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Leveraging Big Data Analytics to Strategically Expand Digital Microcredit Access for MSMEs

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ABSTRACT

Micro, Small, and Medium Enterprises (MSMEs) play a pivotal role in driving economic development and job creation, especially in emerging economies. However, limited access to formal credit remains a persistent challenge due to the reliance on conventional financial assessments that often exclude MSMEs with informal or incomplete financial histories. **This study aims** to investigate how big data analytics can be effectively leveraged to strategically expand digital microcredit access for MSMEs, offering more inclusive and accurate credit evaluation models. **The research** adopts a qualitative descriptive methodology, incorporating a comprehensive literature review and multiple case studies of fintech platforms that utilize alternative data sources such as e commerce transactions, mobile phone activity, utility bill payments, and social media engagement to construct alternative credit scoring systems. **The findings** indicate that big data enables improved risk profiling, faster loan processing, and wider financial inclusion by reaching unbanked and underbanked MSMEs. Additionally, the integration of machine learning algorithms in analyzing real time behavioral data enhances decision making precision and operational efficiency in digital lending. However, the study also raises critical issues regarding data privacy, ethical use, and transparency in automated credit decisions. **In conclusion**, the use of big data analytics offers transformative potential to reshape digital microcredit services, empowering MSMEs through accessible, scalable, and intelligent financial solutions that align with broader goals of sustainable economic inclusion and digital transformation.

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1. INTRODUCTION

MSMEs serve as the backbone of economic growth and social stability, dominating business activities in developing economies while contributing significantly to job creation, innovation, and equitable income distribution. Their role in fostering entrepreneurship and strengthening local economic resilience is widely recognized; however, MSMEs continue to face persistent barriers in accessing formal financial services, particularly credit. Conventional banking systems often emphasize collateral requirements and documented financial histories criteria that many MSMEs, especially those operating informally, are unable to meet [1]. As a result,

a large portion of MSMEs remains excluded from formal financial systems, limiting their capacity to expand, digitalize, and participate in broader economic networks. This ongoing credit constraint not only deepens the gap in financial inclusion but also undermines the potential contribution of MSMEs to national economic transformation. In the era of rapid digitalization and post pandemic recovery, there is an urgent need to redesign credit assessment mechanisms that are adaptive to the dynamic and informal characteristics of MSMEs.

The advancement of Financial Technology (fintech) presents a transformative opportunity to bridge these structural gaps by providing digital financial services that are more inclusive and responsive to the needs of small businesses [2]. Among various technological innovations, big data analytics has emerged as one of the most influential tools in reshaping credit evaluation processes and enhancing financial accessibility. By utilizing alternative data sources such as digital transaction histories, e-commerce activities, mobile phone usage, and social media engagement fintech platforms are able to develop more inclusive, accurate, and context sensitive credit scoring models. These models enable lenders to assess creditworthiness in real time with greater efficiency and fairness, while expanding access to financial services for unbanked and underbanked MSMEs. Furthermore, the integration of big data with artificial intelligence allows for adaptive risk detection, continuous optimization of credit decisions, and operational scalability. Despite these advantages, the increasing adoption of data driven models also raises important ethical and regulatory considerations, particularly concerning data privacy, algorithmic transparency, and fairness in automated decision making. Hence, ensuring a balance between technological innovation and responsible governance has become a crucial challenge in the digital financial ecosystem [3, 4].

In response to these emerging challenges and opportunities, this study aims to analyze how big data analytics can be strategically leveraged to expand digital microcredit access for MSMEs. Employing a qualitative descriptive approach that combines literature analysis and multiple case studies, the research explores how fintech platforms utilize alternative data and algorithmic systems to enhance financial accessibility, mitigate credit risks, and improve operational efficiency [5]. It also examines the ethical and governance dimensions surrounding data driven decision making in digital lending. By framing big data not merely as a technological advancement but as a strategic enabler of equitable financial participation, this study seeks to contribute both theoretically and practically to the development of inclusive and sustainable fintech ecosystems. The findings are expected to offer valuable insights for policymakers, financial institutions, and fintech practitioners, demonstrating how data driven innovation can empower MSMEs, accelerate digital inclusion, and support broader goals of sustainable economic growth and resilience [6, 7]. Ultimately, leveraging big data in digital microcredit represents not only a technological evolution but also a strategic pathway toward building a more intelligent, transparent, and inclusive financial future.

2. RESEARCH METHOD

This study employs a descriptive qualitative approach designed to explore how big data analytics is strategically utilized by fintech platforms to expand digital microcredit access for MSMEs. The research framework includes the type and approach of study, data collection techniques, analysis procedures, research objects, and ethical considerations. Data were obtained through an extensive literature review and multiple fintech case studies to provide both theoretical and practical insights [8]. The collected data were analyzed using content and thematic analysis to identify patterns, relationships, and strategic applications of big data in digital credit evaluation. Each stage was conducted systematically to maintain transparency, validity, and ethical integrity. This methodological design supports the exploratory nature of the research, offering a structured foundation to understand how fintech innovation contributes to financial inclusion and digital transformation for MSMEs [9].

2.1. Type and Research Approach

This study employs a descriptive qualitative approach designed to gain a comprehensive understanding of how big data analytics is strategically utilized by fintech platforms to expand digital microcredit access for MSMEs. The use of this approach enables the researcher to explore technological, behavioral, and strategic dynamics within digital financial ecosystems without relying solely on numerical analysis by [10]. It emphasizes understanding processes, perceptions, and contextual realities that influence the implementation of data driven credit systems in fintech operations. The following points outline the essential aspects of this methodological choice:

- Research Orientation
  This study adopts a descriptive qualitative orientation that focuses on exploring and interpreting real world phenomena related to fintech innovation and big data utilization. It aims to uncover patterns, strategies, and interactions between technology and financial inclusion practices, particularly how alternative data sources support the credit evaluation of MSMEs. This approach allows for a deeper understanding of how fintech platforms apply big data in shaping inclusive credit systems while capturing contextual and behavioral factors that influence their effectiveness.

- Rationale for the Approach
  The qualitative design is appropriate because the observed phenomena are complex, contextual, and continuously evolving. It allows researchers to capture nuanced insights into fintech operations, user behavior, and algorithmic processes that cannot be fully represented through quantitative measures. This approach also facilitates a deeper understanding of social and technological integration in digital lending ecosystems.

- Theoretical Foundations
  The methodological framework of this study is reinforced by several theoretical perspectives that provide conceptual depth and analytical clarity. Financial Inclusion Theory highlights digital microcredit as a mechanism to promote equitable access to financial resources and reduce socio economic inequality. The Technology Acceptance Model (TAM) explains the behavioral aspect of MSMEs in adopting fintech based credit systems through perceived usefulness and ease of use. Meanwhile, Data Driven Decision Making Theory provides a comprehensive lens to understand how big data improves risk assessment, enhances operational efficiency, and strengthens strategic precision in digital credit analysis. The integration of these theories ensures that the study remains both empirically grounded and theoretically coherent.

- Relevance to Research Context
  Given that most fintech phenomena are context dependent and influenced by digital infrastructure, cultural adoption, and regulatory environments, this approach provides the flexibility required to examine these variations comprehensively. It allows researchers to explore how big data technologies operate differently across platforms while identifying effective strategies for improving MSMEs access to finance.

- Contribution to Sustainable Development
  This methodological approach aligns with the broader objectives of the Sustainable Development Goals (SDGs), particularly SDG 8, which promotes decent work and economic growth, and SDG 9, which encourages industry, innovation, and infrastructure. By emphasizing inclusivity, ethics, and sustainability, this approach contributes to the global agenda of advancing equitable digital finance for MSMEs.

2.2. Data Collection Methods

Data for this study were collected using three main techniques: literature review, fintech case studies, and optional interviews. The literature review formed the theoretical foundation of the research by examining a wide range of academic journals, policy documents, and institutional reports from credible organizations such as the World Bank, McKinsey, OJK, and UNDP. This process helped identify conceptual frameworks, global trends, and challenges related to the application of big data analytics in digital financial systems. The findings from this review established a strong analytical basis for understanding how alternative data and digital innovation contribute to financial inclusion and the transformation of microcredit services for MSMEs [11].

Complementing the literature review, case studies and optional interviews provided empirical depth and practical validation. The case studies focused on fintech platforms that apply big data analytics in credit evaluation, including Amartha and KoinWorks from Indonesia, Tala and Branch from Asia and Africa, and LenddoEFL at the global level [12]. Data were gathered from company documents, industry reports, and academic publications to analyze data utilization models and their impact on MSMEs financing. To enrich these findings, semi structured interviews were conducted with fintech managers, data analysts, and MSMEs users, exploring perceptions of fairness, efficiency, and data ethics in digital lending. These three complementary techniques literature review, case studies, and interviews ensured methodological triangulation, enhanced validity, and provided a comprehensive understanding of how big data analytics drives inclusive financial innovation before the analysis is summarized in Table 1.

Table 1. Data Collection Methods

Technique	Primary Data Sources	Purpose of Use
Literature Review	Academic journals, institutional reports, white papers	Build theoretical foundation and identify global trends
Fintech Case Studies	Amartha, KoinWorks, Tala, Branch, LenddoEFL	Analyze real world strategies in big data implementation
Interviews (Optional)	Fintech practitioners, data analysts, MSMEs actors	Explore practical application context and user perspectives

The Table 1 shown summarizes the three primary techniques employed in this research: literature review, fintech case studies, and optional interviews. Each technique is paired with its primary data sources and specific purpose. The literature review draws from academic journals, institutional reports, and white papers to construct a strong theoretical foundation and to identify global trends [13, 14]. Fintech case studies focus on platforms such as Amartha, KoinWorks, Tala, Branch, and LenddoEFL to analyze real world implementations of big data in credit systems. Optional interviews with fintech practitioners, data analysts, and MSMEs actors provide additional insights into the practical application and user experiences. This multi method strategy ensures a comprehensive and well triangulated understanding of how big data analytics is employed in expanding digital microcredit for MSMEs [15]. In addition, Table 1 is not only a descriptive summary but also demonstrates the complementary nature of the three data collection techniques. The literature review provides theoretical grounding, the case studies reveal practical applications, and the interviews (when conducted) add contextual depth from user perspectives. Interpreting the table in this way underscores how triangulation strengthens validity and ensures that the study's conclusions are not dependent on a single source of evidence.

2.3. Data Analysis Techniques

This study employs a combination of content analysis and thematic analysis to ensure comprehensive and systematic interpretation of qualitative data. Content analysis filters and categorizes information from documents, reports, and interviews into meaningful units aligned with research objectives. Thematic analysis identifies recurring patterns and themes, including alternative data types, credit evaluation strategies, AI/ML integration, and data ethics. The process begins with data reduction, organizing information into thematic clusters; followed by data display through narratives, summary tables, and quotations for contextual clarity. Conclusion drawing then synthesizes insights and interconnections across themes to derive theoretical and practical implications. When multiple fintech platforms are examined, cross case triangulation enhances validity and minimizes bias. This integrated analytical framework strengthens the credibility, transparency, and interpretive depth of the research, offering a solid basis for understanding how big data analytics promotes inclusive and sustainable digital microcredit systems [16].

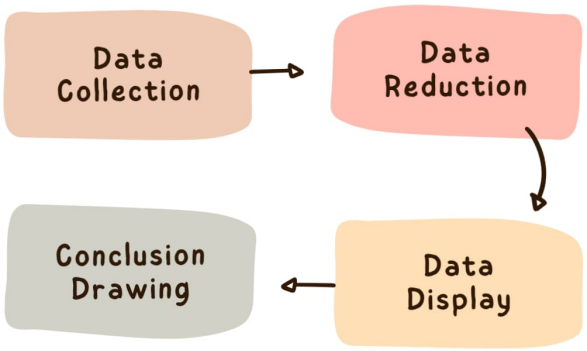

Figure 1. Data Analysis Flow

The Figure 1 shown illustrates the four key stages of the qualitative data analysis process used in this study: Data Collection, Data Reduction, Data Display, and Conclusion Drawing. The process begins with gathering data from various sources, such as literature, case studies, and interviews. This is followed by data reduction, where the information is organized, filtered, and categorized to highlight relevant patterns. Next, the

data is displayed in visual or narrative formats, such as thematic tables or quotes, to facilitate interpretation. Finally, conclusion drawing involves identifying key insights, relationships, and recurring themes that answer the research objectives by [17]. This structured flow ensures clarity, consistency, and analytical rigor throughout the research process. To improve clarity, the methodological steps are summarized in a straightforward sequence:

- Collect data from literature, case studies, and interviews.
- Reduce and categorize data into themes.
- Display findings in narrative or visual form.
- Draw conclusions through pattern identification and cross case triangulation.

This step by step explanation simplifies the process for readers and avoids unnecessary technical jargon, ensuring methodological transparency.

2.4. Research Object

The object of this research is digital lending fintech platforms that actively apply big data analytics in assessing the creditworthiness of MSMEs seeking microcredit [18, 19]. These platforms are at the forefront of financial innovation, providing alternative financing models that extend access to unbanked and underbanked business sectors. Their integration of data analytics enables more accurate and inclusive credit assessments, especially for MSMEs lacking formal documentation or collateral. By studying these platforms, this research seeks to understand how digital transformation through big data analytics contributes to addressing credit access disparities and promoting sustainable economic growth [20]. To ensure that the selected research units are both relevant and representative, the following criteria were applied:

- Operational Criteria
  The fintech platform must operate through a fully digital infrastructure supported by reliable technological systems and be officially recognized or registered with national regulatory authorities. This ensures operational transparency, compliance with financial regulations, and accountability in the implementation of digital lending practices using big data analytics.
- Market Focus Criteria
  The platform must primarily target MSMEs as its main beneficiaries, particularly those involved in microcredit or small scale enterprise financing. This focus demonstrates a direct commitment to advancing financial inclusion by addressing the credit accessibility gaps faced by underserved and unbanked business segments.
- Analytical Criteria
  The selected platform must present verifiable evidence of big data analytics integration in its operations, particularly within its credit evaluation and risk assessment systems. This includes the use of alternative data sources, algorithmic scoring models, and digital performance indicators that enhance transparency and precision in assessing MSMEs creditworthiness.

Overall, these criteria collectively ensure that the selected fintech platforms accurately represent the intersection of digital innovation and financial inclusion within the MSMEs sector. By applying operational, market focus, and analytical standards, the research guarantees that each chosen case embodies both technological maturity and socio economic relevance. This comprehensive selection framework enhances the study's validity by aligning its analytical scope with platforms that demonstrate measurable impact, transparency, and scalability in advancing inclusive digital lending ecosystems.

2.5. Validity Criteria and Research Ethics

Ensuring the validity of the research findings is a key consideration in this study and is achieved through the systematic implementation of data triangulation. This process enhances the credibility, consistency, and robustness of the analysis by integrating multiple data sources and perspectives [21]. Data were obtained from academic literature, industry reports, policy documents, and media interviews, providing a broad representation of both macro and micro insights into big data utilization in fintech platforms. The triangulation of

methods including literature review, case studies, and interviews strengthens analytical rigor and allows for the cross verification of findings across various layers of analysis. By synthesizing diverse and reliable sources, the study builds a more comprehensive understanding of how big data analytics influences MSMEs credit access, reduces research bias, and enhances contextual depth in examining digital financial ecosystems [22].

From an ethical standpoint, this research adheres strictly to the principles of transparency, confidentiality, and responsible data management throughout every stage of the study. All data used were obtained from credible and verifiable references to maintain the highest level of academic integrity. In instances involving interviews, informed consent was obtained, and participants' identities and personal information were handled with utmost confidentiality [23]. The analysis was restricted to publicly available datasets or materials accessed through authorized permission to ensure compliance with global data privacy standards. These safeguards not only protect the rights of participants but also strengthen stakeholder trust and uphold the credibility of the research process. Despite its methodological strengths, this study recognizes its limitation in relying solely on qualitative methods without quantitative validation [24]. Therefore, future studies are encouraged to incorporate mixed method or econometric approaches to enrich analytical depth, improve generalizability, and advance scholarly contributions to the field of data driven financial inclusion.

3. FINDINGS

The findings of this study offer a comprehensive examination of how big data analytics is strategically employed by fintech platforms to expand digital microcredit access for MSMEs [25]. This section presents empirical insights drawn from case studies and literature analysis, focusing on the practical implementation of alternative data, the effectiveness of data driven credit models, and their impact on financial inclusion. Each subsection provides a detailed exploration of the mechanisms through which fintech firms leverage behavioral data, machine learning algorithms, and digital infrastructure to overcome traditional limitations in credit evaluation [26]. Moreover, the findings highlight how these innovations contribute to inclusive economic growth and align with the SDGs, particularly in advancing access to finance among unbanked and underserved communities.

3.1. Utilization of Big Data in Digital Credit Assessment

The utilization of big data in digital credit assessment enables fintech platforms to transform conventional, collateral based, and document heavy credit systems into more adaptive, data driven approaches. Through behavioral and alternative data, fintechs can evaluate creditworthiness beyond traditional financial records. For example, Amartha employs socio economic and community based data collected from group lending schemes, while KoinWorks analyzes user transaction histories and digital behavior to generate individualized credit scores. Similarly, Tala operating in Asia and Africa constructs credit profiles using smartphone derived data such as SMS logs, call records, and app usage patterns. These diverse data sources reflect how fintech platforms integrate technology to capture the financial potential of unbanked and underbanked MSMEs, which are often excluded from formal credit systems.

The types of alternative data utilized include transactional records, social media activity, geolocation data, device metadata, and informal repayment histories. These inputs are processed automatically through machine learning algorithms to build accurate and adaptive risk profiles. This integration not only accelerates the credit approval process but also strengthens financial inclusion by expanding access to microcredit for MSMEs previously marginalized by traditional banking. Moreover, real time analytics powered by artificial intelligence enhances risk detection, ensures better borrower evaluation, and supports sustainable lending practices. Such initiatives align with SDG 9, which promotes industry, innovation, and infrastructure particularly through the modernization of microfinance systems and the ethical adoption of technological innovation to drive equitable economic growth [27].

3.2. Fintech Strategies to Reach Unbanked MSMEs

Fintechs employ a range of innovative strategies to reach unbanked MSMEs. One key approach is the use of alternative data, such as community based indicators (Amartha), digital transaction footprints (KoinWorks), and mobile behavioral data (Tala). These strategies reduce the dependency on formal documentation, which is often lacking among micro entrepreneurs [28, 29]. Another strategy involves user centric on boarding through mobile apps that feature simplified interfaces and embedded financial literacy content. Many platforms

also partner with e commerce marketplaces and digital wallets to seamlessly integrate financial services into the MSMEs digital ecosystem.

Fintechs further customize their credit models to suit micro entrepreneurial needs, including flexible loan tenures, weekly repayment schedules, and groupbased financing. These tailored approaches foster higher adoption of digital finance services among the unbanked segment while empowering MSMEs to participate in the digital economy. However, low literacy MSMEs particularly in rural areas face significant adoption barriers, including limited digital skills, lack of access to structured training, and difficulties navigating mobile lending applications. For example, many rural micro entrepreneurs struggle to interpret loan terms displayed through fintech apps, leading to low trust and hesitancy in using digital services [30]. In response, fintechs like Amartha integrate peer group mentoring and offline community engagement to build digital awareness, while KoinWorks embeds simplified app interfaces with visual prompts to reduce literacy dependence. These literacy focused interventions not only improve usability but also ensure that inclusive digital finance does not unintentionally marginalize vulnerable groups. By addressing digital literacy as a structural barrier, this study underscores the necessity of coupling technological innovation with capacity building initiatives to achieve genuine financial inclusion. This directly contributes to SDG 8, which aims to promote sustained, inclusive economic growth and productive employment.

3.3. Effectiveness Analysis of Big Data Based Credit Models

The effectiveness of big data–based credit models is evident through improved approval speed, repayment reliability, and scoring accuracy, particularly for underserved MSMEs. Platforms such as Tala and Amartha utilize digital and mobile based analytics to assess creditworthiness, achieving approval rates of up to 97%. Tala's use of smartphone behavioral data accelerates decision making, while Amartha's community based trust system sustains repayment reliability in rural areas. Similarly, platforms like KoinWorks use AI powered engines that analyze user behavior, transaction history, and e-commerce activity to evaluate credit scores with 80–90% accuracy by [31, 32]. These innovations enhance financial inclusion, allowing credit access for those excluded from formal channels and improving decision making accuracy.

The findings reveal that big data integration not only boosts operational efficiency but also aligns with SDGs by promoting social equity and innovation. Each platform demonstrates different strengths: Tala emphasizes rapid decision making and financial inclusion, Amartha leverages social trust and sustainability, and KoinWorks prioritizes accuracy and risk control. This comparison underscores how data driven scoring reflects varying strategic emphases, from speed and repayment reliability to fairness and transparency. Ultimately, big data analytics represent not merely technological advancement but a broader transformation toward equitable and inclusive financial ecosystems.

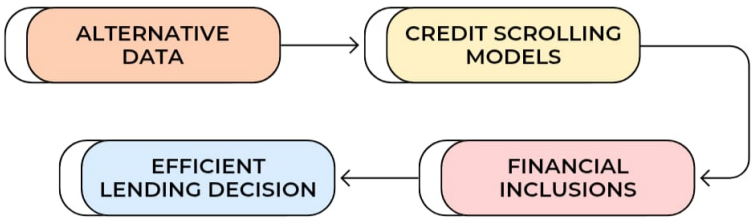

Figure 2. Utilizion of Big Data in Digital Credit Assessment

The Figure 2 shown illustrates the utilization of big data in the digital credit assessment process, highlighting the sequential flow from alternative data sources to broader financial inclusion. It begins with the use of alternative data, such as mobile usage patterns, transaction histories, and social media behavior, which serves as a foundation for developing a credit scoring model tailored to digitally underserved populations. These models enhance the accuracy and inclusivity of risk evaluation, leading to more efficient lending decisions by fintech platforms. As a result, this streamlined approach supports greater financial inclusion, enabling MSMEs especially the unbanked or underbanked to access credit through non traditional means. This process not only improves credit accessibility but also contributes to the realization of SDGs, particularly those related to economic growth and innovation [33].

Nevertheless, the models' performance depends on data quality, regulatory oversight, and users' digital literacy. Therefore, fintechs must blend data driven methods with sociocultural understanding to ensure

that credit assessments are both accurate and inclusive. This balance ensures that technological advancement translates into equitable access to finance.

3.4. Risks, Challenges, and Ethics in Big Data Usage

The integration of big data in digital lending offers opportunities for expanding financial inclusion among underserved MSMEs but introduces ethical challenges such as privacy violations, unauthorized profiling, surveillance, and exploitation. Algorithmic bias also arises when credit scoring models rely on incomplete or skewed datasets, leading to unfair exclusion in access to credit. This highlights the need for fairness aware algorithms and explainable AI to ensure accountability and transparency in decision making [34]. Increasing reliance on automated systems may eliminate essential human judgment, particularly where creditworthiness is assessed through computational models, necessitating multidisciplinary oversight combining data science, ethics, and regulation to create trustworthy systems.

Beyond algorithmic issues, digital infrastructure gaps pose further challenges in financial inclusion, as limited internet access and low digital literacy hinder participation in digital lending. Users often face misinterpretation or unjust rejection due to algorithmic errors or incomplete data. Addressing these concerns requires an emphasis on fairness, accountability, transparency, and inclusivity in AI systems, supported by clear audit processes and ethical regulations. A balanced and inclusive digital lending ecosystem can only be achieved through responsible innovation and governance frameworks that prioritize equity, data protection, and user rights [35].

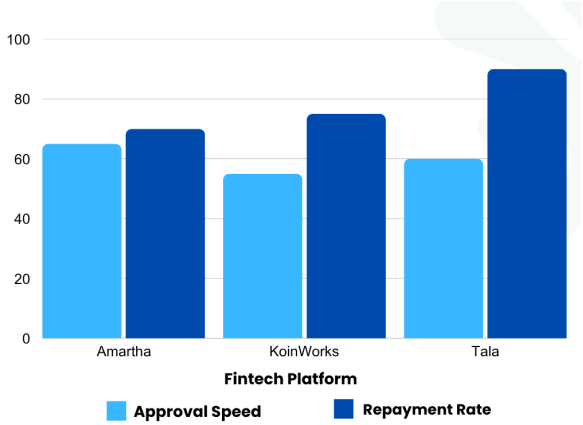

Figure 3. Effectiveness of Big Data Based Credit Models

The Figure 3 shown compares the effectiveness of big data based credit models across three fintech platforms Amartha, KoinWorks, and Tala by analyzing two key metrics: approval speed and repayment rate. The approval speed, represented by the purple bars, indicates how quickly credit applications are processed, while the pink bars reflect the repayment rate, highlighting the reliability of borrowers identified through big data models. The chart reveals that Tala leads in both dimensions, showing the highest repayment rate and a relatively fast approval process, which suggests a robust and accurate credit scoring system based on mobile data by [36]. KoinWorks demonstrates a strong repayment rate but slightly lower approval speed, indicating a more cautious but effective approach. Amartha, while slightly behind in both aspects, still maintains a respectable balance, particularly in rural contexts where data infrastructure may be more limited. Overall, the figure underscores the positive correlation between big data utilization and improved credit performance, reinforcing the value of alternative data analytics in enhancing financial access and sustainability.

3.5. Relevance to SDGs and Financial Inclusion

The findings of this study reveal a strong alignment between the integration of big data analytics in digital credit systems and the objectives of the SDGs, particularly SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure). Big data plays a transformative role in promoting inclusive economic participation by expanding access to financing for MSMEs that were previously excluded from traditional banking systems. Through advanced data driven technologies, fintech platforms are able to assess creditworthiness based on behavioral, transactional, and social indicators rather than relying solely on collateral

or formal documentation. This innovation enables a more adaptive and fair lending environment, empowering underserved entrepreneurs to obtain capital, develop their businesses, and improve their livelihoods [34**?**]. By aligning financial innovation with sustainability principles, big data driven credit systems contribute not only to economic empowerment but also to the reduction of inequality and the advancement of digital inclusion across emerging markets.

Furthermore, the study highlights the importance of collaboration between fintech companies, regulators, and development institutions to build a responsible and sustainable digital financial ecosystem. The comparative analysis demonstrates that traditional credit scoring methods remain constrained by limited data availability and structural biases, which often exclude MSMEs from access to finance. In contrast, data driven systems such as those utilized by Amartha, KoinWorks, and Tala employ real time behavioral analytics, AI based scoring models, and community trust indicators to generate more accurate, inclusive, and context sensitive evaluations. This approach represents a significant step forward in addressing MSMEs financing challenges by combining technological innovation with social responsibility. The findings also underscore that the integration of big data analytics reshapes the microcredit landscape by improving transparency, operational efficiency, and decision making accuracy. Overall, the study offers both theoretical and practical implications, positioning big data as a catalyst for advancing sustainable development and promoting equitable financial growth in the global digital economy.

4. MANAGERIAL IMPLICATION

This study presents actionable insights for fintech managers, credit risk strategists, and digital finance decision makers seeking to scale inclusive financial services through big data innovation. The integration of alternative data such as mobile activity, transaction history, and social media behavior into credit assessment models enables faster, more equitable loan approvals, especially for micro entrepreneurs lacking formal financial documentation. Fintech platforms like Tala, KoinWorks, and Amartha demonstrate that leveraging real time behavioral analytics can significantly improve both approval speed and repayment reliability. Therefore, managers must prioritize the development of advanced data pipelines and machine learning frameworks capable of processing such dynamic datasets while maintaining explainability and fairness. Moreover, embedding adaptive scoring systems into mobile first lending platforms can reduce operational bottlenecks and better serve unbanked or underbanked MSMEs.

However, the strategic deployment of big data must be balanced with strong ethical and regulatory compliance mechanisms. Managers should implement transparent data governance policies that ensure user consent, mitigate algorithmic bias, and comply with evolving data privacy standards. Ethical risk management must not be an afterthought but a core component of fintech product design. Additionally, collaboration with regulators, civil society, and development institutions is essential to co create a responsible digital finance ecosystem that builds user trust while scaling access to capital. These findings underscore the need for fintech leaders to adopt a human centered data strategy that not only drives innovation and profitability but also supports broader goals of financial inclusion, economic resilience, and sustainable development, particularly those reflected in SDG 8 and SDG 9.

5. CONCLUSION

The findings of this study reaffirm the transformative potential of big data analytics in overcoming long standing barriers to financial access among MSMEs, particularly in developing economies. By integrating behavioral, transactional, and alternative data into credit evaluation frameworks, fintech platforms can generate more accurate, inclusive, and adaptive lending systems. Evidence from the cases of Amartha, KoinWorks, and Tala demonstrates that big data analytics enhances credit scoring reliability, expedites loan processing, and minimizes dependency on collateral based lending models. These advancements not only improve operational efficiency but also expand financial inclusion by enabling underserved MSMEs to access digital microcredit services and participate more effectively in the formal financial ecosystem.

The novelty of this research lies in its contextual exploration of how big data analytics operates as both a technological enabler and a strategic instrument for sustainable financial inclusion. Unlike prior studies that mainly focused on digital transformation from a technological or policy perspective, this study integrates a multidimensional analysis combining operational, ethical, and socio economic aspects. It introduces a holistic understanding of the interplay between big data, fintech innovation, and MSMEs empowerment within the

digital lending ecosystem. Moreover, the findings contribute new theoretical insights into the alignment of fintech innovation with global sustainability agendas, particularly through its contribution to SDG 8 on Decent Work and Economic Growth and SDG 9 on Industry, Innovation, and Infrastructure. This integrated framework strengthens both academic discussion and practical implementation of data driven inclusion strategies.

Looking ahead, future research should further examine the quantitative implications of big data integration in digital microcredit systems. Employing mixed method approaches such as structural equation modeling, regression analysis, or large scale cross country surveys could validate the causal relationships between data driven models, credit access, and MSMEs performance. Researchers are also encouraged to investigate emerging areas such as algorithmic fairness, data ethics, and the socio cultural acceptance of fintech adoption in diverse markets. Expanding this research toward comparative and longitudinal studies would enhance understanding of how big data can sustainably reshape credit ecosystems worldwide. By addressing these gaps, future work can build upon the present study's foundation, advancing the role of big data as both a catalyst for innovation and a pathway toward equitable and sustainable financial development.

6. DECLARATIONS

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6.2. Author Contributions

Conceptualization: MR; Methodology: AR; Software: AA; Validation: MR and AR; Formal Analysis: AA and MR; Investigation: AR; Resources: AA; Data Curation: MR; Writing Original Draft Preparation: AR and AA; Writing Review and Editing: MR and AR; Visualization: AA; All authors, AR, MR and AA, have read and agreed to the published version of the manuscript.

6.3. Data Availability Statement

The datasets and materials supporting the conclusions of this study are available from the corresponding author upon reasonable request. All information used in the analysis is derived from credible and accessible secondary sources.

6.4. Funding

The authors confirm that no external financial assistance or sponsorship was received for conducting, writing, or publishing this research. The work was completed independently without institutional or commercial funding.

6.5. Declaration of Conflicting Interest

The authors declare that there are no known financial, professional, or personal relationships that could be viewed as influencing the content or outcomes of this research. All authors have contributed and approved the final version of the paper transparently.

REFERENCES

[1] B. M. Omowole, O. Urefe, C. Mokogwu, and S. E. Ewim, "Integrating fintech and innovation in microfinance: Transforming credit accessibility for small businesses," *International Journal of Frontline Research and Reviews*, vol. 3, no. 1, pp. 090–100, 2024.

[2] T. Chibueze, "Leveraging strategic partnerships to expand msme financial inclusion and strengthen access to affordable, sustainable cooperative banking services," *International Journal Of Engineering Technology Research & Management (IJETRM). 2025Aug31*, vol. 7, no. 12, pp. 580–99, 2025.

[3] N. Anwar, J. Anderson, T. Williams *et al.*, "Applying data science to analyze and improve student learning outcomes in educational environments," *International Transactions on Education Technology (ITEE)*, vol. 3, no. 1, pp. 72–83, 2024.

[4] E. Ogbuefi, A. C. Mgbame, O.-e. E. Akpe, A. A. Abayomi, and O. O. Adeyelu, "Data democratization: Making advanced analytics accessible for micro and small enterprises," *International Journal of Management and Organizational Research*, vol. 1, no. 1, pp. 199–212, 2022.

[5] O. A. Bello, "The role of data analytics in enhancing financial inclusion in emerging economies," *International Journal of Developing and Emerging Economies*, vol. 11, no. 3, pp. 90–112, 2024.

[6] S. Purnama, C. S. Bangun, and E. P. Mahadewi, "Predicting consumer purchase intention in personal shopper services using big data analytics and sem," *International Journal of Cyber and IT Service Management (IJCITSM)*, vol. 5, no. 1, pp. 105–119, 2025.

[7] C. Musyoka *et al.*, "Big data analytics for smes' performance sustainability in post-covid-19 kenya," *AFRICAN JOURNAL OF SCIENCE, TECHNOLOGY AND ENGINEERING (AJSTE)*, vol. 4, no. 2, pp. 81–91, 2024.

[8] F. Fajri, K. A. Perdana, D. U. Manurung, P. K. N. Dharmawan, and N. G. Dewi, "The role of early adoption of artificial intelligence in supporting the growth of micro and ultra-micro enterprises in indonesia: Challenges and opportunities," *Jurnal Akuntansi dan Bisnis*, vol. 10, no. 02, pp. 133–143, 2024.

[9] D. Wuisan, J. W. Manurung, C. Wantah, and M. E. Yuliana, "Entrepreneurial self-employment and work engagement in msmes through autonomy and rewards," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 7, no. 1, pp. 264–281, 2025.

[10] C. Ruehmer, "Empowering msme financing in rwanda: A pragmatic framework for domestic credit market development," *Volume 2, July 2025*, p. 28, 2025.

[11] N. Kumari, "Empowering progress: The pivotal role of msmes in sustainable global development," *Int. J. of Multidisciplinary and Current research*, vol. 13, 2025.

[12] M. Azuddin, M. Yusup, H. Setiyowati, S. Wibowo, J. Suwita, S. Basuki, and E. D. Astuti, "Design and implementation of a relational database for an academic information system," *International Transactions on Artificial Intelligence*, vol. 3, no. 2, pp. 171–180, 2025.

[13] T. K. Latif, "Leveraging digital transformation to overcome competitive challenges for new entrant: A strategic approach for msme digital bank (study case: Harapan bank)." *Journal Research of Social Science, Economics & Management*, vol. 4, no. 8, 2025.

[14] A. Jabang, "An analysis of microfinance credit's impact on msmes' performance in the gambia," 2024.

[15] U. Rahardja and Q. Aini, "Analyzing player performance metrics for rank prediction in valorant using random forest: A data-driven approach to skill profiling in the metaverse," *International Journal Research on Metaverse*, vol. 2, no. 2, pp. 102–120, 2025.

[16] S. Darajatun *et al.*, "Waqf and microfinance integration strategy in improving welfare through community economic empowerment," *Jurnal Ilmu Ekonomi dan Bisnis Islam*, vol. 7, no. 1, pp. 75–90, 2025.

[17] T. Shamim and N. Ahmad, "Mapping the intellectual landscape of digital financial inclusion, msmes and entrepreneurship in india," *SEDME (Small Enterprises Development, Management & Extension Journal)*, vol. 52, no. 3, pp. 314–330, 2025.

[18] R. A. Sunarjo, T. Pujiati, D. Apriliasari, and M. Hardini, "Digital onboarding in agricultural platforms and its impact on agricultural productivity," *IAIC Transactions on Sustainable Digital Innovation (ITSDI)*, vol. 6, no. 2, pp. 205–214, 2025.

[19] U. ESCAP, "Msme access to finance: the role of digital payments," 2022.

[20] A. Erica, L. Gantari, O. Qurotulain, A. Nuche, and O. Sy, "Optimizing decision-making: Data analytics applications in management information systems," *APTISI Transactions on Management*, vol. 8, no. 2, pp. 115–122, 2024.

[21] M. A. Rizkita, A. Winarno, and H. Suwono, "Harnessing sustainability and innovation in micro, small, and medium enterprises: Strategies and challenges for competitive advantage." *International Journal of Sustainable Development & Planning*, vol. 20, no. 6, 2025.

[22] A. Sutarman, R. Aprianto, R. Adyatama, K. C. Pokkali, and M. Yusup, "Influence of digital technology & data analytics on strategic decision making," *Startupreneur Business Digital (SABDA Journal)*, vol. 4, no. 1, pp. 12–23, 2025.

[23] O. Elebe and C. C. Imediegwu, "A credit scoring system using transaction-level behavioral data for msmes," *Journal of Frontiers in Multidisciplinary Research*, vol. 2, no. 1, pp. 312–322, 2021.

[24] S. Kurnia Rahayu, I. Budiarti, D. Waluya Firdaus, and V. Onegina, "Digitalization and informal msme: Digital financial inclusion for msme development in the formal economy," *Journal of Eastern European and Central Asian Research*, vol. 10, no. 1, 2023.

[25] P. E. Odio, E. Kokogho, T. A. Olorunfemi, M. O. Nwaozomudoh, I. E. Adeniji, and A. Sobowale, "Innovative financial solutions: A conceptual framework for expanding sme portfolios in nigeria's banking sector," *International Journal of Multidisciplinary Research and Growth Evaluation*, vol. 2, no. 1, pp. 495–507, 2021.

[26] Q. Aini, P. Purwanti, R. N. Muti, E. Fletcher *et al.*, "Developing sustainable technology through ethical ai governance models in business environments," *ADI Journal on Recent Innovation*, vol. 6, no. 2, pp. 145–156, 2025.

[27] H. Harunurrasyid, G. Gustriani, M. Mardalena, and R. Nida, "The impact of digital transformation on financial inclusion: Evidence from msmes in indonesia," *Jurnal Perspektif Pembiayaan dan Pembangunan Daerah*, vol. 12, no. 4, pp. 343–356, 2024.

[28] A. Rokhim, "Business management strategies to enhance msme competitiveness," *Indonesian Economic Review*, vol. 4, no. 2, pp. 40–58, 2024.

[29] M. A. Setiawan, H. Hartoyo, K. B. Seminar, B. Sartono, R. Fitriati, and V. Ginting, "Improving e-service quality of indonesian toll road application with entrepreneurship insights," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 7, no. 2, pp. 503–515, 2025.

[30] C. Baburao, I. B. Raju, S. Gupta, and P. Manjushree, "A bibliometric review study on a decade of msmes: Major challenges, problems, and prosperity," *Pacific Business Review International*, vol. 17, no. 6, 2024.

[31] L. Charfeddine, M. I. Umlai, and M. El-Masri, "Impact of financial literacy, perceived access to finance, ict use, and digitization on credit constraints: evidence from qatari msme importers," *Financial Innovation*, vol. 10, no. 1, p. 15, 2024.

[32] A. Erica, S. Wulandari, and R. Widayanti, "Data security transformation: The significant role of blockchain technology," *Blockchain Frontier Technology*, vol. 3, no. 2, pp. 107–112, 2024.

[33] D. W. Arner, S. Animashaun, K. Charamba, and Y. Cai, "Msme access to finance: The role of digital payments," *United Nations, Economic and Social Commission for Asia and the Pacific, MSME Financing Series*, no. 7, 2022.

[34] M. M. Sulaeman, A. S. Parwati, M. S. A. Saputra, R. Pinatih, and K. Abidin, "Strategies for improving the msme economy through the implementation of technology-based business management," *Technology and Society Perspectives (TACIT)*, vol. 2, no. 2, pp. 218–224, 2024.

[35] N. P. L. Santoso, R. Nurmala, and U. Rahardja, "Corporate leadership in the digital business era and its impact on economic development across global markets," *IAIC Transactions on Sustainable Digital Innovation (ITSDI)*, vol. 6, no. 2, pp. 188–195, 2025.

[36] Y. Syarkani *et al.*, "Digital business model innovation for msmes in indonesia's creative economy era: A strategic management approach," *Lex localis-Journal of Local Self-Government*, vol. 23, no. 10, pp. 1305–1324, 2025.