REVIEW OF OPPORTUNITIES AND CHALLENGES REPRESENTED BY BIG DATA FOR FINTECH IN MALAYSIA

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ABSTRACT: This paper explores the potential of big data for driving economic growth and innovation within the fintech sector in Malaysia. By using systematic literature review, it investigates the opportunities of big data in the fintech sector and its current utilisation in Malaysia. Firstly, the paper will outline current trends in fintech within the Malaysian context. This will include examining the current state of big data utilization, prevalent initiatives, and current industry players. Secondly, it will identify challenges for fintech development by exploring technological, organisational, and environmental factors that might affect the utilisation of big data in Malaysia. Finally, it will suggest approaches for organisations to adopt in overcoming these challenges. The paper hopes to enrich the understanding of the opportunities and challenges for big data in fintech in Malaysia and the ways it can contribute to the domestic economy.

KEY WORDS: *Big Data, Fintech, Malaysia, Challenges, Opportunities*

1. INTRODUCTION

Big data and predictive analytics have revolutionized the way banks, lenders, and other financial institutions make decisions and develop new products. Utilizing big data collection and analysis techniques, fintech companies can identify risks and opportunities enclosing issues swiftly and accurately.

Big data refers to the vast volumes of structured and unstructured information generated from diverse sources, including financial transactions (Siew and Farouk, 2023), social media (Shayaa et al., 2018), as well as purchase and search history (Chan et al., 2021). Fintech companies are leveraging this data to gain valuable insights, enhance decision-making processes, and develop innovative financial products and services.

In recent years, Malaysia has seen a surge in the number of fintech companies that are transforming the country's banking and financial services sector. The Malaysian government has been actively promoting the development of fintech technologies and encouraging the adoption of digital-driven solutions. At present, there are several leading fintech players in Malaysia offering a wide range of services such as digital banking (Mohsin et al., 2022), e-wallets (Teng and Khong, 2021), blockchain and cryptocurrencies (Muneeza et al., 2018), insurance (Hemed et al., 2021), and crowdfunding (Muneeza et al., 2018).

Despite the strong growth, the fintech sector in Malaysia is still in its early stages. The Malaysian government and relevant stakeholders need to take further steps to ensure that the sector reaches its full potential in the near future.

However, there has been lack of research focusing on a comprehensive review of big data adoption in the context of Malaysia. The aim of this study is thus to review the studies of big data adoption in Malaysia, and also identifies key influencing factors that affect big data adoption in Malaysia organisations as well as its associated challenges. This paper is divided further into sections as follows: Section 2 discusses the opportunities of big data adoption in fintech and the current state of big data utilisation in Malaysia. Next, Section 3 presents the research methodology. Following to that, Section 4 covers the findings of this study and Section 5 discuses the findings which are then followed by conclusion, recommendation, and future research directions.

2. BIG DATA IN FINTECH

2.1. Opportunities

The utilization of big data also allows fintech companies to personalize financial services and improve customer experiences. By analyzing customer behaviour, preferences, and historical data (Siew and Farouk, 2023), financial institutions can tailor their offerings to individual needs, provide customized recommendations, and deliver targeted marketing campaigns. By analysing their customers' purchasing behaviour and the decisions of their competitors, banks are likely to increase their profitability by targeting the right customers, improving the customer experience, maintaining good customer relationships and reducing the cost of customer acquisition and retention (Abd Aziz and Long, 2023). Ali et al. (2021) showed that big data analytics supports an organisational capacity for promoting social and environmental performance in Islamic banking.

By analyzing patterns and anomalies within large datasets, audit firms can identify potential risks and detect fraudulent activities (Rosnidah et al., 2022), thus minimizing losses and improving security. Moreover, big data enables the creation of more accurate credit scoring models (Siew and Farouk, 2023), which benefit underserved individuals and small businesses by expanding access to credit.

Furthermore, big data plays a crucial role in the development of predictive analytics and algorithmic trading in the fintech industry. By leveraging historical market data, real-time market information, and other relevant factors, fintech firms can create sophisticated predictive models that help identify market risks and new opportunities and reallocate resources accordingly (Abd Aziz and Long, 2023). These data-driven approaches enable faster and more informed decision-making in real time (Teng and Khong, 2021).

2.2. Big data adoption in Malaysia

The use of big data in Malaysia is still at its early stage, but it is growing noticeably. The Malaysian government has taken a number of initiatives to promote the adoption of new technologies, namely big data, to drive the uptake of data-driven infrastructure and services. For example, the Malaysian government launched Big Data Analytics Digital Government Lab in 2015 which increased efficiency by reducing the use of data in silos and highlighted the need to have a

national data centre shared among Government agencies (Ong, 2021). To help control COVID-19 outbreaks in the country, the Malaysian government created the MySejahtera app, which helps users to self-assess their own health, to book vaccine appointment, and to perform contact tracing activities. More recently, the government intends to make MySejahtera a digital super-app for public health as part of the health service digitalisation plan, and the data collected through the app would be used as big data (Ridzaimi, 2023).

In the private sector, e-commerce platforms like Shopee and Lazada have adopted big data to provide personalised services to their customers. Shopee is one of the fastest growing online shopping platforms in Southeast Asia that is heavily driven by big data. In particular, big data is used to tailor online shopping experiences to each market segment based on demographic data, search history, and previous shopping records (Chan et al., 2021). Data science has also been instrumental in game development: Shopee Games users can play games in exchange for rewards such as or brand-sponsored products or Shopee Coins - the platform's virtual currency that can be redeemed for discounts at checkout (Tan, 2020).

However, a recent report made by World Bank Group indicated that Malaysia still lags behind neighbouring countries in the adoption of users-friendly and data-driven digital solutions (Sanghi et al., 2023). Moreover, data that is useful and needed is not widely accessible and this problem is highlighted during the early stage of Covid-19 pandemic when data such as occupancy rate of intensive care units was not made available to the public (Shaharudin, 2020).

To sum up, the growth of big data adoption in Malaysia has the potential to revolutionise the way services are delivered and businesses are operating in the country.

3. METHODOLOGY

This paper adopts systematic literature review for the purpose of this study. This systematic literature review is designed to identify key aspects related to big data adoption in Malaysia, key challenges to big data adoption, as well as possible solutions in overcoming these challenges.

The systematic review follows the widely accepted PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology to minimise bias in identifying, selecting, synthesising and summarising sources (Herrmann and Masawi, 2022). The academic literature was selected from academic databases, namely Google Scholar and Emerald Group Publishing, while the newspaper articles and industry reports were selected from Google News. The inclusion criteria comprise of Big Data, Fintech, Malaysia, challenges, and factors. Literature published before 2012 is excluded in this study. Figure 1 illustrates the flowchart of PRISMA systematic review adopted in this study.

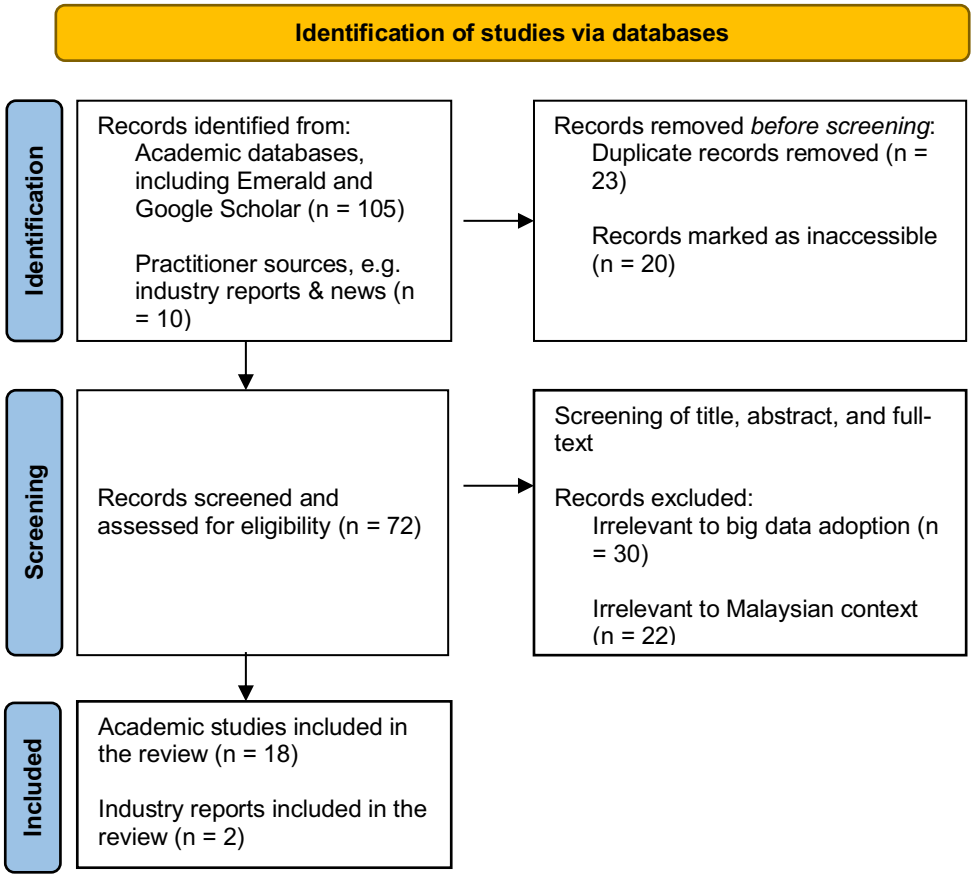

Fig. 1. PRISMA flow diagram for systematic reviews which included searches of databases and other sources.

To reduce the number of false positives unrelated to the research objectives, the researchers of this study processed the title, abstract and keywords of each publication. In total, 20 journal articles, conference papers, industry reports, and book chapters were found in Emerald and Google Scholar for the period 2012—2023. Inclusion criteria:

- All published papers, journals, and books that are written in English language
- Studies that explore factors that affect Big Data adoption, key challenges, and recommendations to overcome these challenges

Exclusion criteria:

- Papers that have not been published in English
- Duplicate papers
- Literatures that are irrelevant to big data adoption

Table 1 summarizes the literature that were included in this systematic literature review.

Table 1: literature used in this study

Authors	Research methods	Sample	Sector	Limitations
Abd Aziz and Long, 2023	Survey & statistical analysis	162 bank managers	Banking	cross-sectional data from bank managers only
Abdullah et al. 2021	Interview	2 managers	Manufacturing	Small sample size
Ahmad et al., 2020	Interview	14 managers	Textile & apparel	Small sample size
Anawar et al., 2022	Focus group	8 experienced specialists	Telecom	Small sample size
Ali et al., 2021	Survey & Structural Equation Modelling (SEM)	407 executives and managers	Banking	The sampled population only outlines the managers' and executives' perception
Bamiah et al., 2018	Conceptual	-	Higher education	No empirical data
Chan et al., 2021	Survey & SEM	318 respondents	e-commerce	The study used the user's response as a dependent variable
Falahat et al., 2023	Two focus groups	14 participants	Various	Small sample size
Fernando et al., 2018	Survey & SEM	145 respondents	Service	Small sample size
Ghaleb et al., 2021	Survey & SEM	302 health professionals	Healthcare	Cross-sectional data
InterSystems, 2022	Survey & statistical analysis	554 business leaders across 12 countries	Fintech	This global survey is more about technology challenges in Fintech
Lim et al., 2021	Survey & statistical analysis	64 respondents	Manufacturing	Small sample size
Said et al., 2023	Survey & content analysis	100 companies	Public listed companies	Small sample size; the study is concerned the tome set by top management
Salleh and Janczewski, 2019	Case study & interview	7 employees	Banking	Small sample size, the study is more concerned about data security
Sanghi et al., 2023	Survey & statistical analysis	1,412 respondents across Malaysia in 2019-2020	manufacturing and services firms	It is more about digital economy in general, less about big data adoption
Siew and Farouk, 2023	Case study	2 managers	Banking	Can't be generalised
Wahab et al., 2021	Survey & SEM	110 respondents	Warehousing	The study only focuses on the five influential factors
Wong et al., 2015	Survey & statistical analysis	132 respondents	Various	Small sample size

Yadegaridehkordi et al., 2018	Survey & DEMATEL-ANFIS	234 senior managers	Manufacturing	Results are based on numerical responses; not much insight into thoughts and behaviours
Yadegaridehkordi et al., 2020	Survey & SEM	418 hotel managers	Hotel	Respondents came from one city

4. FINDINGS

The literature review highlights three key factors affecting big data utilisation in Malaysia: technology, organization, and environment related factors. These factors are explained in detail in the following sections.

4.1. Technology-related factors

Three technology-related factors emerged from the literature review: data privacy and security, perceived benefits, and complexity.

Table 2: technology-related factors that affect big data adoption

Dimension	Sub-themes	Authors
Technology	Data Privacy and Security	Anawar et al., 2022; Fernando et al., 2018; Ghaleb et al., 2021 ; Salleh and Janczewski, 2019
	Perceived Benefits	Ali et al., 2021; Fernando et al., 2018; Ghaleb et al., 2021; Yadegaridehkordi et al., 2020
	Complexity	Ahmad et al., 2020; Fernando et al., 2018; Ghaleb et al., 2021; InterSystems, 2022; Yadegaridehkordi et al., 2020

4.1.1. Data Privacy and Security

The foremost challenge associated with big data in fintech is data security and privacy (Anawar et al., 2022). Existing non-Big Data security solutions are often not designed to handle the scale, velocity, variety and complexity of Big Data, and most organisations are limited in taking a systematic approach to ensuring appropriate mechanisms for accessing data (Fernando et al., 2018). To protect and ensure the security of the data, the infrastructure that is used to collect, store, and analyse it must be reliable, secure, and adequately protected from possible cyber-attacks (Anawar et al., 2022).

The data that is collected, stored, and analysed by financial institutions is extremely valuable and sensitive (Salleh and Janczewski, 2019). As economic activity becomes less cash-based and transactions are increasingly conducted through financial sector providers, the amount of transaction data collected by financial institutions has grown exponentially. This data typically includes credit history, income, employment, tax records and financial statements. As a result of the availability of data in both structured and unstructured formats, there are privacy and security risks associated with large volumes of data from a variety of sources (Fernando et al., 2018). Financial institutions must therefore comply with the industry regulations regarding data protection, and ensure that no unauthorized access is allowed to the data.

4.1.2. Perceived Benefit

Perceived benefit refers to the perceptual measurement of benefits, i.e. the belief in the effectiveness of new technology adoption in improving organisational

performance. Organisations, especially organisations in the finance industry, must weigh the costs and benefits of big data adoption before investing in new technology. An organization is less likely to adopt new technology if the technology is relatively new and the financial rewards are uncertain.

Companies in Malaysia have been reluctant to adopt big data analytics due to a lack of evidence on the benefits of big data in driving organisational performance (Fernando et al., 2018). A recent study conducted by Ali et al. (2021) showed that the use of big data is viewed positively by Islamic banks in Malaysia, concluding that big data predictive analysis is a potential capability that Islamic banks needed to cultivate.

4.1.3. Complexity

More data does not necessarily translate into better analysis. Big data analytics tools are good at finding correlations between variables, but may not good at distinguishing correlation from actual causation. The ability of organisations to instantly access relevant data is often hampered by outdated and manual spreadsheets. According to a recent InterSystems survey (2022), the top data challenges cited by respondents are the inability to access real-time data (37%) and the inability to obtain data from all required sources (33%). Most of these challenges stem from overly complex data infrastructures built from disparate technologies and applications, creating silos that make it difficult to obtain timely information and insights that can be easily interpreted and shared. The findings of InterSystems survey (2022) is consistent with earlier studies which concluded that complexity has negative influence on big data adoption in Malaysian hotel (Yadegaridehkordi et al., 2020) and textile industries (Ahmad et al., 2020).

4.2. Organisation-related factors

There are six organisation-related factors emerged from the literature review: technical skills, technological resources, organization size, financial capacity, perceived risks, and management support.

Table 3: Organisation-related factors that affect big data adoption

Dimension	Sub-themes	Authors
Organisation	Technical Skills	Abd Aziz and Long, 2023; Anawar et al., 2022; Falahat et al., 2023; Fernando et al., 2018; Salleh and Janczewski, 2019; Wahab et al., 2021; Yadegaridehkordi et al., 2020
	Technological Resources	Abd Aziz and Long, 2023; Anawar et al., 2022 ; Salleh and Janczewski, 2019; Wahab et al., 2021 Yadegaridehkordi et al., 2020
	Organization Size	Falahat et al., 2023; Ghaleb et al., 2021; Yadegaridehkordi et al., 2020
	Financial Capacity	Falahat et al., 2023 ; Ghaleb et al., 2021; Lim et al., 2021; Wahab et al., 2021
	Perceived Risks	Abd Aziz and Long, 2023; Abdul Jabar et al., 2022 Anawar et al., 2022; Falahat et al., 2023
	Management Support	Abd Aziz and Long, 2023; Anawar et al., 2022; Salleh and Janczewski, 2019; Wahab et al., 2021; Yadegaridehkordi et al., 2020

4.2.1. Technical skills

Lack of digital literacy is one of the frequently cited challenges for firms in Malaysia to adopt big data (Abd Aziz and Long, 2023; Anawar et al., 2022; Salleh and Janczewski, 2019; Wahab et al., 2021; Yadegaridehkordi et al., 2020). World Bank Group (2018) found that Malaysia's education system and training programmes for its workforce are not yet preparing a workforce with the right skills for the digital economy. The challenge of finding employees with the digital skills affects both large and small firms, with 27% of the companies outsource big data analytics to third parties (Sanghi et al., 2023). This finding is consistent with earlier study conducted by Fernando et al. (2018) which found that lack of competent employees who can conduct big data analysis is one of the difficulties toward adoption of big data and therefore, many firms outsourced big data activities to third parties. It is difficult for untrained or inexperienced data scientists to know where to start and what to look for, and the relevant information may lie beneath a mountain of useless data. In order to compensate for the limited in-house IT capabilities, some companies outsource big data analytics to technology vendors (Lim et al., 2021).

4.2.2. Technological Resources

With the right technological resources, organisations can effectively capture, store, analyse and visualise large volume data to inform strategic decisions and maximize their competitive advantage (Abd Aziz and Long, 2023). Additionally, the technology used by organisations should be appropriate for their needs and the scale of their operations. By leveraging technological resources such as hardware, software, cloud computing platforms and analytics tools, organizations can efficiently manage their data, allowing them to capitalize on the opportunities presented by large datasets (Abd Aziz and Long, 2023; Wahab et al., 2021; Yadegaridehkordi et al., 2020).

4.2.3. Organization Size

Organisation size is one of the important determinants of big data adoption (Yadegaridehkordi et al., 2020). Larger firms are typically better equipped than the smaller firms due to greater financial, technological, and human capital resources. In addition, larger firms often benefit from economies of scale and more likely to optimise big data analytics (Ghaleb et al., 2021). On the other hand, smaller firms experience financial constraints to either purchase or develop the required technology and data analytics tools, hire specialists to manage and understand the data, and invest in data storage systems (Falahat et al., 2023).

4.2.4. Financial Capacity

Another challenge with big data in fintech is the cost associated with the implementation of effective technologies that allow it to be collected, stored, and analysed properly (Falahat et al., 2023 ; Ghaleb et al., 2021 ; Lim et al., 2021; Wahab et al., 2021). The process of collecting, processing, and analysing big data can be quite an expensive investment. The process of adopting big data is time-consuming and requires substantial investments in resources (Yadegaridehkordi et al., 2018). Organisations must also take into consideration the long-term costs associated with maintaining the infrastructure such as storage and energy consumption. If a firm cannot reap the benefits of technology due to insufficient

resources and capabilities, investment in that technology is meaningless despite its tremendous advantages.

4.2.5. Perceived Risks

Perceived risk refers to the uncertainty about the return on investment (ROI) in implementing big data initiatives (Falahat et al., 2023). Companies must assess the perceived risks and benefits of using big data before investing it. The process of big data adoption can be lengthy and costly because of the large amounts of data that need to be collected, analysed, and stored appropriately. Organisations must consider the legal and ethical implications of harvesting and analysing data from customers, ensuring that the collected data is secure and complies with any associated regulations (Anawar et al., 2022). Inaccurate, incomplete and inconsistent data can lead to misinterpretation, often resulting in the wrong decisions or insights (Abdul Jabar et al., 2022; Anawar et al., 2022; Salleh and Janczewski, 2019). There are also cost considerations with respect to software licenses and also training and support for personnel. All of these factors create a heightened sense of perceived risk, which can be a deterrent to big data adoption.

4.2.6. Management Support

Management support is critical to successful implementation of big data, determining how much funding needs to be allocated and where the initiatives should be heading (Abd Aziz and Long, 2023; Anawar et al., 2022; Salleh and Janczewski, 2019; Wahab et al., 2021; Yadegaridehkordi et al., 2020). The implementation of big data is unlikely to be successful without the support of executives and management. Management plays a key role in ensuring that big data projects have clear directions (Anawar et al., 2022), that resources are allocated efficiently (Salleh and Janczewski, 2019; Wahab et al., 2021; Yadegaridehkordi et al., 2020) and that staffs are given full support (Salleh and Janczewski, 2019). Effective communication between management and key stakeholders can partially mitigate the information asymmetry problem. Management must also ensure that everyone is on the same page when it comes to the big data strategy, and that key stakeholders are informed and involved in the decision-making process. The tone of assurance set by top executives and management sends a clear message to key stakeholders (Said et al. 2023). Big data is also more likely to be successfully implemented when the employees are empowered and given the training they need to perform their tasks (Salleh and Janczewski, 2019).

4.3. Environment-related factors

There are four environment-related factors emerged from the collected data: regulatory intervention, vendor support, environmental uncertainty, and lastly, competition.

Table 4: Environment-related factors that affect big data adoption

Dimension	Sub-themes	Authors
Environment	Regulatory Intervention	Falahat et al., 2023; Siew and Farouk, 2023; World Bank Group, 2018
	Vendor support	Ahmad et al., 2020; Anawar et al., 2022; Lim et al, 2021 ; Yadegaridehkordi et al., 2020

Environmental Uncertainty	Abd Aziz and Long, 2023; Anawar et al., 2022; Falahat et al., 2023; Salleh and Janczewski, 2019; Yadegaridehkordi et al., 2020
Competition	Abd Aziz and Long, 2023; Lim et al., 2021; Wahab et al., 2021

4.3.1. Regulatory Intervention

Big data aims to collect as much data as possible in order to analyse it and make decisions based on it. Problems arise when access to data is restricted and when personal data is analysed for unspecified reasons. Malaysian government's open data initiative was launched in 2014, requiring government departments to identify data sets to share under licenses allowing users to re-use, amend and commercialise data (World Bank Group, 2018). However, many agencies have taken a cautious approach, citing security and privacy concerns, and the lack of open government data was evident during the Covid-19 pandemic, when up-to-date data such as the occupancy rate of intensive care units was not made available to the public (Shaharudin, 2020). Lack of institutional policy and support is also noted by Falahat et al., (2023) as one of the key barriers to big data adoption in Malaysia.

Data protection in Malaysia is primarily governed by the Personal Data Protection Act (PDPA) 2010, which came into force on 15 November 2013, with the aim of protecting personal data and ensuring that client data and analysis results are not misused by unauthorised parties. Prior to the introduction of the PDPA 2010, personal information was only protected as confidential information through contractual obligations related to breach of confidence.

In addition to PDPA 2010, the financial industry in Malaysia is highly regulated and financial institutions are required to produce and submit comprehensive data to the authorities regarding their activities and the risks associated with them on a regular basis. The lengthy process of obtaining approvals from the Central Bank of Malaysia and sitting on committees contribute to barriers to big data adoption (Siew and Farouk, 2023).

4.3.2. Vendor support

Vendor support plays an important role in the adoption of big data (Ahmad et al., 2020; Anawar et al., 2022; Yadegaridehkordi et al., 2020). Companies can rely on the expertise of trusted vendors to help them integrate new technologies and manage big data effectively (Lim et al, 2021). Aside from providing expert guidance (Anawar et al., 2022), vendors also provide training materials and sessions to ensure a smooth transition (Yadegaridehkordi et al., 2020). On the other hand, the lack of support or inadequate support from vendors is a challenge for organisations to adopt big data, which not only increases the costs, but also causes a delay in the use of big data (Ahmad et al., 2020).

4.3.3. Environmental Uncertainty

Environmental uncertainty refers to the uncertain conditions that an organisation may encounter when adopting big data technologies, which includes a variety of factors such as limited knowledge about the technology (Lim et al., 2021), market turbulence (Yadegaridehkordi et al., 2018), and data security concerns (Anawar et al., 2022). Environmental uncertainty affects the decision of organisations to adopt big data, as it can make organisations more or less likely to

invest due to the potential risks and rewards associated with the technology. On one hand, market turbulence and environmental uncertainty could have pushed an organisation to improve its organisational capabilities (Fernando et al., 2018); on the other hand, environmental uncertainty can be a challenge for organisation in the implementation of big data (Anawar et al., 2022).

4.3.4. Competition

Competition is one of the key drivers for new technology adoption (Abd Aziz and Long, 2023; Lim et al., 2021; Yadegaridehkordi et al., 2020). Lim et al. (2021) noted that there is a low compulsion to adopt big data in the Malaysian plastics manufacturing industry and at the same time consider competitive pressure would influence their decision to adopt big data. The financial industry is becoming increasingly competitive, as fintech and banks compete for the same customers. Customers are prepared to switch to another financial institution if their expectations are not met. With future technological developments, the issue of keeping up with the competition will only become more important.

The rise of mobile wallets and digital banking are increasingly adopted payment methods in Malaysia due to the abrupt shift to online and contactless commerce in early 2020. In 2022, the central bank of Malaysia, Bank Negara Malaysia (BNM) awarded digital banking licences to five consortia led by established financial institutions and large technology companies. Malaysia's existing banking licences permit established banks to offer digital banking services, but these recently awarded digital banking licences allow the younger, more agile challengers to enter the digital financial services sector. These digital banks are expected to complement the traditional financial institutions by filling the gap and serving the underserved population in the country; and the central bank is counting on these digital banks to put their much-vaunted big data acumen to the test (Kapronasia, 2022).

The central banks in the Southeast Asia are planning to go even further. In addition to developing a comprehensive regional network of proxy-based real-time payment systems, central bankers in Southeast Asia plan to link up with other regional clusters around the world and eventually apply the same structure to real-time bank transfers and central bank digital currencies (Kapronasia, 2023). Financial institutions, in turn, are constantly improving their services to better serve their customers in the face of intense competition in the financial industry.

5. DISCUSSION

Big data and analytics can facilitate personalization of financial services for individual customers, reducing the cost of customer acquisition, and improving customer retention (Abd Aziz and Long, 2023). Big data can also be used to identify and mitigate fraud, along with helping banks and other financial institutions to automate processes like loan approvals, account management, and fraud prevention (Rosnidah et al., 2022). By mining large datasets from a diverse set of data sources, fintech companies can develop predictive models that can identify risks and opportunities in real time (Yadegaridehkordi et al., 2018).

Despite the opportunities offered by the use of big data to improve organisational performance, Malaysia has been slow to adopt big data. Since

2015, the Malaysian government has initiated several measures related to big data analytics in the public sector (Ong, 2021). However, it is not clear how much each ministry and agency plans to use data to improve decision-making and drive innovation in public service delivery (Sanghi et al., 2023). At the time of writing, the use of big data is notable in multinational corporations such as Shopee (Tan, 2020) and Cainiao Smart Logistics Network (Wahab et al., 2021), but Malaysia lags behind neighbouring countries in the adoption of digital solutions that are both user-centred and data-driven (Sanghi et al., 2023).

Based on the literature review, this study selects the most frequently cited factors that have significant influence on big data adoption under three main categories: technology, organisation, and environment. While technology-related factors include data security and privacy, complexity, and perceived benefits, the most commonly mentioned organisational factors include management support, financial capacity, perceived risk, organisation size, technological resources, and technical human skills. Lastly, regulatory intervention, vendor support, and environment uncertainty are identified as most influential environmental factors which affect big data adoption. Note that some similar factors and themes are grouped together to avoid repetition.

Table below summarizes the factors affecting big data adoption.

Table 5: Factors that affect big data adoption

Authors	**Dimensions**												
	Technology			***Organisation***						***Environment***			
	Data Privacy and Security	Complexity	Perceived Benefit	Technical skills	Technological Resources	Organization Size	Financial Capacity	Perceived Risk	Management Support	Regulatory Intervention	Vendor support	Environmental Uncertainty	Competition
Abd Aziz and Long, 2023	-	✓	✓	✓	✓	-	-	✓	✓	-	-	-	✓
Ahmad et al., 2020	-	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	✓
Ali et al., 2021	-	-	✓	✓	✓	-	-	-	✓	-	-	-	-
Anawar et al., 2022	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓
Bamiah et al., 2018	✓	✓	✓	✓	✓	-	✓	✓	-	✓	-	-	-
Chan et al., 2021	✓	-	✓	✓	✓	-	-	✓	-	✓	-	✓	✓
Falahat et al., 2023	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	-	✓	✓
Fernando et al., 2018	✓	✓	✓	✓	✓	-	✓	✓	-	-	-	-	-
Ghaleb et al., 2021	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Lim et al., 2021	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	-	-	✓
Salleh and Janczewski, 2019	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	-
Wahab et al., 2021	-	-	✓	✓	✓	-	-	-	✓	-	-	-	✓

Wong et al., 2015	-	✓	✓	✓	✓	-	✓	-	-	-	✓	-	-
Yadegaridehkordi et al., 2018	✓	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	✓
Yadegaridehkordi et al., 2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓

6. CONCLUSION

In conclusion, big data has a tremendous potential for financial institutions to gain insights, identify trends, and improve operational efficiency. Overall, big data is offering many opportunities to fintech companies and is transforming the way financial services are being delivered. It provides improved risk management, reduced fraud, and more accurate prediction of customer behavior, and better customer experience. By leveraging the power of data analytics, fintech companies can make informed decisions, provide personalized solutions, and adapt to changing market dynamics. As these new technologies continue to develop and mature, the financial sector and its clients will experience greater amounts of convenience, relaxed protocols, and improved services.

However, there are several significant challenges that come with the use of big data in fintech. These challenges include data security and privacy, costs of implementation and maintenance, and lack of standardization. To properly overcome these challenges, financial institutions must take the necessary steps such as investing in data security infrastructure. With adequate implementation, big data can provide great benefits to the fintech industry.

6.1. Recommendations

In order to overcome the challenges in adopting big data and to optimise the benefits of big data, the study makes recommendations for the short, medium and long terms.

6.1.1. Short-term

In short term, organisations could set up small but achievable short-term goals such as review existing IT system and assess the feasibility of big data adoption. Big data systems must be tailored to the specific needs of a company. Adopting big data effectively requires an understanding of the organisational goals and the availability of data to be used, and assessment of the need for additional data to help achieve those goals. Careful planning and preparation are essential for any new project. Previous studies (Intersystems, 2022; Siew and Farouk, 2023; Wong et al., 2015) shown that the challenges faced by organisations in adopting big data are about integrating and migrating large volumes of data. To overcome these challenges, organisations need to develop a detailed plan of action outlining each step of data migration.

6.1.2. Medium term

Over a period of two to three years, organisations could provide training for employees to acquire relevant skills in big data analysis and security. Many studies have identified skills shortages as one of the key barriers to big data adoption (Abd Aziz and Long, 2023; Anawar et al., 2022; Falahat et al., 2023; Fernando et al., 2018; Salleh and Janczewski, 2019; Wahab et al., 2021;

Yadegaridehkordi et al., 2020) and thus regular training is needed. Regular training can help companies adopt big data analytics by familiarizing and training employees in the advanced analytics methods and data science techniques. Companies can benefit from having well-trained staffs who understand the value of data-driven decision-making in order to gain competitive advantage.

6.1.3. Long-term

In the longer term, organisations could work with key industry players to develop common standards and best practice frameworks. The idea is to set industry standards and stay ahead of the competition. Setting industry standards can help companies adopt big data analytics by providing them with a framework that they can use to effectively manage and incorporate data into their operations. For example, industry standards can outline which data types should be collected, how they should be stored, and how the information should be accessed and used. These standards can also provide guidance on how to audit, secure, and protect the data. Furthermore, establishing these standards can make it easier for companies to access industry-wide best practices and create a level playing field for all industry participants.

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