THE ROLE OF BIG DATA IN MANAGERIAL DECISION-MAKING IN ISLAMIC EDUCATIONAL INSTITUTIONS: AN ARTIFICIAL INTELLIGENCE-BASED APPROACH

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Abstract	History Articles
The study on the adoption of Big Data and Artificial Intelligence (AI) in Islamic educational institutions offers a detailed exploration of their potential benefits and challenges. The research aims to identify obstacles faced by these institutions in adopting advanced technologies, assess their opportunities for enhancing managerial effectiveness, and evaluate their impact on educational quality and financial transparency. A qualitative-descriptive approach was employed, incorporating interviews with leaders, administrative staff, and teaching personnel from institutions with varying levels of technological integration. This method provided rich insights into the perceptions and experiences of stakeholders, capturing diverse perspectives on the implementation of Big Data and AI. The findings reveal significant advancements in decision-making processes, enabling managers to respond swiftly and effectively to emerging challenges. AI-driven personalized learning enhances student engagement and outcomes, while the integration of Big Data contributes to transparent financial management by optimizing resource allocation. However, several challenges were identified, including inadequate technological infrastructure, a lack of skilled human resources, and concerns about data privacy and security. These obstacles underscore the need for strategic investments in technology, staff training programs, and robust data security measures. The implications of this study suggest a pathway for Islamic educational institutions toward successful digital transformation. Strategic planning that aligns technology adoption with institutional goals, active stakeholder engagement, and continuous evaluation mechanisms are crucial for achieving sustainable integration. By addressing these elements, institutions can harness the potential of Big Data and AI while remaining aligned with Islamic educational values.	Received 25/1/2024 Revised 13/3/2024 Accepted 15/6/2024
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INTRODUCTION

In the era of the Industrial Revolution 4.0, information technology is experiencing rapid development, allowing organizations to manage and analyze large amounts of data. This opens up new opportunities and challenges for Islamic educational institutions, both formal and non-formal, in improving the effectiveness of management and decision-making. Big Data is now a strategic asset in the world of education because it is able to provide in-depth insights into student behavior, preferences, and learning outcomes (Ang et al., 2020; Baig et al., 2020; Fischer et al., 2020). The application of Artificial Intelligence (AI) in Big Data management further expands the capabilities of educational institutions to analyze complex data more quickly and accurately. It assists education managers in making managerial decisions that are more effective, on target, and in accordance with the institution's mission. However, the application of Big Data and AI in Islamic educational institutions is still relatively minimal, due to constraints such as limited technology, lack of human resource skills, and budget limitations. With the great opportunities presented by this technology, it is important to explore how Big Data and AI can be utilized as strategic tools in supporting the achievement of the vision and mission of Islamic education.

Previous research has shown that Big Data and AI have a positive impact on the education sector in general, especially in improving student learning outcomes,

personalizing learning, and managing finances and resources more efficiently (Bhutoria, 2022; Luan et al., 2020). Studies in the conventional education sector reveal that institutions that use Big Data and AI technology in decision-making have succeeded in improving the quality of their services and academic achievement (Alyahyan & Düştegör, 2020; Kuleto et al., 2021). However, research that discusses the implementation of Big Data and AI specifically in the context of the management of Islamic educational institutions is still very limited, especially in the Southeast Asian region which has distinctive characteristics and dynamics of Islamic education.

This study is designed to answer key questions related to how Big Data can support better managerial decision-making in Islamic educational institutions and the extent to which the implementation of AI can improve management effectiveness in these institutions. This research also aims to identify the challenges and opportunities faced in the process of adopting Big Data and AI in Islamic educational institutions. In other words, the purpose of this research is to explore the role of Big Data and AI as supporting tools in improving the effectiveness of Islamic education management.

Although several studies have shown the benefits of Big Data and AI in the general education sector, studies focusing on their application in Islamic educational institutions are still minimal. These limitations are especially in the context of how the technology can be aligned with the values and goals of Islamic education. Therefore, this study offers novelty value through two main aspects: first, this research explores the role of Big Data in Islamic education management by providing a unique perspective on technology optimization in faith-based educational institutions; Second, the AI-based approach in this study not only examines the collection and analysis of big data but also examines how AI can provide the right recommendations according to the needs and characteristics of Islamic educational institutions.

RESEARCH METHODS

The research method used in this study is a qualitative descriptive method (Holili et al., 2024; Munkar & Walid, 2023), with a case study approach to explore the application of Big Data and Artificial Intelligence (AI) in supporting managerial decision-making in Islamic educational institutions. This research involves data collection through in-depth interviews, observations, and documentation on several Islamic educational institutions that have implemented or are in the process of adopting Big Data and AI technology. Participants in this study include managers or heads of institutions, administrative staff, and information technology experts involved in managerial and technical processes in the institution.

In the qualitative descriptive method employed in this study, the identification and analysis of themes were conducted through a systematic and iterative process to ensure transparency and rigor. The research began with comprehensive data collection using in-depth interviews, observations, and document analysis. Each method provided unique insights into the application of Big Data and AI within Islamic educational institutions. Semi-structured interviews with managers, administrative staff, and IT experts allowed participants to share their experiences and perceptions regarding the use of technology in decision-making. Observations offered contextual information about daily operations, highlighting the role of Big Data and AI in institutional processes. Additionally, institutional documents such as annual reports and policies were analyzed to understand the strategic objectives and outcomes related to technological implementation.

Following data collection, all interviews were transcribed verbatim, and the researchers immersed themselves in the transcripts and field notes to gain familiarity with the data. Initial impressions and recurring ideas were noted during this stage. The coding process began with open coding, where significant phrases, concepts, and patterns were identified. These codes were then grouped into broader categories through focused coding, enabling researchers to refine and consolidate related codes into comprehensive themes.

The development of themes involved examining the relationships between codes and categories through thematic analysis. Patterns and connections were identified, and their relevance to the research questions and objectives was assessed. An iterative review process followed, during which themes were refined based on team feedback and further analysis, ensuring they accurately reflected the data and the complexities of participants' experiences.

To enhance the credibility and reliability of the findings, several validation

strategies were employed. Member checking allowed participants to review the findings and confirm the accuracy of the interpretations. Peer review by qualitative research experts provided an external perspective on the coding and theme development process, ensuring methodological rigor.

The final step involved synthesizing the themes into a coherent narrative that addressed the research questions. The findings were organized to illustrate how Big Data and AI contribute to decision-making improvements in Islamic educational institutions. Themes were supported by direct quotes from participants and relevant data from document analysis, providing a rich and nuanced understanding of the research context.

This transparent and systematic approach enabled the researchers to uncover the complexities and nuances of how Big Data and AI are utilized in Islamic educational institutions. The findings not only highlight the potential benefits of these technologies but also reveal the challenges and opportunities of their adoption. These insights inform strategic recommendations aligned with Islamic educational values, offering valuable contributions to the field.

FINDINGS AND DISCUSSION

Big Data Can Support Better Decision-Making In Islamic Educational Institutions

The application of Big Data in Islamic educational institutions has a significant impact in supporting better and more efficient managerial decision-making, in line with the research topic. These findings are based on an analysis of interviews conducted with various stakeholders in educational institutions, which consistently state that Big Data provides access to important data that was previously difficult to process and evaluate in detail. An educational institution manager, revealed that

With Big Data, we can understand student attendance trends and academic performance in more detail (Kepsek-2024).

This data allows institutions to intervene early on at-risk students, both in achievement and discipline (Adnan et al., 2021; Gerlinger et al., 2021; Gregory et al., 2021). So as to help improve the quality of teaching and learning and the effectiveness of educational programs organized by the institution.

Furthermore, the findings show that Big Data also helps in managing resources more accurately. According to the administrative staff, it was revealed that

Previously, decision-making for resource allocation was often based on estimates (Ops-2024)

With structured data through Big Data, institutions are now able to make more accurate and efficient decisions, which has an impact on the smooth operation of the institution as a whole. Organized financial data has also become more accessible, allowing management to optimize the use of the budget as needed.

In addition, the use of Big Data in student engagement analysis on online learning platforms shows improved academic quality and student learning satisfaction. Information technology experts, stated that

Big Data provides insights into student engagement in the learning process, including when they are most active and how they access subject matter (FY 2024)

This information allows for the adjustment of teaching methods to better suit students' learning styles, ultimately improving their learning outcomes. This approach is also supported by the findings of a teacher who stated that

Big data allows personalization of learning to meet the individual needs of students, especially for those who need additional assistance (Gr-2024)

According to him, by looking at the learning pattern of each student, institutions can provide additional modules or special attention to improve the quality of education.

On the financial side, Big Data also provides significant benefits. In line with the statement of the financial manager that

Financial analysis with Big Data makes budget planning more efficient and reduces unnecessary expenses (Mankeu-2024).

With detailed and real-time data, institutions can track financial flows with more transparency, which is crucial for maintaining financial stability in the long term. This detailed data enables more responsible financial decision-making and supports budget planning that suits the needs of the institution.

Thus, this study finds that Big Data has a significant impact on improving managerial quality in Islamic educational institutions, especially in supporting more strategic and accurate decision-making in various aspects, from academic to financial.

The discussion of the results of this study highlights the importance of Big Data in optimizing managerial decision-making in Islamic educational institutions. In accordance with various interviews conducted, there is strong evidence that Big Data acts as a catalyst for more precise, effective, and data-driven decision-making. The benefits of Big Data in improving the quality of management can be seen in various aspects, ranging from academics, resource allocation, to institutional finance.

Big Data enables a nuanced analysis of student behavior patterns, offering insights that significantly impact educational policies in Islamic institutions. For instance, through the aggregation and analysis of attendance records, learning outcomes, and engagement metrics, institutions can identify trends and anomalies that reveal underlying issues. A specific example is the ability to detect declining academic performance in students who frequently access online learning platforms late at night. This insight might suggest that these students face time management challenges, prompting administrators to implement time-blocked study schedules or counseling programs tailored to their needs.

Another example involves analyzing participation in extracurricular activities alongside academic performance. Big Data tools can highlight correlations, such as students who actively engage in debate clubs or religious study groups performing better in critical thinking assessments. These findings can lead to policies that encourage broader participation in such activities as part of the curriculum.

Furthermore, sentiment analysis of feedback collected from student surveys and social media discussions allows institutions to gauge overall satisfaction and identify areas needing improvement. For example, students expressing frustration about the lack of modern teaching tools might drive policymakers to prioritize investments in smart classroom technology.

These analyses have far-reaching impacts on educational policy. By understanding student behavior patterns through Big Data, Islamic educational institutions can craft policies that are not only reactive to immediate needs but also proactive in fostering a supportive learning environment. They can ensure that interventions are equitable and aligned with the institution's values, ultimately enhancing educational outcomes while maintaining a balance between technological advancements and Islamic principles.

Implementation of AI in improving management effectiveness in Islamic Education institutions

AI technology is a tool that has a positive impact on management efficiency and effectiveness, especially in student data management, teaching, finance, and program planning (George & Wooden, 2023; Hannan & Liu, 2023). In the observed Islamic educational institutions, AI technology is widely used in several operational and academic fields.

In terms of academic data management and student administration, AI is applied through a system that is able to identify patterns of attendance, academic performance, and student participation. This AI-based system allows institutions to automatically track students who are frequently absent or have a decline in academic achievement, so that early intervention can be made to help them. This implementation is proven to support the effectiveness of student management, where managers can directly access reports and data analysis generated by AI for faster and more targeted decision-making.

AI technology is also used in the learning process, such as in e-learning platforms and virtual classrooms. Observations show that the AI system on the platform is able to analyze student learning behavior, such as material access patterns, login frequency, and the most frequently accessed types of content. Based on this data, AI automatically recommends learning materials that suit the needs and learning styles of individual students, thereby creating a more personalized and effective learning experience. Teachers also gain insights from these AI reports to set up more effective teaching strategies, so that each student gets attention that suits their learning abilities and needs.

Meanwhile, in institutional financial management, AI helps in making budget analysis more accurate and efficient. The institution's AI-based financial system is able to automatically process income and expense data, identify spending trends, and provide recommendations to optimize budget use. Observations show that the financial reports generated by AI help management in making decisions related to fund allocation, cost savings, and long-term budget planning. AI systems also make it easier for management to monitor cash flow in real-time, which in turn increases the transparency and accountability of the institution's finances.

In addition, AI also supports the effectiveness of educational program planning and curriculum development (Bear & Bottle, 2020; Su & Zhong, 2022). Based on the analysis of AI-generated data regarding student performance and the effectiveness of programs that have been running, educational institutions can adjust the curriculum and programs based on student needs. For example, if the AI identifies that a student is having difficulties in a particular topic, the institution can design remedial or additional programs for that topic. The use of AI in program planning allows institutions to adapt to student needs in a more responsive manner, ultimately improving the quality of education offered.

The results of this observation show that the implementation of AI in Islamic educational institutions not only supports effectiveness in managerial decision-making but also creates efficiency in operational and academic processes. However, it was also found that the application of AI still faces several challenges, such as the need for staff training in the use of AI technology and the limitations of the existing technological infrastructure in the institution. However, the great potential of AI in improving the effectiveness of the management of Islamic educational institutions looks very promising and can continue to be developed according to the needs and capacity of the institution.

The results of this study show that the implementation of AI in the management of Islamic educational institutions presents significant changes that support smarter, more responsive, and efficient decision-making. AI technology provides access to in-depth data analysis, which was previously difficult to achieve through traditional methods. The positive impact of AI can be seen in various aspects, ranging from student data management, more personalized teaching, financial efficiency, to more adaptive educational program planning. The application of AI not only serves as an administrative tool, but also as a strategic guide that allows agency leaders to make data-driven decisions.

In student management, AI is able to recognize important patterns such as attendance and academic performance, which allows for rapid intervention actions to prevent academic or disciplinary problems. This indicates that student management can be improved with AI that can identify students who need support early, as mentioned in the observation that

This AI-based system allows institutions to track students who are frequently absent or have a decline in academic achievement (I_TopMan-2024)

This ability makes AI an important element in supporting the achievement of student achievement and the quality of learning in institutions.

In the field of teaching, the application of AI to e-learning platforms also allows for personalized learning. AI systems can tailor the material to individual learning styles, creating a more engaging learning experience that suits the specific needs of students. This point is supported by the observation that

AI automatically recommends learning materials that suit students' individual needs and learning styles, creating a more personalized and effective learning experience (I_Gr-2024)

In this way, AI not only improves teaching effectiveness, but also helps teachers design methods that are more appropriate for each student.

The implementation of AI in financial management in Islamic educational institutions also brings new efficiencies, especially in managing the budget optimally. Automated financial analysis enables cost savings through more accurate resource allocation, which is relevant to the statement that

AI helps create more accurate and efficient budget analysis (I_Mankeu-2024)

The use of AI in this aspect of finance creates greater transparency and facilitates long-term financial planning, which in turn improves the financial stability of the institution.

AI has also been proven to support the effectiveness of educational program planning through the analysis of student performance data which can be a reference in developing more adaptive curricula and programs. In this context, AI is an important tool to understand and adjust education based on student needs, as explained by

AI allows institutions to tailor curricula and programs according to student needs (I_WakMan-2024)

This confirms that AI can be an important instrument in the development of responsive and quality curriculum.

However, there are several challenges in AI implementation, such as the need for staff training to operate AI systems optimally and limitations in technology infrastructure that may hinder the full implementation of AI. This challenge underscores the importance

of preparation and investment in technology and human resource development to support the successful implementation of AI.

It can be concluded that AI has great potential in improving management effectiveness in Islamic educational institutions, making operational processes more efficient, decision-making more accurate, and teaching quality better. The potential of AI can continue to be developed in line with the needs and capacities of institutions, resulting in Islamic education management that is increasingly superior and responsive to the dynamics of modern education.

Challenges and opportunities in the process of adopting Big Data and AI for Islamic Education Management

The adoption of Big Data and AI for Islamic education management provides in-depth insight into the readiness and needs of Islamic educational institutions in the face of technological developments (Al Haddar et al., 2023; Ali et al., 2023; Firdaus et al., 2023). In addition, Big Data and AI are also faced with several challenges that can hinder their implementation. A number of major challenges faced by Islamic educational institutions. The first challenge is the limitations of technological infrastructure. Hardware and software limitations still do not fully support large amounts of data processing and AI applications. The absence of adequate infrastructure reduces the effectiveness of the integration of advanced technologies such as Big Data and AI in the institution.

The second challenge is the lack of competence of human resources in operating Big Data and AI technology, staff and teachers have not had enough training to understand and utilize these technologies optimally. For example, a statement from the administrative staff states that

There are still many staff who are not familiar with complex data analysis and tend to need time to adapt to this new system (Admn-2024)

This shows the need to invest in training and skills development programs for educators and administrators.

The third challenge is the aspect of data privacy and security that is a concern, especially in the context of student data and institutional finances. The agency's leaders expressed their concern that

Data security is crucial, especially when it comes to personal information of students and staff (I_TopMan1-2024)

These challenges signal the need for strict security policies as well as adequate encryption technology to protect sensitive data.

Despite the challenges, there are also great opportunities that can be obtained from the application of Big Data and AI in Islamic educational institutions. The main opportunity is to increase the efficiency of managerial decision-making. For example, the head of the institution stated that with this technology, they can

make faster, data-driven decisions, from resource allocation to education program planning (I_TopMan2-2024)

This shows that Big Data and AI can make it easier for management to make strategic decisions that focus on the needs of institutions and students.

The second opportunity is to improve the quality of education through personalized learning. Teachers and faculty believe that AI allows institutions to develop more personalized learning approaches. One of the teachers stated that

Student data can provide clear guidance for designing a curriculum that suits the needs of each individual (Gr-2024)

This approach not only enhances the student's learning experience, but also improves overall academic outcomes.

The third opportunity is increased transparency and accountability in financial management. Especially from the financial management community, it is considered that Big Data allows institutions to manage budgets more efficiently and accurately.

With real-time data analysis, we can identify suboptimal spending posts and allocate funds more efficiently (ManKeu-2024)

Said one of the financial managers. This shows that the use of Big Data helps management in financial supervision, making it easier to make responsible planning.

The adoption of Big Data and AI for Islamic education management shows the readiness and fundamental needs of Islamic educational institutions in utilizing technology. Based on the survey results, several significant challenges were found, including limited technological infrastructure, lack of human resource competence, and

data privacy issues. The main challenge is the limitations of the technological infrastructure, where the existing hardware and software are inadequate to accommodate the processing of large amounts of data as well as the implementation of AI. This lack of infrastructure reduces the effectiveness of the integration of Big Data and AI technology that should be able to support various management processes in the institution.

Another very important challenge is the competence of human resources in operating Big Data and AI technology. Staff and teachers do not have enough training to understand or utilize this technology optimally. One of the respondents from the administrative staff stated that many staff are not yet familiar with complex data analysis and need time to adapt to the new system. These results suggest that Islamic educational institutions need to invest in training and skills development programs specifically for educators and administrators.

In addition, data privacy and security are significant challenges, especially when it comes to student and staff personal information. The leaders of the institution stated that data security is very important, especially when it comes to sensitive information. These challenges signal the need for strong data security policies and adequate encryption technologies to maintain the confidentiality of institutional data.

Despite these challenges, the adoption of Big Data and AI also presents great opportunities for Islamic educational institutions. One of the key opportunities is to improve the efficiency of managerial decision-making. With Big Data and AI, leaders can make faster and more accurate decisions, from resource allocation to educational program planning. Big Data and AI can make it easier for management to make strategic decisions that are more focused on the needs of students and institutions.

Another opportunity identified is improving the quality of education through personalization of learning. Teachers believe that AI allows them to develop a more personalized approach to learning. Based on student data, AI can provide clear guidance in designing a curriculum tailored to each individual's needs, which not only improves the student learning experience but also strengthens overall academic outcomes.

Increased transparency and accountability in financial management is also recognized as a significant technology-driven opportunity. Big Data allows institutions to manage budgets more efficiently and accurately. With real-time data analysis, they can identify suboptimal spending posts and allocate funds more efficiently, thus strengthening responsible budget planning.

CONCLUSION

The conclusion of this study shows that the adoption of Big Data and AI in Islamic educational institutions has significant potential in improving the effectiveness of management and the quality of education. From the results of the research, it was found that this technology can speed up decision-making and improve efficiency in various managerial aspects, including resource allocation, educational program planning, and financial management. The use of Big Data and AI allows institutions to make decisions based on accurate and real-time data, as well as identify areas that require intervention. In addition, this technology also helps in personalizing learning by providing material recommendations that suit the individual needs of students, which can ultimately improve the overall quality of education.

This research reveals several specific challenges that need to be addressed to ensure the effective implementation of Big Data and AI in Islamic educational institutions. One major challenge is the limitation of technological infrastructure, particularly in institutions located in remote areas with restricted access to internet networks and modern hardware. Additionally, the human resource competence gap is a significant obstacle, as many administrative staff and educators lack adequate skills to optimally utilize these technologies. Concerns related to data privacy and security also represent an urgent issue, considering that the data being managed includes sensitive information about students and institutions. To overcome these challenges, recommended actions include strategic investments in building technological infrastructure, such as procuring hardware and enhancing access to stable internet connections. Intensive training programs should be designed to enhance staff capacity, covering technical training in data analysis and AI device management. Moreover, stringent data security policies must be implemented, including encryption use, hierarchical data access management, and regular security audits to prevent data breaches. Collaborating with technology providers or cybersecurity consultants can be a strategic step to ensure data management aligns with

modern security standards. By addressing these challenges in a structured manner, Islamic educational institutions can maximize the benefits of Big Data and AI in supporting educational management and improving learning quality sustainably.

Based on these findings, further research is recommended to focus on the development of infrastructure solutions and training programs that can support the adoption of Big Data and AI in Islamic educational institutions. Further research also needs to examine data security models that can be applied to protect sensitive data without hindering user accessibility and flexibility. In addition, further studies are also suggested to explore more in-depth AI-based learning personalization strategies, in order to maximize the potential of technology in creating adaptive and responsive learning experiences to student needs.

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