analytics in solving various risks associated with organizational management. However, they should take several steps to ensure the initiative is successful.

1) First, the company should establish a risk assessment process. It should develop an assessment process to analyze potential sources of risk in each organizational function with the help of data and analytics. It could involve examining

external factors such as current market conditions, consumer trends, and competitive intelligence.

2) The company should utilize data from multiple sources by leveraging data from inside and outside the organization, such as customer reviews, transaction data, and operational data. It can help to provide a comprehensive picture of risk and opportunities for actionable insights.

3) Third, the organization should identify actionable insights. It should develop algorithms to identify actionable insights from the data, determine ways to mitigate the risk and implement a proactive approach.

4) Lastly, the implementors should communicate with stakeholders. To ensure data accuracy, transparency, and trustworthiness, they must ensure proper communication with all stakeholders, such as customers, employees, and shareholders.

5.2. Shortcomings and Future Research

The research is not without its shortcomings. Firstly, the study is limited to small sample size, which makes the conclusion and deductions not representative of the overall population. Additionally, the case studies on Apple Inc., Google, and Amazon Inc. do not always lead to generalizable results, as the findings may not be transferable to other contexts. As a result, while the information provided may help promote big data, the deductions may not apply in all organizations. Lastly, the organizations used in the case study are giant players in the global landscape. Therefore, the data used may not necessarily apply to small-medium enterprises (SMEs). Subsequent studies should employ methods that allow more organizations to be analyzed.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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