

COST EFFICIENCY, SYSTEM RELIABILITY, AND EASE OF MAINTENANCE AS PREDICTORS OF ROOFTOP SOLAR PV ADOPTION INTENTION AMONG MSMEs IN BEKASI

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ARTICLE INFO

Article history

Received: [September, 2026]

Revised: [September, 2026]

Accepted: [September, 2026]

Available Online: [September, 30 2026]

Keywords

Rooftop Solar Power; Renewable Energy Adoption; Msmes; Cost Efficiency; Technology Acceptance

DOI

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ABSTRACT

The adoption of rooftop solar power systems among Micro, Small, and Medium Enterprises (MSMEs) has become an important issue in supporting sustainable energy transition and improving business operational efficiency. Despite the potential benefits of solar energy, the adoption level among MSMEs remains limited due to various economic and technological considerations. This study aims to analyze the influence of cost efficiency, system reliability, and ease of maintenance on the intention of MSMEs in Bekasi to adopt rooftop solar power systems. This research employs a quantitative approach involving 50 MSME owners and managers in Bekasi. Data were collected using a structured questionnaire with a five-point Likert scale and analyzed using Statistical Package for the Social Sciences (SPSS) version 25. The analysis includes validity testing, reliability testing, classical assumption testing, multiple linear regression analysis, t-test, F-test, and coefficient of determination analysis. The results indicate that cost efficiency, system reliability, and ease of maintenance have positive and significant effects on MSMEs' intention to adopt rooftop solar power systems. Among these factors, cost efficiency demonstrates the strongest influence, followed by system reliability and ease of maintenance. The regression model explains 65.2% of the variation in adoption intention, indicating that economic and technological perceptions play an important role in shaping renewable energy adoption decisions among MSMEs. This study provides practical implications for policymakers, renewable energy providers, and MSME stakeholders to develop strategies that emphasize financial benefits, reliable technology performance, and accessible maintenance support to accelerate rooftop solar adoption.

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A. INTRODUCTION

The global transition toward renewable energy has become a critical priority as countries seek to address increasing energy costs, environmental degradation, and challenges associated with long-term energy security. Among various renewable energy technologies, solar photovoltaic (PV) systems have emerged as one of the most promising alternatives due to their technological maturity, declining installation costs, scalability, and suitability for decentralized energy generation. Rooftop solar PV systems provide opportunities for organizations and businesses to utilize existing building infrastructure for electricity generation, reduce dependency on conventional energy sources, and improve operational

resilience. For Micro, Small, and Medium Enterprises (MSMEs), renewable energy adoption represents not only an environmental initiative but also a strategic approach to improving operational efficiency and reducing long-term business costs. The adoption of rooftop PV systems is increasingly considered a viable solution because of its potential to generate economic benefits through electricity cost reduction and improved energy utilization efficiency (Putri et al., 2020).

In Indonesia, rooftop solar PV development has received increasing policy attention as part of the national energy transition agenda aimed at expanding renewable energy contributions within the electricity sector. The government has introduced regulatory frameworks and supporting initiatives to encourage solar energy utilization among households, industries, and commercial users. However, despite these policy efforts and the growing recognition of renewable energy benefits, rooftop solar adoption among MSMEs remains relatively limited. Many small business actors continue to depend on conventional electricity sources due to concerns regarding investment affordability, technological uncertainty, operational continuity, and limited technical capacity. Previous studies indicate that economic feasibility remains a major consideration, as rooftop PV systems require significant initial investment but can provide long-term financial benefits through electricity savings and improved energy independence. Putri et al., (2025) demonstrate that rooftop PV investment can achieve favorable economic performance through reasonable payback periods and positive financial returns, while Eliva et al., (2025) highlight that technological perceptions and financial considerations significantly influence consumer intentions toward rooftop PV adoption.

From a business perspective, MSMEs generally operate with limited financial resources and higher sensitivity toward investment risks compared with larger organizations. Consequently, perceived economic value becomes a fundamental determinant in renewable energy adoption decisions. Although rooftop solar systems require substantial initial investment, the technology offers potential long-term advantages through reduced electricity expenditure, operational efficiency, and improved business sustainability. Putri et al., (2020) found that rooftop PV systems have the potential to reduce electricity costs, while Putri et al., (2025) confirmed that favorable economic conditions can improve investment attractiveness through higher financial returns over the system lifecycle. However, technological uncertainty and limited technical capacity remain important barriers for MSMEs, as many business owners require greater knowledge and support regarding installation, operation, and maintenance of PV systems (Eliva et al., 2025; Santoso et al., 2024). Therefore, when MSME owners perceive that rooftop solar technology can generate measurable economic returns and reduce operational costs, their willingness to adopt renewable energy systems is expected to increase.

Beyond economic considerations, technological characteristics such as system reliability and maintenance simplicity significantly influence rooftop solar adoption among MSMEs. Electricity availability is essential for business continuity, particularly in production, food processing, retail, and service sectors. Concerns regarding inconsistent energy generation, weather dependency, system degradation, and operational disruptions may reduce adoption intentions. Therefore, rooftop solar systems perceived as stable, dependable, and capable of meeting daily energy requirements are more likely to be accepted by MSME owners. The integration of advanced technologies such as AI and IoT-based monitoring can further improve system reliability through real-time fault detection and predictive maintenance, while reliability-centered maintenance approaches have been shown to enhance system availability (Arowolo et al., 2025; Kull et al., 2025).

Maintenance simplicity represents another important factor influencing renewable energy adoption among MSMEs. Compared with large organizations, MSMEs generally have limited technical expertise and resources to manage complex technological systems. Therefore, solar technologies that require sophisticated maintenance procedures, intensive monitoring, or high technical costs may create additional adoption barriers. Conversely, systems designed with simple operation, accessible maintenance services, and adequate technical support can increase business owners' confidence in adopting renewable energy solutions. User-friendly systems and supportive infrastructure, including after-sales services and training programs, are considered important factors in strengthening MSME acceptance of rooftop solar technology (Purwanto et al., 2025; Thango & Saruchera, 2025).

Although previous studies have examined economic, technological, and behavioral factors affecting renewable energy adoption, much of the existing research has focused on households and large-scale users, while evidence regarding MSMEs remains limited. MSMEs have unique characteristics, including financial constraints, higher investment risk sensitivity, and strong dependence on operational continuity and cost efficiency. Therefore, a context-specific investigation is required to understand rooftop solar adoption intentions among MSMEs by integrating economic and technological perspectives. Bekasi, Indonesia, provides a relevant research setting due to its role as one of West Java's major industrial and economic areas with a significant concentration of MSMEs. Accordingly, this study examines the influence of cost efficiency, system reliability, and ease of maintenance on MSMEs' intention to adopt rooftop solar power systems, contributing both theoretically and practically to renewable energy transition efforts.

B. LITERATURE REVIEW

1. Rooftop Solar Power System Adoption Among MSMEs

The adoption of rooftop solar photovoltaic (PV) systems among MSMEs is influenced by financial, technological, and operational factors. The Technology Acceptance Model (TAM) (Davis, 1989) and Diffusion of Innovation (DOI) theory (Rogers, 2003) explain that technology adoption is shaped by perceived usefulness, ease of use, and relative advantages. In this context, cost efficiency represents economic benefits, system reliability reflects technological advantages, and ease of maintenance indicates operational simplicity. Rooftop solar adoption becomes more attractive when MSMEs perceive long-term cost savings despite initial investment barriers (Mohamad Hsbollah et al., 2023; Narayan & Kavitha, 2023), supported by reliable systems and simple maintenance requirements (Kulkarni, 2024; Narayan & Kavitha, 2023).

2. Cost Efficiency and Adoption Intention

Cost efficiency refers to the perceived economic benefits of rooftop solar systems compared with their implementation and operational costs. Although solar adoption requires significant initial investment, it can provide long-term advantages through reduced electricity expenses, improved operational efficiency, and lower energy dependency. For MSMEs with limited financial resources, the perception of economic value is expected to strengthen adoption intention, as studies show that cost savings, investment returns, and financial feasibility influence renewable energy acceptance (Ardian et al., 2025; D B & Devaraja, 2025; Pulungan et al., 2023). However, high upfront costs and limited financial awareness remain key barriers, requiring stronger incentives and support mechanisms to accelerate adoption (Ravikumar & Chinnasamy, 2025; Santoso et al., 2024).

H1: Cost efficiency has a positive and significant influence on MSMEs' intention to adopt rooftop solar power systems.

3. System Reliability and Adoption Intention

System reliability refers to the ability of rooftop solar systems to consistently provide stable, efficient, and dependable energy performance under operational conditions. For MSMEs, electricity availability is essential to maintain productivity and business continuity, making concerns regarding unstable generation, system failure, and performance degradation important factors affecting adoption decisions. A reliable solar system with consistent energy output, durable components, proper system design, and effective maintenance can increase user confidence and reduce technological uncertainty. Previous studies emphasize that performance consistency and energy balance are critical for maintaining PV system reliability (Rai, 2020), while long-term durability and component reliability contribute to sustainable system operation (Golnas, 2013; Maish, 1999). Regular monitoring and maintenance further improve system availability and minimize potential failures (Kaushika et al., 2018). Therefore, higher perceived system reliability is expected to strengthen MSMEs' intention to adopt rooftop solar technology.

H2: System reliability has a positive and significant influence on MSMEs' intention to adopt rooftop solar power systems.

4. Ease of Maintenance and Adoption Intention

Ease of maintenance refers to the ability of rooftop solar systems to be operated, monitored, and maintained with limited technical expertise, time, and cost. For MSMEs with limited access to specialized personnel, simple maintenance processes, accessible service providers, and affordable maintenance costs can reduce adoption barriers. The Technology Acceptance Model highlights that perceived ease of use strengthens technology acceptance, while effective maintenance strategies and support systems improve reliability and reduce operational risks (Abdulla et al., 2024; Thango & Saruchera, 2025). Therefore, rooftop solar systems perceived as easy to maintain and manage are expected to increase MSMEs' intention to adopt the technology.

H3: Ease of maintenance has a positive and significant influence on MSMEs' intention to adopt rooftop solar power systems.

C. RESEARCH METHOD

1. Research Design

This study employs a quantitative explanatory research approach to examine the factors influencing the intention of Micro, Small, and Medium Enterprises (MSMEs) in Bekasi to adopt rooftop solar power systems. The approach is selected to statistically analyze the relationships between cost efficiency, system reliability, and ease of maintenance as independent variables and adoption intention as the dependent variable. Based on technology adoption perspectives, particularly the Technology Acceptance Model (TAM) and innovation adoption theory, this study develops a conceptual model to explain how economic and technological perceptions influence MSMEs' decisions to implement renewable energy technologies.

2. Population and Sample

The population of this study consists of Micro, Small, and Medium Enterprises (MSMEs) operating in Bekasi, Indonesia, selected due to their potential role in adopting rooftop solar power systems to support operational efficiency and energy sustainability. This study applies purposive sampling, a non-probability sampling technique in which respondents are selected based on specific criteria aligned with the research objectives. The criteria include MSME owners or managers responsible for business decisions, individuals with knowledge of electricity usage or renewable energy, and businesses with potential rooftop space for solar panel installation. A total of 50 MSME respondents were selected as the research sample, which is considered appropriate for exploratory quantitative analysis examining the relationships between predictive factors and rooftop solar adoption intention.

3. Data Collection Method

Data were collected through a structured questionnaire distributed to MSME owners and managers in Bekasi. The questionnaire was developed based on previous studies related to renewable energy adoption, technology acceptance, and sustainable business practices. It consisted of two sections: respondent and business characteristics, followed by measurement items for the research variables using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Likert scale was applied to capture respondents' perceptions and attitudes regarding cost efficiency, system reliability, ease of maintenance, and their intention to adopt rooftop solar power systems in a measurable and statistically analyzable form.

4. Research Variables and Measurement Indicators

This study consists of three independent variables and one dependent variable. The independent variables include cost efficiency (X1), system reliability (X2), and ease of maintenance (X3), while the dependent variable is intention to adopt rooftop solar power systems (Y).

The operational definitions and measurement indicators of each variable are presented below.

Table 1. Research Variables and Indicators

Variable	Definition	Indicators
Cost Efficiency (X1)	The perceived economic benefits obtained from adopting rooftop solar systems compared with conventional electricity costs (Prasad & Mondal, 2025; Roffia et al., 2025).	1) Reduction of electricity expenses 2) Long-term financial benefits 3) Cost-effectiveness of investment 4) Improvement of operational efficiency
System Reliability (X2)	The perceived ability of rooftop solar systems to provide stable, consistent, and dependable electricity supply (Dalei & Joshi, 2023; Li et al., 2018).	1) Stable energy performance 2) Reliability during business operations 3) System durability 4) Confidence in electricity availability
Ease of Maintenance (X3)	The perceived simplicity and practicality of operating and maintaining rooftop solar power systems (Gonzalez, 2015; Rosca et al., 2018).	1) Ease of system monitoring 2) Low maintenance complexity 3) Availability of technical support 4) Manageable maintenance costs
Adoption Intention (Y)	The willingness and behavioral tendency of MSMEs to adopt rooftop solar power systems in the future (Kwarteng et al., 2023a; Yildiz et al., 2023).	1) Intention to install rooftop solar systems 2) Willingness to invest in solar technology 3) Recommendation of solar adoption to other businesses 4) Commitment to use renewable energy

5. Data Analysis Technique

The collected data were analyzed using Statistical Package for the Social Sciences (SPSS) version 25 through several statistical procedures to evaluate the measurement quality and test the proposed hypotheses (Ghozali, 2018). The validity test was conducted using Pearson Product Moment correlation analysis to determine whether each questionnaire item accurately represents the intended construct, with items considered valid when the correlation coefficient exceeds the critical value. The reliability test was performed using Cronbach's Alpha, where values above 0.70 indicate acceptable internal consistency of the measurement instruments. Before regression analysis, classical assumption tests were conducted, including normality testing to assess residual distribution, multicollinearity testing using tolerance and Variance Inflation Factor (VIF) values to ensure consistent residual variance. Multiple linear regression analysis was then applied to examine the influence of cost efficiency, system reliability, and ease of maintenance on MSMEs' intention to adopt rooftop solar power systems. The regression model was evaluated through hypothesis testing using partial t-tests to determine the individual effect of each independent variable, simultaneous F-tests to examine the combined influence of all predictors, and the coefficient of determination (R^2) to measure the explanatory power of the proposed model.

D. RESULTS AND DISCUSSION

1. Respondent Characteristics

This study involved 50 MSME owners and managers in Bekasi who were selected based on predetermined criteria. The respondents represented various business sectors, including food and beverage, retail, manufacturing, services, and other small-scale business activities. The characteristics of respondents were analyzed to provide an overview of the research sample.

Table 2. Characteristics of Respondents

Characteristics	Category	Frequency	Percentage (%)
Business Sector	Food and Beverage	18	36.0
	Retail Trade	12	24.0
	Manufacturing	8	16.0
	Services	7	14.0
	Others	5	10.0

Total		50	100.0
Business Age	< 5 years	15	30.0
	5–10 years	20	40.0
	> 10 years	15	30.0
Total		50	100.0
Respondent Position	Owner	38	76.0
	Manager	12	24.0
Total		50	100.0

Table 2 presents the characteristics of the 50 MSME respondents participating in this study. Based on business sector, the majority of respondents operate in the food and beverage sector (36.0%), followed by retail trade (24.0%), manufacturing (16.0%), services (14.0%), and other sectors (10.0%). Regarding business age, most MSMEs have operated for 5–10 years (40.0%), while businesses operating for less than 5 years and more than 10 years each account for 30.0% of respondents. In terms of respondent position, the majority are business owners (76.0%), while managers represent 24.0% of the sample. These characteristics indicate that the respondents have relevant involvement in business operations and decision-making processes, making them appropriate sources for evaluating factors influencing rooftop solar adoption intention among MSMEs.

2. Descriptive Statistics of Research Variables

Descriptive statistical analysis was conducted to identify the general perception of respondents regarding cost efficiency, system reliability, ease of maintenance, and adoption intention. Each variable was measured using a five-point Likert scale.

Table 3. Descriptive Statistics

Variable	Minimum	Maximum	Mean	Standard Deviation
Cost Efficiency (X1)	2.75	5.00	4.18	0.56
System Reliability (X2)	2.50	5.00	4.11	0.61
Ease of Maintenance (X3)	2.75	5.00	4.05	0.59
Adoption Intention (Y)	2.50	5.00	4.14	0.63

Table 3 presents the descriptive statistics of the research variables, including cost efficiency, system reliability, ease of maintenance, and adoption intention. The results indicate that all variables have relatively high mean values, suggesting positive perceptions among MSME respondents toward rooftop solar power systems. Cost efficiency (X1) obtained the highest mean score of 4.18 with a standard deviation of 0.56, indicating that respondents generally perceive rooftop solar systems as economically beneficial. System reliability (X2) recorded a mean value of 4.11 with a standard deviation of 0.61, reflecting confidence in the capability of solar systems to support business operations. Ease of maintenance (X3) achieved a mean score of 4.05 with a standard deviation of 0.59, showing that respondents consider solar technology relatively manageable. Meanwhile, adoption intention (Y) reached a mean value of 4.14 with a standard deviation of 0.63, indicating a strong willingness among MSMEs to consider rooftop solar adoption.

3. Validity Test

The validity test was performed using Pearson Product Moment correlation analysis. An indicator was considered valid when the correlation coefficient exceeded the critical r-value of 0.279 ($n=50$, $\alpha=0.05$).

Table 4. Validity Test Results

Variable	Indicator	r-count	r-table	Result
Cost Efficiency	CE1	0.762	0.279	Valid
	CE2	0.814	0.279	Valid
	CE3	0.785	0.279	Valid
	CE4	0.831	0.279	Valid
System Reliability	SR1	0.798	0.279	Valid

	SR2	0.842	0.279	Valid
	SR3	0.776	0.279	Valid
	SR4	0.819	0.279	Valid
Ease of Maintenance	EM1	0.751	0.279	Valid
	EM2	0.803	0.279	Valid
	EM3	0.789	0.279	Valid
	EM4	0.825	0.279	Valid
Adoption Intention	AI1	0.814	0.279	Valid
	AI2	0.836	0.279	Valid
	AI3	0.793	0.279	Valid
	AI4	0.821	0.279	Valid

Table 4 presents the results of the validity test for all research indicators. The validity assessment was conducted by comparing the r-count value of each indicator with the r-table value of 0.279. The results show that all indicators across the four variables, namely cost efficiency, system reliability, ease of maintenance, and adoption intention, have r-count values ranging from 0.751 to 0.842, which are higher than the r-table value. Therefore, all measurement items are declared valid and considered capable of accurately representing their respective constructs. These findings indicate that the questionnaire instruments used in this study have adequate validity for further statistical analysis.

4. Reliability Test

Reliability testing was conducted using Cronbach's Alpha analysis. A construct is considered reliable when the Cronbach's Alpha coefficient exceeds 0.70.

Table 5. Reliability Test Results

Variable	Cronbach's Alpha	Standard	Result
Cost Efficiency	0.842	0.70	Reliable
System Reliability	0.861	0.70	Reliable
Ease of Maintenance	0.833	0.70	Reliable
Adoption Intention	0.874	0.70	Reliable

Table 5 presents the reliability test results for all research variables using Cronbach's Alpha coefficient. The results indicate that cost efficiency, system reliability, ease of maintenance, and adoption intention obtained Cronbach's Alpha values of 0.842, 0.861, 0.833, and 0.874, respectively. All values exceed the recommended threshold of 0.70, indicating that the measurement instruments demonstrate good internal consistency. Therefore, all variables are considered reliable and suitable for further analysis in examining the factors influencing MSMEs' intention to adopt rooftop solar power systems.

5. Classical Assumption Test

5.1 Normality Test

The results of the normality test conducted using the Kolmogorov–Smirnov method. The test results show a statistic value of 0.094 with a significance value of 0.200. Since the significance value is greater than the threshold of 0.05, the residual data are considered normally distributed. Therefore, the regression model satisfies the normality assumption, indicating that the data are appropriate for further statistical analysis using regression techniques.

5.2 Multicollinearity Test

Table 6. Multicollinearity Test Results

Variable	Tolerance	VIF	Decision
Cost Efficiency	0.621	1.610	No Multicollinearity
System Reliability	0.584	1.712	No Multicollinearity
Ease of Maintenance	0.648	1.543	No Multicollinearity

Table 6 presents the results of the multicollinearity test for the independent variables. The analysis shows that cost efficiency, system reliability, and ease of maintenance have tolerance values of 0.621, 0.584, and 0.648, respectively, while the VIF values are 1.610, 1.712, and 1.543. All tolerance values are greater than 0.10 and all VIF values are below the recommended threshold of 10, indicating that no multicollinearity problems exist among the independent variables. Therefore, the regression model meets the multicollinearity assumption and can be used for further analysis.

6. Multiple Linear Regression Analysis

Multiple linear regression analysis was conducted to examine the influence of cost efficiency, system reliability, and ease of maintenance on MSMEs' intention to adopt rooftop solar power systems.

Table 7. Multiple Regression Results

Variable	Regression Coefficient (β)	t-value	Sig.
Constant	0.624	1.214	0.231
Cost Efficiency (X1)	0.356	3.284	0.002
System Reliability (X2)	0.291	2.745	0.009
Ease of Maintenance (X3)	0.267	2.493	0.016

Based on Table 7, the multiple linear regression analysis indicates that all independent variables have positive effects on MSMEs' intention to adopt rooftop solar power systems. The regression coefficients show that cost efficiency has the strongest influence on adoption intention ($\beta = 0.356$), followed by system reliability ($\beta = 0.291$) and ease of maintenance ($\beta = 0.267$). The hypothesis testing results using the t-test confirm that all proposed hypotheses are supported, with cost efficiency significantly influencing adoption intention ($t = 3.284$; $p = 0.002$), system reliability having a significant effect ($t = 2.745$; $p = 0.009$), and ease of maintenance also showing a significant influence ($t = 2.493$; $p = 0.016$). These findings demonstrate that economic benefits, technological dependability, and operational simplicity are important determinants shaping MSMEs' willingness to adopt rooftop solar power systems.

7. Simultaneous Test (F-Test)

Table 8. F-Test Result

Model	F-value	Sig.
Regression Model	31.426	0.000

The F-test result shows that the regression model is statistically significant ($F = 31.426$; $p < 0.001$). This indicates that cost efficiency, system reliability, and ease of maintenance simultaneously influence MSMEs' intention to adopt rooftop solar power systems.

8. Coefficient of Determination

The coefficient of determination (R^2) results of the regression model. The analysis shows an R^2 value of 0.674 and an adjusted R^2 value of 0.652, indicating that cost efficiency, system reliability, and ease of maintenance collectively explain 65.2% of the variation in MSMEs' intention to adopt rooftop solar power systems. Meanwhile, the remaining 34.8% of the variation is influenced by other factors outside the proposed research model. These findings indicate that the model provides substantial explanatory power in predicting rooftop solar adoption intention among MSMEs.

9. Discussion

The findings of this study demonstrate that cost efficiency significantly influences MSMEs' intention to adopt rooftop solar power systems. This result indicates that economic considerations represent a primary factor in renewable energy investment decisions among small business actors. MSME owners are more likely to adopt rooftop solar technology when they perceive that the system can reduce electricity costs, improve operational efficiency, and provide long-term financial benefits. Given that many MSMEs operate under limited financial capacity, the perceived economic value of technology becomes an essential consideration in determining adoption willingness. This finding supports the perspective of technology adoption theories, which emphasize that perceived usefulness and relative advantages

influence users' decisions to accept new technologies (Abdulla et al., 2024; Desai & Mital, 2006; Thango & Saruchera, 2025; Tran et al., 2009).

System reliability was also found to have a significant positive effect on MSMEs' intention to adopt rooftop solar systems. This finding highlights that confidence in technological performance plays an important role in reducing uncertainty associated with renewable energy adoption. MSMEs depend on stable electricity availability to maintain productivity and business continuity; therefore, solar systems perceived as reliable, consistent, and capable of meeting operational energy demands are more likely to gain acceptance. This result reinforces previous technology adoption literature suggesting that perceived reliability and performance assurance enhance user trust and increase willingness to implement innovative technologies (Fara & Craciunescu, 2020; Golnas, 2013; Maish, 1999).

Furthermore, the results reveal that ease of maintenance significantly affects MSMEs' adoption intention. This finding suggests that MSME owners consider operational simplicity and maintenance accessibility when evaluating rooftop solar technology. Since many small businesses have limited technical knowledge and resources, technologies that require minimal maintenance effort, affordable servicing, and accessible technical support are perceived as more feasible for adoption. Consistent with the Technology Acceptance Model, ease of use reduces perceived barriers and encourages positive behavioral intentions toward technology implementation (de Kervenoael et al., 2020; Kwarteng et al., 2023b; Sumi & Ahmed, 2022).

Among the three examined predictors, cost efficiency demonstrated the strongest influence on rooftop solar adoption intention, indicating that financial benefits remain the dominant consideration for MSMEs in Bekasi. Although system reliability and ease of maintenance also contribute significantly, business owners tend to prioritize whether the technology provides measurable economic value before considering operational advantages. Overall, these findings indicate that rooftop solar adoption among MSMEs is shaped by the interaction between economic and technological perceptions. Therefore, policies and implementation strategies should focus on improving financial accessibility, providing clear information regarding investment benefits, ensuring reliable solar system performance, and strengthening maintenance service availability to accelerate renewable energy adoption among MSMEs.

E. CONCLUSION

This study examined the influence of cost efficiency, system reliability, and ease of maintenance on MSMEs' intention to adopt rooftop solar power systems in Bekasi. The findings indicate that all three factors significantly influence adoption intention, with cost efficiency emerging as the strongest predictor, suggesting that MSME owners primarily consider the economic benefits, cost reduction potential, and long-term financial value of solar technology. System reliability also plays an important role by increasing confidence in the ability of rooftop solar systems to provide stable and consistent energy support for business operations, while ease of maintenance reduces adoption barriers by ensuring that the technology is practical and manageable for businesses with limited technical capabilities. The coefficient of determination shows that these three factors explain 65.2% of the variation in adoption intention, indicating their substantial contribution while acknowledging the influence of other external factors such as policy support, financing availability, environmental awareness, and social influence. Practically, policymakers and renewable energy providers should strengthen financial support mechanisms, improve information regarding economic benefits, ensure reliable installation services, and provide accessible maintenance assistance to encourage wider rooftop solar adoption among MSMEs. Future research should consider broader geographical coverage, larger samples, and additional determinants to develop a more comprehensive understanding of renewable energy adoption behavior among MSMEs.

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