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Mediating Role of CSR in the Relationship between Technology Adoption and MSMEs' Financial Performance

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Abstract
Micro, small, and medium-sized enterprises (MSMEs) play a vital role in driving economic growth and resilience within the digital economy; however, sustaining strong financial performance remains a persistent challenge. This study explores the direct and indirect effects of artificial intelligence (AI) and Internet of Things (IoT) adoption on MSME financial performance, with corporate social responsibility (CSR) positioned as a mediating mechanism. Data were collected from 200 MSMEs operating in Bali and analyzed using partial least squares structural equation modeling. Findings indicate that AI and IoT adoption significantly enhance financial performance. Furthermore, CSR reinforces this relationship by improving operational efficiency, strengthening stakeholder trust, and supporting long-term sustainability initiatives. From an empirical perspective, the study provides new evidence on the combined role of advanced technologies and CSR in improving MSME outcomes. Theoretically, the research extends existing models by emphasizing CSR as a key link between technological innovation and business performance. Practically, the study offers relevant insights for MSME practitioners and policymakers seeking inclusive and resilient economic development.

Keywords: Technology Adoption, Corporate Social Responsibility (CSR), MSME Growth, Business Performance

Peran Mediasi CSR dalam Hubungan antara Adopsi Teknologi dan Kinerja Keuangan UMKM

Abstrak
Usaha mikro, kecil, dan menengah (UMKM) memegang peranan penting sebagai penggerak pertumbuhan dan ketahanan ekonomi di era digital. Meskipun demikian, menjaga kinerja keuangan yang berkelanjutan masih menjadi tantangan utama. Penelitian ini mengkaji pengaruh langsung dan tidak langsung adopsi Artificial Intelligence (AI) dan Internet of Things (IoT) terhadap kinerja keuangan UMKM, dengan Corporate Social Responsibility (CSR) sebagai variabel mediasi. Data dikumpulkan dari 200 UMKM yang beroperasi di Bali dan dianalisis menggunakan Partial Least Squares Structural Equation Modeling (PLS-SEM). Hasil penelitian menunjukkan bahwa penerapan AI dan IoT berkontribusi positif terhadap peningkatan kinerja keuangan. Selain itu, CSR memperkuat hubungan tersebut melalui peningkatan efisiensi operasional, penguatan kepercayaan pemangku kepentingan, serta dukungan terhadap praktik keberlanjutan jangka panjang. Secara empiris, studi ini memberikan bukti baru mengenai peran sinergis teknologi digital dan CSR dalam mendorong kinerja UMKM. Secara teoretis, penelitian ini memperluas model yang ada dengan menegaskan peran CSR sebagai penghubung antara inovasi teknologi dan kinerja bisnis. Secara praktis, temuan ini memberikan implikasi strategis bagi pelaku UMKM dan pembuat kebijakan dalam mendorong pembangunan ekonomi yang inklusif dan berdaya tahan.

Kata Kunci: Adopsi Teknologi, Corporate Social Responsibility (CSR), Pertumbuhan UMKM, Kinerja Bisnis

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INTRODUCTION

The rapid diffusion of digital technologies has reshaped economic activity across developed and emerging economies. Technologies such as artificial intelligence (AI) and the Internet of Things (IoT) increasingly determine how firms manage operations, analyze data, and make strategic decisions (Rana & Daultani, 2023). For micro, small, and medium-sized enterprises (MSMEs), these technologies offer opportunities to enhance efficiency, reduce operational and supply-chain costs, and improve decision-making quality, particularly in financial portfolio management (Karim et al., 2022; Shrier, 2022). Within the Indonesian context, MSMEs form the backbone of the economy; however, limited resources, technological capabilities, and strategic readiness frequently constrain many from fully exploiting emerging digital innovations.

Despite their potential, access to digital tools alone does not guarantee performance improvement. AI- and IoT-driven transformation often requires complementary organizational mechanisms to translate technological capabilities into sustainable outcomes. Prior studies suggest that AI enables predictive analytics, risk identification, asset allocation, and market forecasting (Mohammed, 2024); whereas IoT supports real-time monitoring, data integration, and financial performance tracking (Hezam et al., 2024). Past research indicates that AI-based personalization boosts customer satisfaction (Sotamaa et al., 2024) and that readiness for AI adoption significantly influences implementation effectiveness in MSMEs (Ishengoma & John, 2024). Nevertheless, MSMEs frequently lack the governance structures, ethical frameworks, and stakeholder engagement mechanisms needed to ensure that technology adoption delivers long-term value rather than short-term efficiency gains.

Within this context, corporate social responsibility (CSR) emerges as a critical organizational process linking technological innovation to financial outcomes. Rather than functioning merely as a boundary condition, CSR operates as an internal transformation mechanism through which AI and IoT adoption influences firm performance. Adoption of these technologies can reshape CSR practices by enabling transparency, traceability, ethical data use, and environmentally responsible operations, thereby strengthening stakeholder trust and legitimacy (Cho et al., 2019; Kolbjørnsrud, 2023). Digital technologies also facilitate CSR-related training, monitoring, and reporting systems, allowing MSMEs to embed responsible practices more deeply into their business models (Afrin & Rahman, 2023; Bashir, 2022).

CSR serves as a mediating variable, rather than a moderator, because AI and IoT adoption does not simply alter the strength of an existing CSR–performance relationship. Instead, technological adoption actively transforms organizational processes, stakeholder engagement, and ethical practices, which subsequently affect financial performance. Through CSR, the operational efficiencies generated by AI and IoT convert into reputational capital, customer loyalty, stakeholder confidence, and alignment with sustainable development goals, all of which contribute to improved financial outcomes (Vieira Junior et al., 2024; ElAlfy et al., 2020). This mediation logic is particularly relevant for MSMEs that lack formal governance structures and rely heavily on relational trust and social legitimacy to sustain business growth.

Rapid global Internet penetration, which surpasses 80% in some industrialized nations, has broadened the digital divide—alienating almost two billion individuals, primarily residing in rural and impoverished areas, from the Internet (Ramos-Ramos et al., 2024). Although digital transformation is often discussed alongside financial literacy and financial inclusion, these aspects function primarily as enabling conditions rather than the core analytical focus of this study. Financial literacy refers to individuals' understanding of budgeting, investment, and financial products (Oxford University, 2015; Khan et al., 2022), whereas financial inclusion concerns access to formal financial services (Tay et al., 2022; Asongu & le Roux, 2024). In Indonesia, a persistent gap remains between financial inclusion (85.10%) and financial literacy (49.68%), despite notable improvements since 2019 (OJK, 2022). Although higher financial literacy correlates with stronger financial inclusion outcomes and improved financial behavior (Song et al., 2024; Kumar, 2023; Ray et al., 2022), this study treats these factors as contextual background rather than central explanatory variables.

The relevance of CSR becomes even more pronounced given the ethical risks, social consequences, and unintended effects associated with AI and IoT adoption (Balahurovska, 2023; Sarker, 2023). CSR provides MSMEs with a social license for digital transformation by addressing stakeholder concerns related to data use, automation, and social impact (Kowalkowski et al., 2024; Al-Ammary & Ghanem, 2024). By integrating socially responsible investment principles and sustainability considerations, MSMEs can balance profitability with social and environmental value creation (Shkalenko & Nazarenko, 2024; Feng, 2024).

Despite increasing scholarly attention to AI, IoT, and CSR as separate constructs, integrative empirical evidence linking these three elements within the context of MSME financial performance remains limited (Siderska et al., 2023; Jo & Baek, 2023; Delipetrev et al., 2020). This study addresses this gap by examining CSR as a strategic mediating mechanism through which AI and IoT adoption influences financial performance among Indonesian MSMEs, thereby contributing to a more nuanced understanding of sustainable digital transformation in emerging economies.

Literature Review

Technology Acceptance Model (TAM) and AI and IoT Adoption

The Technology Acceptance Model (TAM) posits that perceived usefulness (PU) and perceived ease of use (PEOU) constitute the primary determinants of technology adoption behavior (Noor et al., 2024). Numerous empirical studies have demonstrated that these two dimensions significantly influence users' intentions and actual adoption of technological innovations across a wide range of contexts, including financial technologies (Nguyen et al., 2024; Yang et al., 2021). In the context of MSMEs, TAM provides an important theoretical foundation for understanding why organizations adopt emerging technologies such as artificial intelligence (AI) and the Internet of Things (IoT), as well as how these technologies contribute to enhancing organizational competitiveness and business performance (Noor et al., 2024).

The adoption of AI has been associated with substantial improvements in organizational productivity, service quality, and data-driven decision-making capabilities. Through advanced analytics and automation, AI enables MSMEs to optimize operational processes, reduce inefficiencies, and make more accurate strategic decisions, thereby strengthening financial performance (Badghish and Soomro 2024; Schwaeke et al. 2024). In addition, AI-driven operational efficiencies can lower operating costs and allow organizations to redirect human resources toward higher-value activities that support broader social and sustainability objectives, including corporate social responsibility (CSR) initiatives (Zhai & Liu, 2023). Similarly, IoT adoption provides organizations with the ability to collect, integrate, and analyze real-time data from various operational activities. These capabilities facilitate more efficient monitoring of assets, inventories, and supply chains while reducing operational costs and improving resource utilization (Stock et al. 2024; Hezam et al. 2024). Furthermore, IoT-based digital payment and transaction systems contribute to greater financial efficiency by minimizing transaction errors and accelerating cash-flow processes, which are critical factors for MSME sustainability and growth (Yusgiantoro et al. 2019; (Saadah & Setiawan, 2024).

Beyond technological characteristics, the broader institutional and regulatory environment also influences technology adoption decisions. Regulatory support and conducive policy frameworks can strengthen the explanatory power of TAM by encouraging organizations to perceive digital technologies as both useful and feasible to implement (Shwedeh, 2024). Consequently, TAM has been extensively applied across diverse sectors, including e-commerce, education, healthcare, and digital services, demonstrating its versatility in explaining technology adoption behavior in various organizational settings (Alshehri, 2023). Collectively, these arguments suggest that AI and IoT adoption represent strategic technological capabilities that can enhance organizational effectiveness and competitiveness while simultaneously creating opportunities for more responsible and sustainable business practices.

CSR as a Theoretical Outcome of Digital Adoption

Corporate Social Responsibility (CSR) refers to a firm's commitment to managing the social, environmental, and ethical impacts of its business activities while creating value for stakeholders (Cho et al., 2019). In the MSME context, CSR increasingly emerges as an organizational outcome shaped by the adoption of digital technologies such as artificial intelligence (AI) and the Internet of Things (IoT). The implementation of these technologies enhances organizational transparency through improved data traceability and environmental monitoring, enabling MSMEs to develop more effective sustainability reporting and disclosure practices (O'Reilly et al., 2024). In addition, digital transformation encourages employee participation in socially responsible activities and supports the development of an ethical and sustainability-oriented organizational culture (Marcinkowska & Sawicka, 2023).

Furthermore, technology-enabled CSR practices can strengthen corporate reputation and stakeholder trust, thereby supporting long-term business sustainability and organizational legitimacy (Cahyaningati et al. 2023; Ali et al. 2023). The adoption of AI and IoT also requires continuous learning and workforce upskilling, encouraging MSMEs

to establish education- and empowerment-oriented CSR initiatives as part of a responsible digital transformation process (Saadah & Setiawan, 2024). Collectively, these arguments suggest that digital technology adoption can serve as an important driver of CSR engagement by improving transparency, fostering responsible organizational cultures, strengthening stakeholder relationships, and promoting employee development within MSMEs.

Mediation and Moderation

According to Hayes (2022), mediation analysis examines both the direct effect of an independent variable on a dependent variable (c′ path) and the indirect effect transmitted through a mediating variable (a × b path). In the context of this study, CSR is positioned as a mediating mechanism through which technology adoption influences MSME financial performance. Therefore, the model investigates not only whether AI and IoT directly improve financial performance but also whether these technologies generate additional benefits through enhanced CSR engagement.

Memon et al. (2018) distinguish between direct effects, referred to as segmental effects, and indirect effects, referred to as transmittal effects. Following this perspective, the segmental effect in this study captures the direct influence of AI and IoT adoption on MSME financial performance, whereas the transmittal effect represents the indirect pathway through which AI and IoT adoption enhances CSR engagement, which subsequently contributes to improved financial performance. This distinction provides the conceptual basis for examining CSR as a strategic mediating variable in the proposed research model (Hayes, 2022; Memon et al., 2018).

Research Gap and Novelty

Previous studies have examined the roles of AI and IoT in operational efficiency and bottom-line performance (Rana & Daultani, 2023; Afrin & Rahman, 2023), alongside the influence of CSR on reputation and loyalty (Cho et al., 2019). However, limited research integrates all three variables by examining CSR as a mediator between IoT/AI uptake and financial performance within MSMEs in developing countries (Bashir, 2022; Afrin & Rahman, 2023).

Hypothesis Development

On the basis of the proposed theoretical framework and a synthesis of prior empirical studies, this research develops hypotheses under two interconnected thematic streams: direct effects on financial performance and indirect effects through CSR.

Theme A: Segmental Effect (Direct Effect on Financial Performance)

The adoption of advanced digital technologies is widely recognized as a key driver of firm-level performance, particularly for resource-constrained MSMEs. AI adoption enables firms to enhance service quality, personalize customer interactions, and improve data-driven decision-making, which collectively contribute to superior financial outcomes (Badghish & Soomro, 2024; Schwaeke et al., 2024). In a similar vein, IoT adoption strengthens operational efficiency by optimizing resource utilization, improving process monitoring,

and reducing operational costs, thereby supporting improved financial performance (Saadah & Setiawan, 2024; Yusgiantoro et al., 2019). Accordingly, the study proposes the following hypotheses:

H3: AI adoption positively affects the financial performance of MSMEs.

H5: IoT adoption positively affects the financial performance of MSMEs.

Theme B: Transmittal Effect (Indirect Effect via CSR)

Beyond direct performance implications, AI and IoT adoption can reshape organizational practices related to social responsibility. AI adoption supports CSR engagement by facilitating ethical decision-making, transparency, and sustainability-oriented governance mechanisms (Perifanis & Kitsios, 2023; Zhai & Liu, 2023). Likewise, IoT adoption enhances CSR initiatives through real-time data collection, environmental monitoring, and data-driven sustainability practices (Stock et al., 2024; Chen et al., 2021).

Higher levels of CSR engagement, in turn, contribute to improved financial performance by strengthening brand reputation, increasing customer loyalty, and reinforcing long-term sustainability practices (Cahyaningati et al., 2023; Ali et al., 2023). From a mediation perspective, CSR functions as a strategic transmission mechanism that converts technological capabilities into financial value by aligning innovation efforts with ethical standards and sustainability objectives (Hayes, 2022; Memon et al., 2018; Giuggioli & Pellegrini, 2023; Leszkiewicz et al., 2022; Paiva et al., 2024; Marcinkowska & Sawicka, 2023). On this basis, the study formulates the following hypotheses:

H1: CSR engagement positively affects the financial performance of MSMEs.

H2: AI adoption positively affects CSR engagement in MSMEs.

H4: IoT adoption positively affects CSR engagement in MSMEs.

H6: CSR mediates the relationship between AI adoption and MSMEs' financial performance.

H7: CSR mediates the relationship between IoT adoption and MSMEs' financial performance

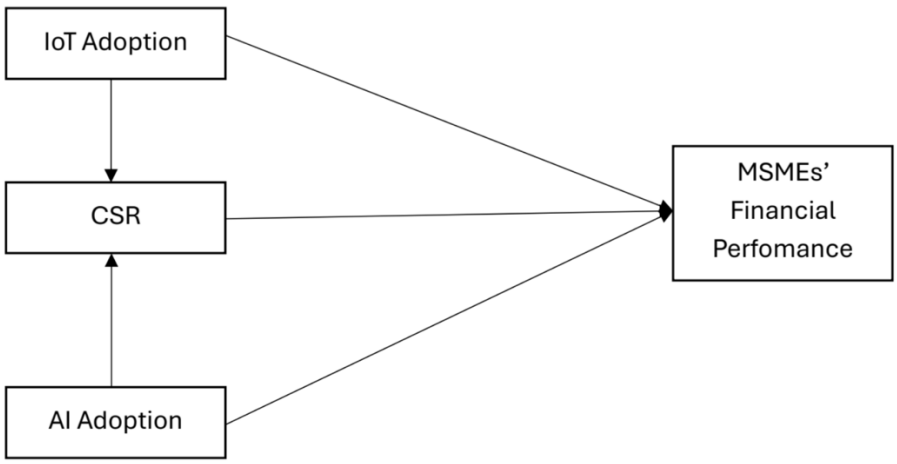

Figure 1. Conceptual Framework Model

METHOD

This research was conducted between August and November 2024. The population comprised 16,650 MSMEs registered with the Department of Cooperative and MSMEs of Bali Province. A purposive sampling strategy ensured that only respondents relevant to the research objectives joined the study. A total of 200 MSMEs participated in the final analysis. To identify respondents who met the study criteria, a screening procedure occupied the beginning of the online questionnaire. Respondents first answered preliminary questions confirming that (1) their business had adopted at least one form of AI or IoT technology in operational or financial activities, and (2) the MSME had been in continuous operation for more than two years. The survey automatically excluded questionnaires that did not meet these criteria.

The data collection involved an online survey administered through Google Forms via social media platforms and MSME digital communities. Prior to full-scale distribution, a pilot test involving 30 MSME owners or managers assessed question clarity, relevance, and instrument reliability. Feedback from the pilot test facilitated the refinement of item wording and ensured the effective function of the screening questions. Although purposive sampling carries a potential risk of selection bias, the use of explicit screening questions, clearly defined inclusion criteria, and pilot testing enhanced the validity and representativeness of the sample in relation to the targeted MSME population.

The study measured variables using indicators adapted from reputable journal sources. Indicators developed by Badghish and Soomro (2024) and Schwaeke et al. (2024) served to measure AI adoption. IoT adoption measurement relied on indicators from Stock et al. (2024) and Chen et al. (2021). CSR engagement indicators originated from Cahyaningati et al. (2023) and Ali et al. (2023). Finally, financial performance indicators followed the works of Saadah and Setiawan (2024) and Yusgiantoro et al. (2019).

Construct validity assessment involved factor loadings, where each indicator required a minimum loading value of 0.7. In addition, average variance extracted (AVE) values above 0.5 confirmed convergent validity. Reliability evaluation utilized Cronbach's alpha and composite reliability, with minimum acceptable values above 0.7, following the recommendations for partial least squares structural equation modeling analysis by (Magno et al., 2024). Five-point Likert scales, as suggested by (Claveria, 2021), ensured the appropriate measurement of latent variables.

Here are the mathematical formulas for each hypothesis:

$H1: FP = \alpha_1 + \beta_1 \cdot CSR + \varepsilon_1$

$H2: CSR = \alpha_2 + \beta_2 \cdot AI + \varepsilon_2$

$H3: FP = \alpha_3 + \beta_3 \cdot AI + \varepsilon_3$

$H4: CSR = \alpha_4 + \beta_4 \cdot IoT + \varepsilon_4$

$H5: FP = \alpha_5 + \beta_5 \cdot IoT + \varepsilon_5$

$H6: FP = \alpha_6 + \beta_6 \cdot AI + \gamma_6 \cdot CSR + \varepsilon_6$

$H7: FP = \alpha_7 + \beta_7 \cdot IoT + \gamma_7 \cdot CSR + \varepsilon_7$

General Explanation:

- FP represents the financial performance of MSMEs.
- CSR represents the engagement of CSR in business strategies.
- AI and IoT are the levels of adoption of the related technologies.
- α, β, and γ are regression coefficients that measure the influence of independent variables on the dependent variable.
- ε is the error term that represents unmeasured variables.

FINDING AND DISCUSSION

Descriptive Analysis

Table 1. *Descriptive Statistics*

Demographic Category	Description	Frequency	Percentage (%)
Gender	Male	115	57.50%
	Female	85	42.50%
Age	20-30 years	45	22.50%
	31-40 years	105	52.50%
	41-50 years	35	17.50%
	51-60 years	15	7.50%
Education Level	Bachelor's	138	69%
	Diploma	32	16%
	Other (High School)	30	15%
Years of Business Experience	1-5 years	50	25%
	6-10 years	80	40%
	11-15 years	40	20%
	16+ years	30	15%

Table 1 provides an overview of the demographic characteristics of the 200 MSME owners in Bali Province who participated in this study. The respondents' mean age is about 38 years. Although the age distribution covers several groups, the majority fall within the 30–40 year bracket, representing a productive demographic. Regarding educational background, most respondents hold a bachelor's degree; hence, these MSME owners have enough educational background to handle their business ventures. The average business experience among respondents is 10 years, with the majority falling between 5 and 15 years. This longevity indicates that most studied MSMEs remain well-established and experienced. The frequency and percentage statistics for each demographic category highlight the sample's diversity, establishing a foundation for further analysis about the

influence of demographic factors on technology adoption and MSME financial performance.

Reliability and Validity Test

Table 2. *Construct Reliability and Validity*

Variable	Main Indicator Theme	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	(AVE)
AI Adoption	Integration of AI technology into operations	0.965	0.967	0.973	0.879
IoT Adoption	Use of IoT technology for operational efficiency	0.959	0.96	0.968	0.859
CSR	Social and environmental responsibility initiatives	0.967	0.968	0.975	0.885
MSMEs Financial Performance	Business profitability and growth	0.971	0.972	0.977	0.897

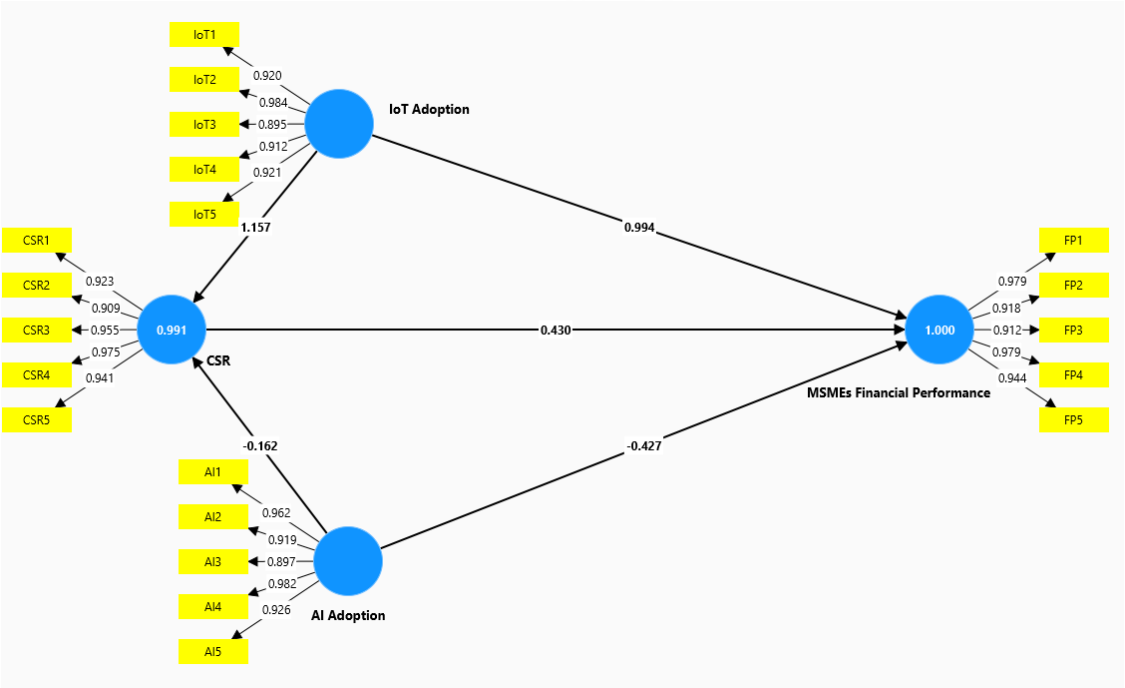

Figure 2. Structural Equation Model Testing

Table 2 and Figure 2 present the results of the construct reliability and convergent validity assessment for all latent variables included in the model. The findings indicate that each construct demonstrates a high level of internal consistency, as evidenced by Cronbach's alpha values ranging from 0.959 to 0.971—figures that significantly exceed the recommended threshold of 0.70. Similarly, both composite reliability measures (ρa and ρc)

are well above the minimum acceptable value of 0.70, confirming the robustness and reliability of the measurement model.

The data also strongly support convergent validity. All constructs report AVE values above 0.50, with figures ranging from 0.859 to 0.897. These values indicate that their respective latent constructs capture a substantial proportion of variance in the indicators. Among the variables, MSMEs' financial performance exhibits the highest AVE, suggesting excellent indicator representativeness for this construct.

Overall, these results confirm that the measurement items reliably and validly capture the underlying dimensions of AI adoption, IoT adoption, CSR, and MSMEs' financial performance. Consequently, these findings provide a sound basis for subsequent structural model analysis.

Hypothesis Test

Table 3. *Regression Weight Structural Equational Model*

	Original Sample (O)	**Sample Mean (M)**	**Standard Deviation (STDEV)**	**T Statistics (|O/STDEV|)**	**P Values**
AI Adoption -> CSR	0.480	0.478	0.083	5.811	0.000
AI Adoption -> MSMEs Financial Performance	0.275	0.266	0.096	2.878	0.004
AI Adoption -> CSR -> MSMEs Financial Performance	0.167	0.163	0.060	2.791	0.005
IoT Adoption -> CSR -> MSMEs Financial Performance	0.180	0.186	0.084	2.141	0.032
IoT Adoption -> CSR	0.518	0.520	0.082	6.319	0.000
IoT Adoption -> MSMEs Financial Performance	0.382	0.388	0.102	3.743	0.000
CSR -> MSMEs Financial Performance	0.347	0.350	0.131	2.648	0.008

Table 3 presents the results of the direct hypothesis testing. The analysis of the direct relationships indicates that AI and IoT adoption significantly influence CSR and MSME financial performance. AI adoption positively influences CSR engagement with a path coefficient of 0.480, T-statistic of 5.811, and p-value of 0.000. It also contributes to improved MSME financial performance with a path coefficient of 0.275, T-statistic of 2.878, and p-value of 0.004. Similarly, IoT adoption strongly influences CSR efforts (path coefficient: 0.518, T-statistic: 6.319, p-value: 0.000) and enhances financial performance (path

coefficient: 0.382, T-statistic: 3.743, p-value: 0.000). These findings indicate that AI and IoT technologies provide direct benefits to MSMEs in achieving practical sustainability and financial growth. Moreover, CSR engagement demonstrates a significantly positive effect on MSMEs' financial performance (path coefficient: 0.347, T-statistic: 2.648, p-value: 0.008), underlining that CSR directly affects financial performance.

Regarding the mediating effects, CSR acts as a mediator between AI adoption and MSME financial performance (path coefficient: 0.167, T-statistic: 2.791, p-value: 0.005) and IoT adoption and MSME financial performance (path coefficient: 0.180, T-statistic: 2.141, p-value: 0.032). This result suggests that CSR practices partially mediate the relationship between technology adoption and financial performance. These findings reinforce the conclusion that although AI and IoT adoption directly contributes to improved financial outcomes, heightened CSR efforts further enhance this positive influence.

CONCLUSION

This study investigated how technology adoption, specifically AI and IoT, directly and indirectly influences MSMEs' financial performance through the mediation of CSR practices. The evidence supports the assumption that embracing technology and CSR serves as a determinant avenue toward achieving financial resiliency and sustainability for MSMEs. These results address the research question regarding how technological innovation results in social responsibility and financial prosperity. The study has several advantages. First, it provides empirical evidence for the strategic mediating function of CSR between technology uptake and financial performance, a previously under-researched area within the MSME industry. Second, it determines the readiness of MSMEs, especially among youth and educated entrepreneurs, to adopt technology and CSR, yielding real-world implications for policymakers and business development programs.

The originality of this research is the combined model that jointly examines AI and IoT adoption while specifying CSR as a mediating variable in the MSME context. Although previous studies have addressed technology and CSR separately, this research shows their interacting roles in achieving financial sustainability. Theoretically, the study contributes to the literature by testing and expanding frameworks that link technological capabilities, CSR engagement, and financial performance. It positions CSR not merely as a moral obligation but as an operational mechanism that translates technological investments into tangible economic benefits, offering a fresh perspective on sustainable development strategies in emerging economies.

Given that the research focused geographically on Bali and employed purposive sampling, subsequent studies should generalize these results by examining other regions, employing external variables, and conducting longitudinal analyses. Furthermore, integrating quantitative analysis with qualitative research could provide richer insights into the challenges and dynamics MSMEs face when adopting technology and CSR practices.

Relevance and Implication to Indonesian Context

These findings provide practical implications for the Indonesian MSME sector, which constitutes a significant portion of the national economy. Policies encouraging technology adoption and CSR practices remain vital for sustainable growth. Training and mentorship

programs for women entrepreneurs, younger business owners, and those with less formal education are crucial in ensuring inclusive technology use. Moreover, simplifying technology interfaces and providing financial incentives can significantly encourage technology adoption among resource-constrained MSMEs.

Indonesia's policy landscape can further amplify these efforts through incentives for sustainable practices and grants for technology integration. The representation of younger entrepreneurs and educated owners suggests a population with substantial potential for innovation-driven growth. By addressing educational gaps in technology support for efficient operations and greener performance, the Indonesian government can develop a model MSME sector for low-carbon economic development.

In addition, the focus on Bali provides a replicable model for other regions despite regional differences in culture, resources, and market dynamics. These findings offer policymakers and practitioners insights to inform context-specific interventions that balance growth across Indonesia's economic landscape.

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