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EXPLORING AI INTEGRATION IN FINANCIAL INSTITUTIONS: CHALLENGES, COMPLIANCE, AND QUALITY ASSURANCE'S ROLE IN SECURITY

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Abstract

The use of Artificial Intelligence (AI) in financial institutions offers significant opportunities while raising concerns about regulatory compliance, security, and the changing function of Quality Assurance (QA). This research explores the impact of AI integration on fairness, transparency, and financial inclusion in the Malaysian financial sector, and investigates the challenges QA professionals face in navigating the dynamic regulatory landscape, with a focus on data privacy and cross-border regulations. It also examines QA's role in mitigating technological risks, addressing security vulnerabilities, and supporting organisational transformation. Employing a qualitative methodology, the study combines a desk review of existing literature and a semi-structured interview with an Enterprise Architecture and Quality Assurance Specialist from Bank Muamalat Malaysia Berhad (BMMB). By triangulating theoretical frameworks with practical insights from industry professionals, the study finds that QA plays a pivotal role in ensuring the responsible and secure implementation of AI. Specifically, findings highlight the need for robust QA processes to address algorithmic bias, ensure transparency in AI decision-making, and promote inclusive access to financial services. This research contributes to the discourse on responsible AI adoption in the financial sector by providing practical recommendations for financial institutions seeking to implement responsible AI strategies. This research was conducted in accordance with ethical research standards..

Keywords: *artificial intelligence (AI), financial institutions, quality assurance (QA), roles, challenges.*

I. INTRODUCTION

Artificial Intelligence (AI) is swiftly reshaping multiple industries, with the financial sector leading this transformation. Defined as "the ability of a machine to imitate intelligent human behaviour", AI includes various technologies such as machine learning, natural language processing, and computer vision.[1] The importance of AI stems from its potential to drive efficiency, enhance

[1] Cole Stryker and Eda Kavlakoglu, "What is Artificial Intelligence (AI)?," IBM, accessed April 15, 2025, https://www.ibm.com/think/topics/artificial-intelligence.

decision-making, and create innovative products and services.[2] In the financial sector, particularly in banking, AI is being deployed for a variety of purposes, including fraud detection, risk management, algorithmic trading, customer service automation (e.g., chatbots), and personalised financial advice.[3] In fraud detection, for instance, AI-powered systems can analyse vast transaction datasets to identify suspicious patterns indicative of fraud, significantly improving detection rates compared to traditional methods.

Meanwhile, Quality Assurance (QA) plays a crucial role in ensuring the responsible and effective deployment of AI within financial institutions. QA officers are responsible for testing, validating, and monitoring AI systems to ensure they meet predefined quality standards, comply with regulatory requirements, and operate ethically. They work closely with data scientists, developers, and business stakeholders, focusing on areas such as data quality, model accuracy, bias detection, and explainability. QA professionals in financial institutions must understand the complexities of AI algorithms and their potential impact on financial stability, customer trust, and regulatory compliance. Their work includes developing test cases, conducting performance evaluations, and implementing monitoring frameworks to detect and address potential issues.

QA officers are required to navigate deep learning models smoothly and professionally. A deep learning model is a type of artificial intelligence that mimics how the human brain learns. It uses layers of interconnected nodes—like virtual neurons—that process large amounts of data to recognise patterns and make decisions. For example, just as a person learns to recognise different faces over time, a deep learning model can learn to detect fraud or assess creditworthiness by analysing patterns in financial transactions. These models are called "deep" because they have multiple layers of processing, each refining the analysis further. However, the integration of AI in finance presents several critical challenges. The complexity of AI algorithms, particularly deep learning models, can make it difficult to ensure transparency and explainability,[4] raising concerns about fairness and accountability.[5]

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[2] James Manyika et al., "A future that works: Automation, employment, and productivity," McKinsey Global Institute, January, 2017, https://www.mckinsey.com/~/media/mckinsey/featured%20insights/Digital%20Disruption/Harnessing%20automation%20for%20a%20future%20that%20works/MGI-A-future-that-works-Executive-summary.ashx?trk=public_post_comment-text.

[3] Thomas Davenport et al., "How Artificial Intelligence Will Change the Future of Marketing," *Journal of the Academy of Marketing Science* 48, no. 1 (2020): 24-42, https://link.springer.com/article/10.1007/s11747-019-00696-0.

[4] Sarvatore Carta et al., "Explainable AI in Financial Forecasting," in *Lecture Notes in Computer Science*, ed. Guissepe Nicosia et al. (Springer, Cham, 2022): 14, 10.1007/978-3-030-95470-3_5.

[5] Deniz Sezin Ayvaz et al., "Data Study Group Final Report: Mastercard - Measuring Fairness in Financial Transaction Machine Learning Models," The Alan Turing Institute, May 20-24, 2024, https://www.turing.ac.uk/sites/default/files/2024-12/turing_dsg_report_may_2024_mastercard_final_publish_opt.pdf.

Furthermore, the rapid pace of technological advancements and the evolving regulatory landscape create difficulties in maintaining compliance.[6] Data privacy and security are also concerns, especially given the sensitive nature of financial data.[7] These challenges create significant hurdles for QA professionals who are tasked with ensuring the responsible and ethical use of AI.

Given the issues outlined above, the researchers have defined three research objectives for this study. First, this study explores the implications of AI integration on fairness, transparency, and financial inclusion within the Malaysian financial sector. The researchers decided to examine the nature of AI applications, particularly in the Islamic financial sector, to ensure that the transparency within it aligns with the deeply rooted Islamic principle of maslahah, which emphasises the public good and societal well-being. To achieve this particular objective, consideration of ethical conduct and the avoidance of gharar (uncertainty) and riba (interest) in the application of AI are thoroughly examined. Second, it investigates the challenges QA professionals face in navigating the dynamic regulatory landscape, focusing on data privacy and cross-border regulations. Third, this study examines QA's role in mitigating technological risks, addressing security vulnerabilities, and supporting organisational transformation.

More specifically, this research investigates the critical intersection of AI integration, fairness, transparency, and financial inclusion within the dynamic landscape of the Malaysian financial sector, focusing on Islamic finance. A 2024 KPMG survey revealed that 10% of companies have fully integrated AI into their financial reporting processes, while 72% are in the pilot or selective usage phase. Notably, 99% of organisations anticipate adopting AI in financial

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[6] Charmaine Ng and Edson Prestes, "Emerging Technologies: It's Time We Embrace an Agile Approach to Regulating AI," World Economic Forum, November 14, 2023, https://www.weforum.org/stories/2023/11/its-time-we-embrace-an-agile-approach-to-regulating-ai/; "Policy paper: The Bletchley Declaration by Countries Attending the AI Safety Summit," Uk.Gov, updated February 13, 2025, https://www.gov.uk/government/publications/ai-safety-summit-2023-the-bletchley-declaration/the-bletchley-declaration-by-countries-attending-the-ai-safety-summit-1-2-november-2023.

[7] Saraphina Brightwood and Henry Jame, "Data Privacy, Security, and Ethical Considerations in AI-Powered Finance." ResearchGate, March 17, 2024, https://www.researchgate.net/profile/Seraphina-Brightwood/publication/379078709_Data_privacy_security_and_ethical_considerations_in_AI-powered_finance/links/65f9f681d3a08551423504c2/Data-privacy-security-and-ethical-considerations-in-AI-powered-finance.pdf; Amsa Selvaraj et al., "Privacy-Preserving Synthetic Data Generation in Financial Services: Implementing Differential Privacy in AI-Driven Data Synthesis for Regulatory Compliance," *Journal of Artificial Intelligence Research* 2, no. 1 (2022): 203–47, https://thesciencebrigade.com/JAIR/article/view/373.

reporting within the next three years.[8] The increasing adoption of AI in this sector presents both transformative opportunities and significant challenges, raising crucial questions about algorithmic bias, data protection, and the ethical implications of automated decision-making.

This study is particularly relevant given the unique context of Malaysian Islamic finance, where Sharia principles, local regulations (including those from Bank Negara Malaysia), and the pursuit of financial inclusion converge. Islamic finance, with its emphasis on transparency (maslahah and avoidance of gharar), data protection, and accountability, offers a robust framework for enhancing these aspects in AI-driven financial services. This paper argues that these core principles can serve as a guide for ensuring that AI integration in Malaysian Islamic finance promotes fairness, strengthens data protection practices, and reinforces the responsible conduct of QA professionals. By examining the interplay of AI, Islamic finance principles, and Malaysian regulatory requirements, this research provides valuable insights for financial institutions, regulators, and QA professionals seeking to navigate the complexities of AI adoption in this unique and rapidly evolving financial ecosystem.

To tackle the above issues and address the research objectives accordingly, a qualitative method was used, including a comprehensive desk review and a semi-structured interview. The data obtained through those approaches were thematically analysed to answer each of the three main research objectives of this research. To provide a more credible analysis, the triangulation method espoused by Denzin[9] is incorporated into the thematic analysis. In short, through this approach, the researchers believe a balanced understanding of theoretical concepts and practical application of AI in the real world can be achieved in its purest form.

II. METHODOLOGY

This qualitative study combines a desk review of academic literature, regulatory documents, case studies, and industry reports with a semi-structured interview with an Enterprise Architect and Quality Assurance Specialist at BMMB. This institution was chosen due to its prominent role in the Malaysian Islamic financial sector and its active engagement with AI technologies. While recognising the limitations of relying on a single interview, the study strategically focuses on

[8] "KPMG: 99 Percent of Organizations Expected to Adopt AI in Financial Reporting within the Next Three Years," KPMG, July 17, 2024, https://kpmg.com/my/en/home/media/press-releases/2024/07/99-percent-of-organizations-expected-to-adopt-ai-in-financial-reporting.html?utm_source=chatgpt.com.

[9] Norman K. Denzin, *The Research Act: A Theoretical Introduction to Sociological Methods*. (Routledge, 2009): 236.

this key expert to gain in-depth, specialised insights into the complex interplay of AI, QA, and regulatory compliance in a real-world financial institution. The respondent is a recognised expert in a highly specialised field, and his insights are considered both representative and authoritative.

The exploratory research is a proof of concept, and the single respondent's data is sufficient to demonstrate the feasibility of AI integration or identify potential issues for larger studies. Future research could expand the scope of interviews to include a broader range of perspectives. The methodology follows an interpretive research paradigm, aiming to derive insights from both theoretical and practical perspectives. The data obtained through those approaches were thematically analysed to address each of the research problems, forming three main research objectives for this research.

To add depth, this research employs the triangulation method approach to analyse primary (interview) and secondary (literature review) data. Triangulation, as proposed by Denzin, strengthens the study's credibility by cross-verifying findings from the desk review with empirical insights. Additionally, Guba's criteria for trustworthiness—credibility, dependability, and confirmability—are applied to ensure methodological rigour.

III. AI IN FINANCIAL INSTITUTIONS

AI is transforming the global financial landscape, enabling institutions to enhance efficiency, improve risk management, and offer personalised banking experiences. From fraud detection to automated customer service, AI is reshaping the way banks operate, reducing operational costs and improving decision-making processes. According to Truby et al., AI adoption in the financial sector has advanced across five key areas: compliance, fraud and anti-money laundering (AML) detection, lending and credit assessments, cybersecurity, and trading and investment decision-making.[10] Thus, technological solutions have been developed to meet the growing demands of and increasing need for regulatory compliance.

AL-Dosari et al. added that the rise of financial technology (FinTech) companies has intensified competition in the financial sector, pushing banks to adopt innovative solutions and robust security measures to protect customer data and meet evolving demands.[11] However, compared to FinTech firms,

[10] Jon Truby et al., "Banking on AI: Mandating a Proactive Approach to AI Regulation in the Financial Sector," *Law and Financial Markets Review* 14, no. 2 (2020): 110–20, doi:10.1080/17521440.2020.1760454.

[11] Khalifa AL-Dosari et al., "Artificial Intelligence and Cyber Defense System for Banking Industry: A Qualitative Study of AI Applications and Challenges," *Cybernetics and Systems* 55, no. 2 (2022): 302–30, doi:10.1080/01969722.2022.2112539.

traditional banks face inherent challenges in leveraging new technologies. Banks' established practices can hinder the seamless integration of technological advancements, potentially leading to security vulnerabilities, as legacy financial and security systems may not be compatible with modern solutions. Thus, as financial services move towards a more digitally driven economy, AI adoption in financial institutions is expected to accelerate, revolutionising traditional banking services.

Meanwhile, in Malaysia, financial institutions are rapidly adopting AI to stay competitive in the digital era. Market leaders such as Maybank, Bank Negara Malaysia, Hong Leong Bank, and Bank Islam Malaysia Berhad are leveraging AI-driven solutions for fraud prevention, credit scoring, chatbot services, and robo-advisory platforms. This is because AI tools offer significant advantages by enabling task automation and enhancing analytical capabilities beyond traditional methods. Maybank introduced a Shariah-compliant Discretionary Portfolio Mandate (DPM) utilising AI for active asset management, analysing data from over 25,000 listed equities. On November 1, 2023, Maybank Asset Management Sendirian Berhad (MAM Malaysia) launched this innovative investment solution in partnership with Arabesque AI, a UK-based investment advisory and technology firm. This DPM leverages artificial intelligence, enabling the creation of hyper-customised, Shariah-compliant portfolios tailored to individual investor preferences and objectives.[12] Malaysia's central bank, Bank Negara Malaysia (BNM), launched the National Fraud Portal (NFP) in 2024, leveraging AI for predictive analysis to detect suspicious financial transactions, enhancing the country's anti-fraud capabilities. Additionally, MayBank's MAE app employs AI to provide personalised financial insights and planning tools.[13] Hong Leong Bank organised a generative AI-focused hackathon, resulting in the development of an AI-powered employee onboarding platform aimed at improving talent development and customer service efficiency.[14] Bank Islam Malaysia Berhad (BIMB) utilises AI to aggregate and synthesise corporate information, reducing proposal preparation time from several weeks to a few

[12] "Maybank Asset Management Launches AI-powered, Shariah-compliant Discretionary Portfolio Mandate with Arabesque AI," MayBank Asset Management, November 1, 2023, https://www.maybank-am.com.my/w/maybank-asset-management-launches-ai-powered-shariah-compliant-discretionary-portfolio-mandate-with-arabesque-ai-1?utm; Bianca Fisher, "Banking on AI: A Malaysian Bank is Betting Big on AI as it Rethinks How it Does Business in the Future," Workflow, October 28, 2024, https://www.servicenow.com/workflow/customer-experience/maybank-banking-ai.html?utm.

[13] "Malaysia to Leverage AI to Detect Suspicious Financial Transactions – BNM Governor," The Star, August 20, 2024, https://www.thestar.com.my/business/business-news/2024/08/20/malaysia-to-leverage-ai-to-detect-suspicious-financial-transactions---bnm-governor?utm_source=chatgpt.com.

[14] "Empowering Business with Future-Ready Skills," Excelerate, accessed April 14, 2025, https://excelerate.asia/?utm.

hours, thereby increasing operational efficiency.[15] However, these applications also come with limitations that may render them unsuitable for certain activities, as well as unique risks that require careful management. Challenges such as data privacy, regulatory compliance, and ethical AI usage remain key considerations.

For example, data privacy is a key concern regarding AI adoption in the banking sector. With regulatory frameworks still evolving, it remains unclear whether banks should depend on third-party providers for data protection.

In the context of AI adoption in the banking sector, a third-party provider refers to an external entity or service provider that is not part of the bank's internal organisational structure, but which is contracted or engaged to deliver specific technological solutions or services. These may include cloud computing, data analytics, AI model development, cybersecurity, or software-as-a-service (SaaS) platforms.

Specifically, when banks deploy AI-powered tools—such as Natural Language Processing (NLP) engines to interpret customer communications, or chatbots to handle client interactions—these functionalities are frequently developed or hosted by third-party vendors. These vendors may have access to sensitive customer data, either directly or indirectly, to train, operate, or optimise AI systems.

The reliance on such providers introduces data privacy and governance concerns, particularly when: 1) Data is stored or processed on external servers (e.g., cloud infrastructure); 2) AI models are trained using customer-sensitive information (e.g., transactional data, personal identifiers); and 3) Legal and regulatory responsibilities for data breaches or misuse are ambiguous or shared.

As regulatory frameworks in Malaysia and globally continue to evolve, it remains uncertain how liability, compliance, and oversight should be allocated between banks and third-party vendors. The lack of clarity on whether banks can—or should—delegate data protection responsibilities to external AI solution providers raises ethical and legal questions, especially concerning accountability, consent management, cross-border data flow, and the protection of confidential financial information.

AI-powered tools, such as NLP engines for analysing communications and chatbots for customer interactions, may pose privacy risks.[16] The ongoing regulatory uncertainty further complicates banks' efforts to effectively address cybersecurity threats. Even BNM has encouraged digital innovation through

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[15] "Banking Sector Receives Strong Government Support to Scale AI," The Star, August 19, 2024, https://www.thestar.com.my/business/business-news/2024/08/19/banking-sector-receives-strong-govt-support-to-scale-ai?utm.

[16] M. Caldwell et al., "AI-Enabled Future Crime," *Crime Science* 9, no. 1 (2020): 1–13, doi:10.1186/s40163-020-00123-8.

regulatory frameworks that support AI integration while ensuring data security and consumer protection.

Ultimately, the adoption of AI in the financial sector is already a reality, offering significant benefits to market participants. However, it also introduces various risks and limitations that must be understood and effectively managed to fully harness its potential. It is essential to differentiate among the specific activities for which AI is used, as challenges such as results bias and interpretability vary across different applications. Therefore, the advantages, drawbacks, and appropriate uses of AI should be carefully evaluated on a case-by-case basis.

IV. ASSESSING THE DEMOCRATIC USE OF AI INTEGRATION ON FAIRNESS, TRANSPARENCY, AND FINANCIAL INCLUSION WITHIN THE MALAYSIAN FINANCIAL SECTOR

IV.A. Analysis of Findings from Desk Review and Interview

The integration of AI in the Malaysian financial institutions presents a complex duality. While offering transformative potential in automation, efficiency, and personalised services, it simultaneously raises critical concerns regarding fairness, transparency, and financial inclusion. Algorithmic bias, as highlighted by O'Neil and Barocas et al., is the primary concern. Machine learning algorithms trained on historical data can perpetuate and amplify existing societal biases, leading to discrimination in loan approvals, credit scoring, and fraud detection.[17] For example, if historical loan data disproportionately favours certain demographic groups (e.g., based on race, gender, or location), an AI system may learn and replicate these biases.[18] Mitigating these risks requires robust data quality control, rigorous algorithm auditing, and continuous monitoring.[19] This includes utilising diverse and representative datasets, employing fairness-aware algorithms, and establishing clear accountability frameworks.

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[17] Sandra Wachter et al., "Why a Right to Explanation of Automated Decision-Making Does Not Exist in the General Data Protection Regulation," *International Data Privacy Law* 7, no. 2 (2017): 76–99, https://doi.org/10.1093/idpl/ipx005; Cathy O'Neil, *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* (Crown, 2016); Aylin Caliskan et al, "Semantics Derived Automatically from Language Corpora Contain Human-Like Biases," *Science* 356, no. 6334 (2017): 183–86, doi: 10.1126/science.aal4230; Jon Kleinberg et al., "Discrimination in the Age of Algorithms," *Journal of Legal Analysis* 10, no. 1 (2018): 113–74, https://doi.org/10.1093/jla/laz001; Su Lin Blodgett et al., "Demographic Dialectal Variation in Online Social Media: A Case Study of African American English," in *Proceedings of the Tenth International Conference on Language Resources and Evaluation (LREC 2016)* (Porto, Portugal: Association for Computational Linguistics, 2016): 1077–84. https://aclanthology.org/D16-1120/.

[18] Solon Barocas and Andrew D. Selbst, "Big Data's Disparate Impact," *California Law Review* 104, no. 3 (2016): 671–732. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2477899.

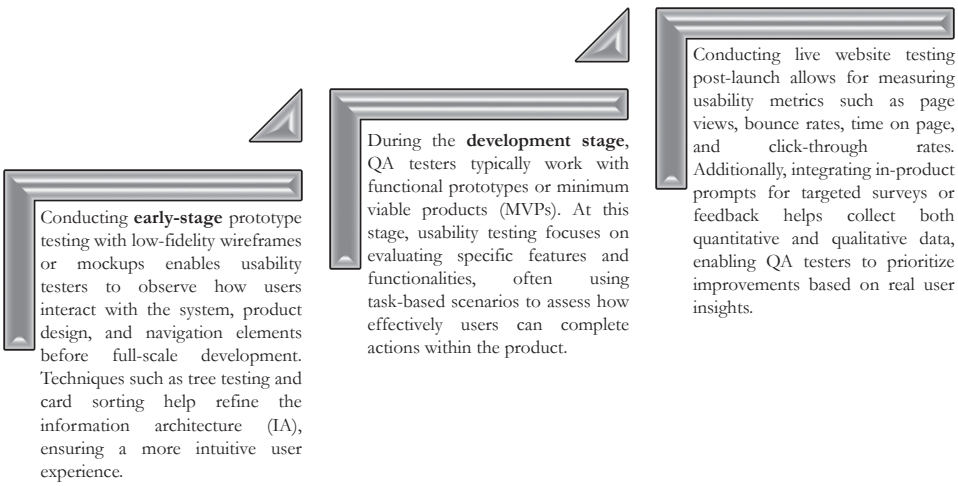
[19] Ninareh Mehrabi et al., "A Survey on Bias and Fairness in Machine Learning." ACM Computing Surveys (CSUR) 54, no. 6 (2021): 1–35, https://doi.org/10.1145/3457607.

Our interview with an Enterprise Architect and QA Specialist from BMMB, Muhammad Mustaqim Abdul Halim, revealed that bias mitigation is primarily addressed through rigorous test-case scenarios during usability testing.[20] Specifically, he wrote that "all AI technologies used are logic-based, meaning we already have a clear understanding of the outputs they produce. Transparency is in the design, ensuring predictable results". He also explained, "during the testing phase, all possible scenarios would have been thoroughly tested. It's unlikely such (bias) issues would occur in go-live environment [sic.]".

This emphasis on testing logic-based systems represents a valuable first step towards ensuring fairness and transparency. The emphasis on testing logic-based systems represents a valuable first step towards ensuring fairness and transparency. As Doshi-Velez and Kim argue, interpretability is crucial for building trust in AI systems, and logic-based approaches often offer greater transparency than complex machine learning models.[21]

Rigorous testing, akin to the formal verification methods discussed by Clarke et al., can help identify potential flaws and biases in these systems.[22] Furthermore, within the financial sector, where regulatory compliance and ethical considerations are paramount, thorough testing is essential for ensuring

Figure 1. Stages for Testing Usability



[20] Muhammad Mustaqim Abdul Halim (Enterprise Architecture & QA Specialist at Bank Muamalat Malaysia Berhad (BMMB), Kuala Lumpur), e-mail message to author, December 31, 2024.

[21] Finale Doshi-Velez and Been Kim, "Towards a Rigorous Science of Interpretable Machine Learning," *arXiv preprint arXiv:1702.08608* (2017), https://arxiv.org/abs/1702.08608; Brent Daniel Mittelstadt et al., "The Ethics of Algorithms: Mapping the Debate," *Big Data & Society* 3, no. 2 (2016): 1-20. https://doi.org/10.1177/2053951716679679.

[22] Edmund M. Clarke et al., *Model Checking* (MIT Press, 2001); Daniel Jackson, *Software Abstractions: Logic, Language, and Analysis* (MIT Press, 2006).

that AI-driven decisions are both fair and compliant. However, even with logic-based systems, it is important to design test cases that specifically target potential biases and discriminatory outcomes.[23] Sharan Phillora explains that there are three basic stages for successful usability testing: the early stage, the development stage, and the post-launch stage, as illustrated by the figure below.

Comparing this method with the practical application of testing explained by the respondent, the testing of the AI model in BMMB was carried out in the development stage. Usability testing can simplify complex processes, including applying for mortgages, making them more accessible and user-friendly. It allows QA officers to address potential issues before launch, ensuring a smoother user experience. This process aligns with the three stages of usability testing (early, development, and post-launch) as illustrated in Figure 1. In the third stage of testing, post-launch usability testing can also uncover user needs and preferences, such as the desire for personalised investment recommendations.[24]

This finding is consistent with the data received from BMMB's specialist, who emphasises that BMMB relies on a logic-based system with predictable outcomes, where the AI implementation has gone through thorough testing of various test-case scenarios, which will be reported by the Usability Quality Assurance Tester accordingly.[25]

It is undeniable that usability testing within QA is crucial for ensuring BMMB's adherence to Malaysian fairness policies governing Islamic finance, mainly the Financial Services Act of 2013 (FSA 2013), the Islamic Financial Services Act of 2013 (IFSA 2013), and BNM guidelines, which are grounded in Shariah principles, emphasise fairness, transparency, and ethical conduct. Usability testing directly supports these principles by evaluating accessibility for diverse user groups and promoting inclusivity. It enhances transparency by identifying and mitigating misleading elements, enabling informed decisions. Clear information, especially terms and conditions, is improved, preventing misinterpretations. Furthermore, it contributes to error prevention, minimising user risk.[26]

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[23] Solon Barocas et al., *Fairness and Machine Learning: Limitations and Opportunities* (MIT Press, 2023); Margaret Mitchell et al., "Model Cards for Model Reporting," in *Proceedings of the Conference on Fairness, Accountability and Transparency* (2019): 220–29. https://doi.org/10.1145/3287560.3287596).

[24] Sharan Phillora, "The Cost of Perfection: How Usability Testing Can Boost the ROI of Financial Products," Maze, June 27, 2023, https://maze.co/blog/usability-testing-financial-services/#:~:text=Usability%20testing%20can%20help%20you,and%20maintain%20compliance%20with%20accessibility.

[25] Halim, e-mail message to author.

[26] Nina Setiyawati and Dwi Hosanna Bangkalang, "The Comparison of Evaluation on User Experience and Usability of Mobile Banking Applications Using User Experience Questionnaire and System Usability Scale," *Proceedings* 82, no. 1 (2022): 87-94, https://doi.org/10.3390/proceedings2022082087.

The established principles of usability testing[27] align with broader financial services regulations (e.g., the Financial Conduct Authority (FCA) in the UK, Consumer Financial Protection Bureau (CFPB) in the US), and the core ethical principles of Islamic finance (AAOIFI Shariah standards). Therefore, robust usability testing within BMMB's QA processes demonstrably contributes to upholding Malaysian fairness policies by promoting accessibility, transparency, clarity, and positive customer experiences in Islamic financial service delivery.

While usability testing is crucial for ensuring a positive user experience and identifying potential fairness breaches, it may not fully address the complexities of advanced AI systems. As Doshi-Velez and Kim argue, even logic-based systems can become increasingly opaque as complexity increases. Furthermore, not all financial processes are simple. Complex processes like loan approvals and credit scoring require more sophisticated AI systems, increasing the risk of the "black box" problem.[28] Here, the transparency issue is inevitable if the AI is not developed and audited accordingly. The specialist from BMMB reiterates that flagging may occur during the decision-making step of the credit-scoring process, where, if it happens, then mitigation will take place by manual human intervention. Halim stated, "you need to understand that Credit scoring comes from CCRIS/CTOS. e.g. For personal financing, (customer Application>Credit Assessment> Decisioning>Approval). If flagged during decisioning, it will require manual intervention".[29]

The QA specialist's assertion that BMMB's system is free from bias due to its logic-based design and thorough usability testing warrants closer scrutiny. While logic-based systems offer a degree of transparency compared to "black box" deep learning models, they are not immune to bias. The specialist's emphasis on predictability stemming from pre-defined rules overlooks the crucial role of input data. Even with transparent logic, if the data used to train the system or inform its rules reflects existing societal biases, the system can perpetuate and even amplify those biases.[30] Furthermore, relying on usability testing as a primary means of bias detection is insufficient.[31] Usability testing focuses on user experience and accessibility, not the intricacies of algorithmic fairness. While usability testing may uncover certain usability-related disparities, it is not designed to detect subtle biases embedded within the data or the logic itself. The specialist acknowledged that credit scoring relies on external data

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[27] Coursera Staff, "What is Usability Testing?," Coursera, updated December 31, 2025, https://www.coursera.org/articles/usability-testing.

[28] Doshi-Velez and Kim, "Towards a rigorous science;" Zachary C. Lipton, "The Mythos of Model Interpretability," *Communications of the ACM* 61, no. 10 (2018): 31-41. https://doi.org/10.1145/3233231.

[29] Halim, e-mail message to author.

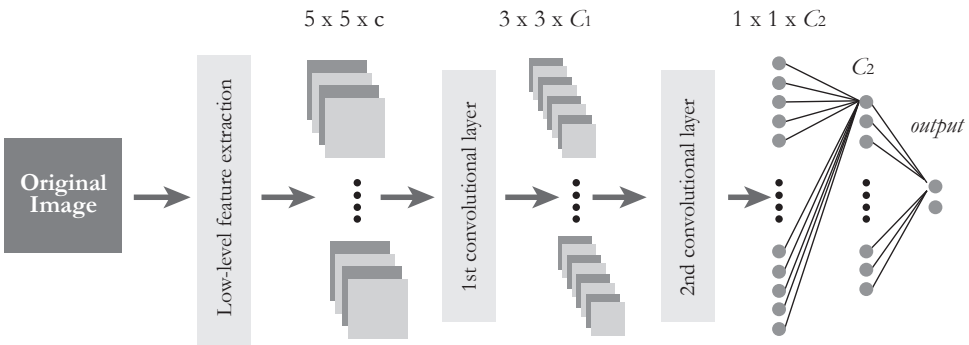
[30] O'Neil, *Weapons of Math Destruction*.; Barocas et al., *Fairness*; Kate Crawford, *Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence* (Yale University Press, 2021).

[31] Wachter et al., "Why a Right to Explanation."

sources, such as BNM's Central Credit Reference Information System CCRIS) and other credit reporting agencies. This reliance means financial institutions must be mindful of the data's characteristics and integrity. The process of application review, which may involve additional assessment, adds a further consideration. Without clear documentation and transparency regarding the flagging criteria, this process can become a "black box" in itself, obscuring the rationale behind manual reviews and potentially reintroducing human biases into the decision-making process. Therefore, while BMMB appears confident in its logic-based approach and usability testing, the reliance on external data, the limitations of usability testing for bias detection, and the potential opacity of the manual review process suggest a need for more comprehensive and robust QA measures to ensure true fairness and transparency in AI-driven financial services.

Therefore, it can be said that another significant challenge is the "black box" nature of many AI algorithms, particularly deep learning models.[32] Deep learning models consist of multiple layers of interconnected nodes (like neurons in a brain). When data is fed into the model, it passes through these layers, undergoing complex mathematical transformations at each step. These transformations are so intricate and involve so many parameters that it's practically impossible for humans to trace the exact steps and understand why the model produced a specific output. Doshi-Velez and Kim described this as the interpretability of machine learning, which exists in various degrees. Below is the illustration of a deep learning model by Konstantinos Makantasis.

Figure 2. Deep Learning Model by Konstantinos Makantasis et al.

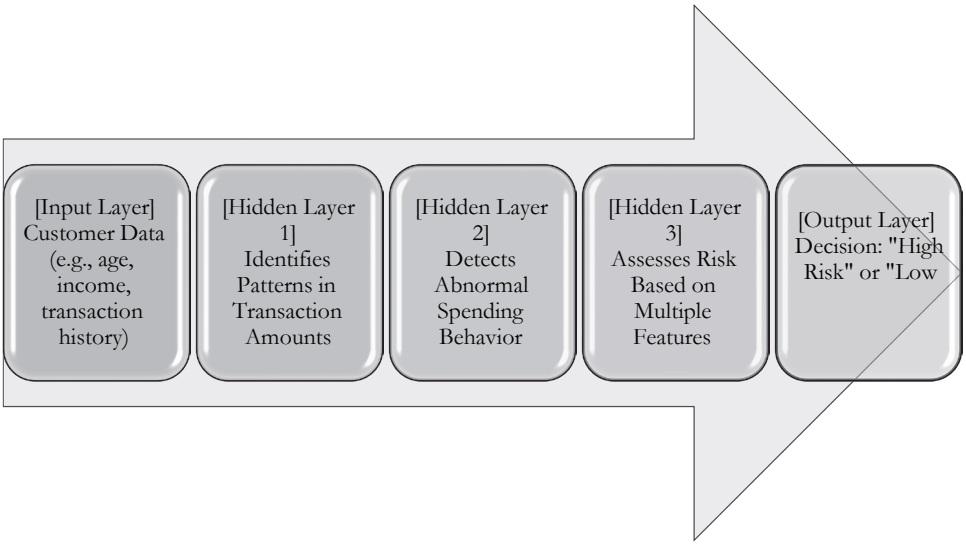


A simplified version of Deep Learning Models is illustrated below by the authors.

[32] Doshi-Velez and Kim, "Towards a Rigorous Science."

[33] Konstantinos Makantasis et al., "Deep Supervised Learning for Hyperspectral Data Classification Through Convolutional Neural Networks," in *Proceedings of the 2015 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Milan, Italy (2015): 4959-4962, doi: 10.1109/IGARSS.2015.7326945.

Figure 3. How Deep Learning Models Process Financial Data in Banks.



This "black box" nature of many AI algorithms, particularly deep learning models, poses a significant challenge.[34] The complex mathematical transformations within these models make it difficult to understand the rationale behind AI-driven decisions, eroding trust and hindering the identification and correction of errors or biases. Explainable AI (XAI) is emerging as a field dedicated to developing techniques that provide insights into AI decision-making processes.[35] XAI aims to enhance transparency, build trust, and facilitate accountability. Our interview data indicates that BMMB, while relying on logic-based systems and human intervention for flagged transactions, is exploring the potential of XAI techniques to enhance transparency and understanding of system behaviour.[36] This enhanced transparency can foster greater trust among stakeholders, including regulators, customers, and developers.[37]

AI also presents a complex picture regarding financial inclusion. While it offers the potential to expand inclusion by automating processes, reducing costs, and offering personalised services,[38] it also carries the risk of exacerbating

[34] Doshi-Velez and Kim, "Towards a Rigorous Science."

[35] Amina Adadi and Mohammed Berradi, "Peeking Inside the Black-Box: A Survey on Explainable Artificial Intelligence (XAI)," IEEE Access 6 (2018): 52138–60, 10.1109/ACCESS.2018.2870052; Carta et al., "Explainable AI."

[36] Wojciech Samek et al., eds., *Explainable AI: Interpreting, Explaining and Visualizing Deep Learning* (Springer, 2019); Alejandro Barredo Arrieta et al., "Explainable Artificial Intelligence (XAI): Concepts, Taxonomies, Opportunities and Challenges toward Responsible AI," *Information Fusion* 58, no. 3 (2020): 82-115, 10.1016/j.inffus.2019.12.012.

[37] Mittelstadt et al., "The Ethics of Algorithms."

[38] Peterson K. Ozili, "Impact of Digital Finance on Financial Inclusion and Stability," *Borsa Istanbul Review* 18, no. 4 (2018): 329-40, https://www.sciencedirect.com/science/article/pii/S2214845017301503.

inequalities.[39] AI-powered chatbots and AI-based credit scoring can be beneficial, but if these systems are not carefully designed and implemented with representative data, they can inadvertently exclude or discriminate against certain groups. Therefore, a principled approach to AI integration is essential. BMMB's focus on human oversight in electronic Know Your Customer (e-KYC) and AML processes is a positive step. However, developing specific, measurable metrics, such as tracking access to financial products for underserved demographics and analysing loan approval rates across different groups, is crucial for a comprehensive understanding of the bank's impact on financial inclusion.

IV.B. Discussion

The analysis of both the desk review and the hypothetical interview data reveals a complex interplay between the transformative potential of AI in finance and the inherent risks to fairness, transparency, and financial inclusion. While AI offers significant opportunities for increased efficiency, personalised services, and expanded access to financial products, our findings underscore the critical need for robust QA processes to mitigate the potential for algorithmic bias and ensure responsible AI implementation.[40] The literature, as exemplified by O'Neil, highlights the dangers of perpetuating societal biases through biased training data.[41] Our hypothetical interview data reinforces this concern. While BMMB has not encountered demonstrable instances of algorithmic bias in its AI systems, the bank faces challenges related to transparency, including flagging of the systems. Enterprise Architecture and Quality Assurance Specialist from BMMB in his interview wrote that "[a]mong the ethical challenges faced by BMMB is a lack of transparency in AI decisions, such as why transactions are flagged. To address this, QA ensures compliance with BNM's expectations for transparency, such as clear documentation of decision-making criteria in AI systems."

Emphasising the importance of clear documentation is crucial, as it is among the significant responsibilities of QA officers. Regular audits of the documentation must be reported to ensure the effectiveness of AI systems in financial institutions. These are supported by the Perwira Affin Bank[42]

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[39] "World Development Report 2021: Data for Better Lives," World Bank Group, accessed May 15, 2025. https://www.worldbank.org/en/publication/wdr2021.

[40] Kostis Chlouverakis, "How Artificial Intelligence Is Reshaping the Financial Services Industry," EY, April 26, 2024, https://www.ey.com/en_gr/insights/financial-services/how-artificial-intelligence-is-reshaping-the-financial-services-industry.

[41] Alfonso Min, "Artificial Intelligence and Bias: Challenges, Implications, and Remedies," ResearchGate (2024), DOI: 10.13140/RG.2.2.36029.03049.

[42] *Perwira Affm Bank Berhad (previously known as Perwira Habib Bank Malaysia Berhad) v. Agrimal Marketing Sdn Bhd and Others* [2009] MLJU 649 (Malaysia)

case. Although this case concerns financial transactions, it offers an analogical perspective on challenges relevant to QA professionals. The dispute over the application of sale proceeds highlights the critical need for process control and adherence to established procedures, mirroring QA's focus on verifying software development process compliance. The difficulties in calculating the exact amount owed and verifying supporting documentation emphasise the importance of accuracy and verification, a core QA function in ensuring software and data integrity.

Furthermore, the reliance on specific financial documents and disputes over their interpretation underscores the necessity of thorough documentation and record-keeping, paralleling QA's use of documentation for defect tracking and test results. Finally, the disagreement regarding the USD330,000 application illustrates the need for transparency and auditability, principles equally crucial in QA to ensure traceable and verifiable processes in software development. Further elaboration from the specialist states "….in credit loan or CTOS report-making processes, there are specific steps in which if flagging happened, then manual intervention would be needed".

This reliance on human intervention for flagged transactions, while mitigating bias, can create a "black box" effect, hinder transparency, and make it challenging for QA to effectively audit and evaluate the AI's logic. This highlights the need for improved documentation of the flagging process and the development of XAI techniques to increase transparency, even in systems that rely on human oversight. Furthermore, the "black box" nature of many AI algorithms, particularly deep learning models, poses a significant threat to transparency and accountability.[43] As Linardatos et al. argue, the lack of interpretability in these models makes it difficult to understand the rationale behind AI-driven decisions, hindering the identification and correction of errors or biases.[44]

This study's findings suggest that while logic-based systems, as employed by BMMB, offer some degree of interpretability, they are not immune to the challenges of complexity and can still benefit from XAI approaches. Interview data regarding XAI and AI Governing System from BMMB reveals that "[w]e have a dedicated team that oversees AI planning stage".

The existence of a dedicated team at BMMB demonstrates a commitment to addressing these evolving challenges. Just as the Perwira Affin Bank case highlights the consequences of inadequate QA, the lack of AI transparency requires an upgrade in QA practices, including a strong focus on usability

[43] Matthew Kosinski, "What Is Black Box Artificial Intelligence (AI)?," IBM, October 29, 2024, https://www.ibm.com/think/topics/black-box-ai.

[44] Pantelis Linardatos et al., "Explainable AI: A Review of Machine Learning Interpretability Methods," *Entropy* 23, no. 1 (2021): 18, https://doi.org/10.3390/e23010018.

testing, XAI, and the development of appropriate metrics to ensure fairness and inclusion.

V. EXAMINING CHALLENGES FACED BY QA PROFESSIONALS

V.A. Analysis of Findings from the Desk Review and Personal Interview

The increasing digitisation of financial institutions, driven by technological advancements like AI and sophisticated financial applications, necessitates robust QA processes. In the banking sector, where continuous operation and the secure handling of sensitive customer data are paramount, QA plays a crucial role in ensuring defect-free products, seamless transactions, and a positive customer experience.[45] This is particularly important for mobile banking apps, where customer expectations for performance and usability are high. Digital transformation in banking, while promising increased data transparency, reduced intermediaries, and secure access to information, also introduces new challenges for QA.

To illustrate the broader challenges faced by QA professionals, even outside the specific context of AI, the cases of TATP Giap Steel Centre Sdn. Bhd. V. Jeffry Bin Ismail [2004][46] and Ruth Chai Mei Hui v. Berjaya Steel Product Sdn. Bhd. [2020][47] offer valuable insights. TATP Giap Steel highlights the potential for subjectivity in performance evaluation, the challenges of inconsistent training, the importance of root cause analysis, and the need for clear communication and documentation – all relevant to QA. The Ruth Chai Mei Hui case further emphasises the challenges related to unclear responsibilities, a lack of clear performance metrics, the importance of thorough record-keeping, communication breakdowns, and the potential for subjective performance assessments. These cases, while not directly related to AI, underscore fundamental QA challenges that AI solutions aim to address (e.g., by providing more objective data and better analytical tools), but also highlight the persistent human and organisational factors that can complicate QA even with advanced technology. They serve as a reminder that technology alone is not a silver bullet.

Turning to the specific challenges of AI in finance in Malaysia, QA professionals in financial institutions, especially banking, play a vital role in overseeing the integration of AI. Their responsibilities extend beyond

[45] "Why Is Quality Assurance So Important in Banking Systems?," Maveric Systems, March 31, 2023, https://maveric-systems.com/blog/why-is-quality-assurance-so-important-in-banking-systems/#:~:text=QA%20testing%20ensures%20that%20banking,for%20high%2Dquality%20mobile%20apps.

[46] *TATP Giap Steel Centre Sdn. Bhd. v. Jeffry Bin Ismail* [2004] ILJU 88, Malaysia.

[47] *Ruth Chai Mei Hui v. Berjaya Steel Product Sdn. Bhd.* [2020] ILJU 114, Malaysia.

traditional software testing to encompass ensuring compliance with regulations and guidelines set by BNM, including Risk Management in Technology (RMiT) requirements. According to data from an interview with the BMMB enterprise architect and QA specialist, he emphasises that collaboration between the QA teams with compliance officers is crucial to ensure that AI development aligns with BNM's expectations for responsible technology use.[48] For example, the RMiT requires financial institutions to have a sound framework for managing technology risks, including those related to AI. This includes robust validation and testing of AI models, as well as ongoing monitoring to ensure they continue to perform as intended and do not introduce new risks. This is crucial for maximising the benefits of AI while mitigating potential risks. While AI offers significant advantages in automating processes, enhancing fraud detection, and improving customer experiences, its implementation presents complex challenges for QA.

The 2023 Financial Stability Oversight Council (FSOC) report highlights the need for continuous monitoring of rapid AI developments, including generative AI, to ensure regulatory frameworks remain ahead of emerging risks.[49] This underscores the evolving nature of the QA role, requiring professionals to stay abreast of AI innovations and potential threats. The application of AI in critical infrastructures like banking introduces concerns related to safety, accuracy, reliability, and security.[50] QA professionals must ensure the safety and security of customer data, particularly against cyberattacks. A robust cybersecurity system is crucial for maintaining customer trust. Security, in this context, means minimising the probability of incidents; validity refers to performing the intended purpose without errors; and trust stems from the ability of AI systems to perform accurately and reliably.

Data security and privacy are paramount in financial services. QA professionals review AI systems to ensure compliance with BNM guidelines, including the Personal Data Protection Act (PDPA). Referring to real-world scenarios, the specialist from BMMB reveals that when implementing services like Visa B2B, QA verifies that sensitive customer data is encrypted and processed securely.[51] However, achieving high levels of QA in AI-based solutions presents significant challenges. AI results, including computations and decisions, must be transparent and understandable. While the objective of AI systems is coded, their behaviour is learned, leading to potential variability

[48] Halim, e-mail message to author.

[49] "AS Kenal Pasti Penggunaan AI Sebagai Risiko dalam Sistem Kewangan," BH Online, December 15, 2023, https://www.bharian.com.my/dunia/amerika/2023/12/1189366/kenal-pasti-penggunaan-ai-sebagai-risiko-dalam-sistem-kewangan.

[50] AL-Dosari et al., "Artificial Intelligence and Cyber Defense System."

[51] Halim, e-mail message to author.

over time. This introduces risks such as biases in training data.[52] Biased data can lead to undesirable outcomes, necessitating robust data quality control and continuous monitoring of AI activity to ensure compliance. Building trust and transparency in AI solutions is a key challenge for QA.

The desk review and data from our open-ended interview reveal that QA officers in financial institutions face significant challenges in monitoring AI systems for compliance with regulations, particularly concerning data privacy and transparency. Although collaboration between QA teams and regulatory bodies is carried out, AI does not run in a defect-free manner and requires continuous and consistent effort for a more effective and evolved system to benefit the customer fairly. QA officers must identify risks and ensure system security at all levels of AI processes, adhering to BNM standards and guidelines. Supervising the quality of AI-based solutions to ensure transparency and understandability is also critical. These challenges, compounded by the more general QA challenges highlighted in the case studies, underscore the evolving and crucial role of QA in ensuring responsible and effective AI implementation in financial institutions.

V.B. Discussion

The challenges confronting QA professionals in the age of AI integration are multifaceted and rapidly evolving. This analysis demonstrates that QA professionals are not only responsible for the technical quality and performance of AI systems but also for navigating a complex regulatory landscape and addressing ethical considerations. The increasing reliance on AI in financial institutions, as highlighted in the desk review, necessitates robust QA processes to ensure compliance with regulations like BNM's RMiT requirements and the PDPA. As the specialist from BMMB noted,[53] "QA reviews AI systems to ensure they meet BNM's guidelines, such as protecting customer data under the Personal Data Protection Act (PDPA). For example, when implementing Visa B2B (cross-border payment service), QA ensures sensitive customer data is encrypted and processed safely, while Visa protects transaction details". This underscores the dynamic nature of regulations and the need for adaptable and well-informed QA professionals.

The case studies of TATP Giap Steel Centre and Ruth Chai Mei Hui, while not directly related to AI, provide valuable analogies for the challenges faced by QA professionals in the financial sector. This paper argues that the challenges inherent in QA processes, particularly those related to subjective

[52] Luisa Kruse et al., "Artificial Intelligence for the Financial Services Industry: What Challenges Organizations to Succeed," in *Proceedings of the 52nd Hawaii International Conference on System Sciences (HICSS 2019),* Maui, Hawaii, USA (January 2019): 6408-6417.

[53] Halim, e-mail message to author.

performance evaluation and communication breakdowns, are significantly amplified when dealing with the complexities of "black box" AI algorithms. While the TATP Giap Steel Centre case illustrates the inherent subjectivity of human performance evaluations, even with seemingly objective criteria, this subjectivity becomes exponentially more problematic when assessing AI systems. The opacity of "black box" AI decision-making, where the algorithmic process is hidden, prevents meaningful evaluation of the AI's "skill, knowledge, attitude, and performance"—analogous to the human evaluation factors in the case. This opacity hinders the identification of biases embedded within the AI, as the lack of transparency obfuscates the "why" behind AI outputs, making it nearly impossible to determine if those outputs are fair and unbiased.[54] Furthermore, even with access to the AI's internal processes, the technical expertise required to interpret them creates a chasm of understanding among stakeholders, including managers, regulators, and those affected by AI decisions. This knowledge gap impedes meaningful discussion and accountability, eroding trust in the AI system even when its decisions are objectively sound. This erosion of trust is a direct parallel to the distrust that can arise from subjective human evaluations but is magnified by the complexity and perceived inscrutability of AI.

Similarly, the communication breakdowns highlighted in the Ruth Chai Mei Hui case, stemming from unclear expectations and differing interpretations of documentation, become drastically more complex in the context of AI. The technical jargon surrounding AI creates communication barriers, hindering a shared understanding of AI's capabilities, limitations, and risks. The diverse technical expertise among stakeholders—developers, managers, regulators, and customers—exacerbates these challenges, creating a Tower of Babel scenario where productive conversation about AI systems is nearly impossible. This lack of a common language extends to discussions of ethical and societal implications, making it difficult to address crucial issues like algorithmic bias. Even with XAI, explaining the rationale behind AI decisions in a way understandable to all stakeholders remains a significant hurdle, potentially leading to frustration, distrust, and perceptions of unfairness. Just as misinterpretations of performance led to disputes in the Ruth Chai Mei Hui case, communication breakdowns surrounding AI can lead to misinterpretations of AI behaviour

[54] Fei, "Beyond Black Box AI: Pitfalls in Machine Learning Interpretability," University of New South Wales, September 22, 2024, https://www.businessthink.unsw.edu.au/articles/black-box-AI-models-bias-interpretability#:~:text=%E2%80%9CBlack%2Dbox%20AI%20models%2C,made%2C%E2%80%9D%20Dr%20Huang%20said.

and its impact,[55] potentially fuelling distrust and hindering the effective implementation of AI in sensitive domains like finance. By explicitly linking these case studies to the unique challenges posed by "black box" AI, this paper demonstrates the critical need for new QA approaches and methodologies that address the amplified subjectivity and communication barriers inherent in AI-driven systems. This contribution underscores the evolving role of QA professionals in the age of AI, highlighting the necessity for not only technical expertise but also strong communication skills and the ability to bridge the gap between technical complexity and stakeholder understanding.[56]

The increasing complexity and opacity of AI systems amplify these traditional QA challenges, requiring professionals to develop new skills and adopt innovative approaches to ensure the quality, safety, and ethical use of AI in finance. Future research should explore the development and implementation of specialised QA frameworks for AI systems in financial services, focusing on addressing the unique challenges related to transparency, bias detection, and regulatory compliance. Additionally, investigating the role of XAI in enhancing QA processes and building trust in AI-driven financial services would be a valuable contribution.

VI. INVESTIGATING THE ROLE OF QA IN MITIGATING RISKS AND SUPPORTING TRANSFORMATION

VI.A. Analysis of Findings from Desk Review and Interview

The increasing integration of AI in financial institutions, particularly within the banking industry, presents both opportunities and significant challenges. While AI enables streamlined operations and enhanced customer experiences,[57] it also introduces new risks related to data security, algorithmic bias, and regulatory compliance. This necessitates a proactive and strategic role for QA professionals, who must not only ensure the technical soundness of AI systems but also contribute to their responsible and ethical deployment. QA officers are tasked with developing comprehensive risk management plans that address the unique characteristics of AI, including its potential for rapid evolution and unpredictable behaviour.

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[55] Raoul Davis, "Communicating AI: Bridging Tech and Conversation," Digitalconfex, accessed February 1, 2025, https://digitalconfex.com/communicating-ai-bridging-tech-and-conversations/#:~:text=Making%20Ai%20Relatable%3A%20Bridging%20The%20Gap&Technical%20language%20can%20create%20a,AI%20impacts%20their%20daily%20lives.

[56] Avital Shulner-Tal, "Enhancing Fairness Perception – Towards Human-Centred AI and Personalized Explanations Understanding the Factors Influencing Laypeople's Fairness Perceptions of Algorithmic Decisions," *International Journal of Human-Computer Interaction* 39, no. 2 (2023): 1455-82, DOI: 10.1080/10447318.2022.2095705.

[57] "AI dalam Industri Kewangan Malaysia: Manfaat, Cabaran, dan Masa Depan," Bijak Duit, accessed March 5, 2025, https://www.bijakduit.com/pengurusan-duit/ai-industri-kewangan-malaysia/.

A crucial aspect of AI risk management is the development of robust strategies to mitigate potential harms. This includes the development of stronger AI algorithms for fraud detection, as well as the use of AI in sentiment analysis to better understand customer behaviour. These advancements can improve efficiency, minimise risk and enhance customer service. However, they also require careful validation and monitoring by QA professionals to ensure accuracy, reliability, and fairness.

Furthermore, the evolving regulatory landscape demands that QA professionals stay abreast of emerging standards and guidelines. The current state of global AI regulation is still largely at the policy level, with various jurisdictions publishing position papers and statements.[58] For example, building a regulatory infrastructure requires politicians to collaborate with technology professionals to understand, manage, and limit the hazards posed by AI in the digital, physical, economic, and political domains.[59] Organisations like the OECD have published recommended AI governance principles, and the European Commission's AI HLEG has published "Ethics Guidelines for Trustworthy AI",[60] emphasising transparency, privacy, and user consent. These developments underscore the need for close collaboration between financial institutions, regulators, and technology professionals to establish comprehensive and effective AI governance frameworks.[61] As the 2023 FSOC report emphasises, continuous monitoring of AI developments is crucial to ensure regulatory frameworks keep pace with emerging risks.

Our interview with a QA specialist at BMMB highlighted the practical challenges of AI risk management. The specialist emphasised the need for AI systems to adapt to new threats, such as sophisticated money-laundering schemes, while avoiding excessive false alarms. Halim stated that, "of the mitigation is, testing AI with real-world scenarios to see how well it detects risks and fine-tuning AI models to reduce unnecessary alerts while catching true risks."[62] This highlights the dynamic nature of AI risk and the need for ongoing monitoring and adaptation.

The specialist also discussed the importance of collaboration with regulatory bodies to co-develop frameworks for AI testing. He explained that "QA ensures that e-KYC models comply with AML requirements while maintaining accessibility for underserved populations, aligning with both

[58] Tim Dutton, "An Overview of National AI Strategies," Medium, June 29, 2018, available at https://medium.com/politics-ai/an-overview-of-national-ai-strategies-2a70ec6edfd.

[59] Truby et al., "Banking on AI."

[60] "Recommendation of the Council on Artificial Intelligence." Organisation for Economic Co-operation and Development, May 22, 2019, https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449.

[61] Truby et al., "Banking on AI."

[62] Halim, e-mail message to author.

regulatory and ethical goals".[63] This underscores the crucial role of QA in bridging the gap between technical requirements and ethical considerations, ensuring that AI systems are both compliant and socially responsible. It also emphasises the need for QA professionals to have a deep understanding of both the technical aspects of AI and the broader ethical and regulatory context.

VI.B. Discussion

The increasing integration of AI in financial institutions presents both transformative opportunities and complex challenges. This analysis demonstrates that QA professionals play a critical role in navigating this complex landscape, mitigating risks, and supporting organisational transformation.[64] The study analysis reveals that QA professionals are not merely responsible for testing and validating AI systems; they are also key players in shaping the responsible and ethical adoption of AI in the financial sector.[65] QA is no longer simply a technical function; it has become a strategic imperative, requiring professionals to possess a diverse skillset that encompasses technical expertise, regulatory knowledge, ethical awareness, and collaborative abilities.

The desk review highlights the need for comprehensive risk management plans that address the unique challenges of AI, including data security, algorithmic bias, and regulatory compliance. The interview with the BMMB Specialist reinforces this point,[66] emphasising the need for AI systems to be adaptable to evolving threats and for QA processes to be dynamic and responsive. Halim stated that:

While challenges for risk management within banks includes [sic.] ensuring AI can adapt to new threats, like advanced money-laundering schemes avoiding over-flagging, which could waste time on false alarms, the mitigation can be testing AI with real-world scenarios to see how well it detects risks and fine-tuning AI models to reduce unnecessary alerts while catching true risks.

The specialist's comments about testing AI with real-world scenarios and fine-tuning models underscore the importance of continuous monitoring and improvement.

Furthermore, the evolving regulatory landscape requires QA professionals to be actively engaged in shaping the future of AI governance. The specialist's

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[63] Halim, e-mail message to author.

[64] "Advancing Quality Engineering for Banking and Finance: Addressing New Challenges with AI," ImpactQA, April 23, 2024, https://www.impactqa.com/blog/advancing-quality-engineering-for-banking-and-finance-addressing-new-challenges-with-ai/.

[65] Jagadish Anandham, "From Code to Conscience: QA and Testing Ensure Responsible AI Solutions," Trigent, February 28, 2024, https://trigent.com/blog/from-code-to-conscience-qa-and-testing-ensure-responsible-ai/#:~:text=These%20real%2Dworld%20examples%20underscore,ensuring%20their%20ethicality%2C%20reliability%2C%20and.

[66] Halim, e-mail message to author.

comments about collaborating with regulatory bodies to co-develop frameworks for AI testing highlight the importance of partnerships and shared responsibility. Halim further stated that:

QA should adapt by collaborating with regulatory bodies to co-develop frameworks for AI testing. For example, QA ensures that e-KYC models comply with AML requirements while maintaining accessibility for underserved populations, aligning with both regulatory and ethical goals. This collaborative approach is crucial for ensuring that AI systems are developed and deployed in a way that is both technically sound and ethically responsible".[67]

QA professionals are uniquely positioned to bridge the gap between technical development and regulatory requirements, ensuring that AI systems are both innovative and compliant.

The global landscape of AI regulation, as evidenced by the OECD principles and the EU's "Ethics Guidelines", is still evolving.[68] This underscores the need for ongoing dialogue and collaboration between financial institutions, regulators, and technology experts to develop effective AI governance frameworks. QA professionals are crucial to this process, bringing their technical expertise and understanding of ethical considerations to the table. They can play a key role in translating high-level principles into concrete testing and validation procedures.[69]

A key finding of this research is the evolving nature of the QA role. QA professionals are no longer just testers; they are becoming guardians of responsible AI. They must possess not only technical skills but also a deep understanding of ethical principles, regulatory requirements, and the potential for equitable societal access to AI. This requires a shift in training and professional development, with a focus on interdisciplinary skills and collaborative approaches. Future research should explore the development of specialised QA frameworks for AI in finance, including standardised testing methodologies, ethical guidelines, and best practices for collaboration with regulatory bodies. Additionally, research on the open governance of AI on innovation and risk mitigation would be valuable. This study contributes to the growing body of knowledge on AI in finance by highlighting the crucial role of QA in ensuring AI is used responsibly and ethically, benefiting both financial institutions and their customers.

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[67] Halim, e-mail message to author.

[68] Suzanne Gilfix, "AI Legislation and Governance: What's on the Horizon," Applause, June 2, 2024, https://www.applause.com/blog/ai-legislation-and-governance-on-the-horizon/.

[69] Darien Sutton et al., "AI Governance – From Concept to Compliance." Forvis Mazars, January 22, 2025. https://www.forvismazars.us/forsights/2025/01/ai-governance-from-concept-to-compliance.

VII. CONCLUDING REMARKS

This research has investigated the multifaceted impact of AI integration on fairness, transparency, and financial inclusion within the Malaysian financial sector. Through a combination of desk research and an interview with an industry professional, this study has revealed a complex interplay between AI's transformative potential and the inherent challenges it poses to established QA practices. The analysis has highlighted the crucial role of QA in navigating this complex landscape, emphasising the need for robust usability testing, particularly for logic-based systems, while acknowledging its limitations in addressing the "black box" problem posed by more complex AI models. Furthermore, the research has underscored the importance of XAI techniques in enhancing transparency and building trust among stakeholders. The study also explored the dual nature of AI's impact on financial inclusion, recognising its potential to both expand access and exacerbate existing inequalities, thus stressing the need for careful design and implementation.

This research contributes to the existing literature by providing a focused examination of these issues within the specific context of Malaysian Islamic finance, taking into account the interplay among local regulations, Sharia principles, and the unique characteristics of this sector. Specifically, this study reveals the critical importance of robust usability testing in navigating the complexities of AI-driven financial services in Malaysia, highlighting both its potential and its limitations in addressing the "black box" nature of advanced AI systems. Moreover, the research demonstrates the crucial need for XAI techniques to enhance transparency and build trust, particularly given the ethical considerations inherent in Islamic finance.

Finally, this study underscores the democratic use of AI on financial inclusion within the Malaysian context, emphasising the necessity for carefully designed metrics and ongoing monitoring to ensure equitable access to financial products. These findings offer valuable insights for financial institutions in Malaysia, regulators seeking to develop effective AI governance frameworks, and QA professionals tasked with ensuring the responsible and ethical development and deployment of AI in finance, offering a framework for navigating the unique challenges and opportunities presented by AI within the dynamic landscape of Malaysian Islamic finance.

Overall, this research serves as a preliminary study, laying the groundwork for future exploration in this field. Future studies could incorporate broader datasets by analysing data from multiple Malaysian banks to provide a more comprehensive assessment of AI integration in financial institutions. Additionally, various other aspects of the financial sector and its relationship with AI warrant further investigation. This study also aims to contribute

to the ongoing discourse on responsible AI adoption by offering practical insights and recommendations for Malaysian financial institutions seeking to implement ethical and effective AI strategies.

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