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The Role of Statistical Literacy and Data-Driven Decision Making in Improving MSME Performance: A Systematic Literature Review

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Abstract

Micro, small, and medium enterprises (MSMEs) generate transaction data daily, yet few use these data as a basis for decisions. This PRISMA 2020 systematic review maps empirical evidence on how statistical literacy and data-driven decision making relate to MSME performance. A Scopus search yielded 323 records (2016–2026); after title and abstract screening, 116 empirical studies were synthesized through descriptive bibliometrics and thematic analysis. Big data analytics capability was examined in 78% of the studies, data-driven decision making in 15%, and record keeping in 15%, whereas owners' statistical or data literacy was measured in only one study. The focus has shifted: Before 2024, 10 of 25 studies examined record keeping, compared with 7 of 91 since 2024. Most studies (84%) reported positive associations with performance, usually through decision quality, innovation, and sustainability capabilities. Three experiments showed revenue gains of 3.6% and 18.8% from analytics and profit gains for female microentrepreneurs from better bookkeeping. However, 68% of the studies relied on cross-sectional structural equation modeling with perceptual measures. The basic statistical skills of MSME owners, a precondition for data use, remain largely unexamined. We propose a model linking statistical literacy, data use, data-driven decisions, and MSME performance as a research agenda and a basis for statistics training.

Keywords: statistical literacy, data literacy, data-driven decision making, MSME performance, systematic literature review

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INTRODUCTION

Micro, small, and medium enterprises (MSMEs) contributed 61.07% of Indonesia's gross domestic product in 2021 (DJKN Kementerian Keuangan, 2022) [update with the latest 2025–2026 data]. Yet many MSME owners record only cash flows and do not use accounting information for business decisions (Ismaulina, 2024), although every sales, inventory, and customer transaction can be processed with simple statistics, such as means, trends, and period comparisons, to set prices, manage stock, and plan marketing. Firm-level evidence shows that data-driven decision making raises output and productivity (Brynjolfsson et al., 2011), but this evidence comes mostly from large firms, whereas MSMEs face skill and investment constraints (Tawil et al., 2024).

Existing reviews address business analytics capabilities and SME competitiveness (Al-Majali & Ahmad, [complete year]) and data-driven decision making in emerging economies (Mere, 2026), focusing on technology and organizational capabilities, while Indonesian MSME studies concentrate on financial and digital literacy (Pradata et al., 2026; Umboh & Aryanto, 2023). No systematic review has treated owners' statistical literacy as a central construct linked to MSME performance through data-driven decisions; indeed, none of the 323 records screened here measured it as a main construct. This review therefore addresses four research questions: (RQ1) What are the publication trends, geographic distribution, and methods in this field? (RQ2) What forms of statistics and data use are examined in MSMEs? (RQ3) How are statistical literacy and data use related to MSME performance, and through which mediators and moderators? (RQ4) What barriers are reported, and what should future research address?

Gal (2002) defined statistical literacy as the ability to interpret and critically evaluate statistical information and to communicate opinions about it, drawing on knowledge (statistics, mathematics, and context) and dispositional components. In business, the related concept of data literacy covers reading, interpreting, and using data; Sajoodi et al. (2025) validated 10 core data literacy dimensions for managers. Here, statistical literacy denotes an MSME owner's competence to process simple business data (calculating means and percentages, reading sales trends, comparing periods, and interpreting charts), distinct from financial literacy (managing money and financial products) and digital literacy (using technology).

Data-driven decision making (DDDM) bases decisions on data analysis rather than intuition alone (Brynjolfsson et al., 2011); in MSMEs it ranges from setting stock levels from weekly sales summaries to using marketplace analytics dashboards. MSME performance is measured through financial (sales, profit) and nonfinancial indicators (customer and market growth, sustainability). Theoretically, the resource-based view (Barney, 1991) treats owners' statistical literacy and accumulated data as intangible resources, and the dynamic capabilities view (Teece et al., 1997) explains how such resources are reconfigured into performance, as in research on analytics and business model innovation (Ciampi et al., 2021).

METHOD

This review follows the PRISMA 2020 statement (Page et al., 2021); the protocol was registered on OSF Registries [complete DOI; state if retrospective]. Using the PICOS framework, eligible studies (a) examined MSMEs; (b) addressed statistical or data literacy, business data recording or analysis, or data-driven decision making; (c) reported business performance or success; and (d) were peer-reviewed empirical journal articles published in 2016–2026 in English or Indonesian. Studies of large firms, of financial literacy or technology adoption without a data-use component, and conceptual papers were excluded.

Scopus was searched on October 29, 2026 (TITLE-ABS-KEY, journal articles, English Indonesian) with three Boolean blocks covering MSMEs, data use, and performance: TITLE-ABS-KEY (("SME" OR "SMEs" OR "MSME" OR "MSMEs" OR "small business*" OR "micro enterprise*" OR "small and medium enterprise*" OR "small and medium-sized enterprise*") AND ("statistical literacy" OR "data literacy" OR "data-driven decision*" OR "business analytics" OR "data analytics" OR "record keeping" OR "bookkeeping") AND (performance OR growth OR sustainability OR competitiveness OR profitability)) AND PUBYEAR > 2015 AND PUBYEAR < 2027 AND DOCTYPE (ar) AND (LANGUAGE (english) OR LANGUAGE (indonesian)) [Replace with the exact string run.] The 323 records were exported in two files (200 and 123) and checked for duplicates by DOI and title. Titles and abstracts were screened with five exclusion codes: E1, not a primary empirical study; E2, population not MSMEs; E3, data construct not tested; E4, outcome not business performance (e.g., adoption intention, readiness, model accuracy); and E5, substantial duplication. Screening was assisted by a large language model (Claude, Anthropic) applying these codes, and decisions were checked by the author; because only one human reviewer was involved,

interrater agreement was not computed. Borderline rules were applied uniformly (e.g., adoption, readiness, internationalization, or supply chain resilience outcomes were coded E4; composite constructs not testing data use separately were coded E3), and all decisions are documented in the screening log (Appendix B).

Extracted data covered country, design, sample, data construct, mediators and moderators, performance measure, and direction of findings. Data constructs were coded as K1, individual statistical or data literacy; K2, record keeping and bookkeeping; K3, simple data analysis; K4, forecasting and planning; K5, digital analytics; and K6, data-driven decision making. Quality was appraised with the Mixed Methods Appraisal Tool (MMAT) 2018 (Hong et al., 2018). Given heterogeneous measures, the synthesis used descriptive bibliometrics (RQ1), code frequencies (RQ2), vote counting of the direction of findings (RQ3), and thematic synthesis (RQ4).

RESULTS

Study Selection and Characteristics (RQ1)

Screening excluded 207 of 323 records (E1 = 78, E4 = 57, E3 = 51, E2 = 19, E5 = 2), leaving 116 studies for full-text assessment (Figure 1); the full list is provided in Appendix B. Publications rose sharply after 2023: 25 studies appeared in 2016–2023, followed by 22, 33, and 36 in 2024, 2025, and 2026. Studies came from 35 countries, led by Pakistan and China (12 each), Indonesia (7), and Saudi Arabia (6); 21 (18.1%) did not report the country in their abstracts. The median sample was 302 MSMEs or respondents (88 studies). Table 1 summarizes design, outcome, and the role of the data construct. Sustainability framing was strong, with 42 titles (36.2%) containing *green*, *sustainab-*, *circular*, or *environment*.

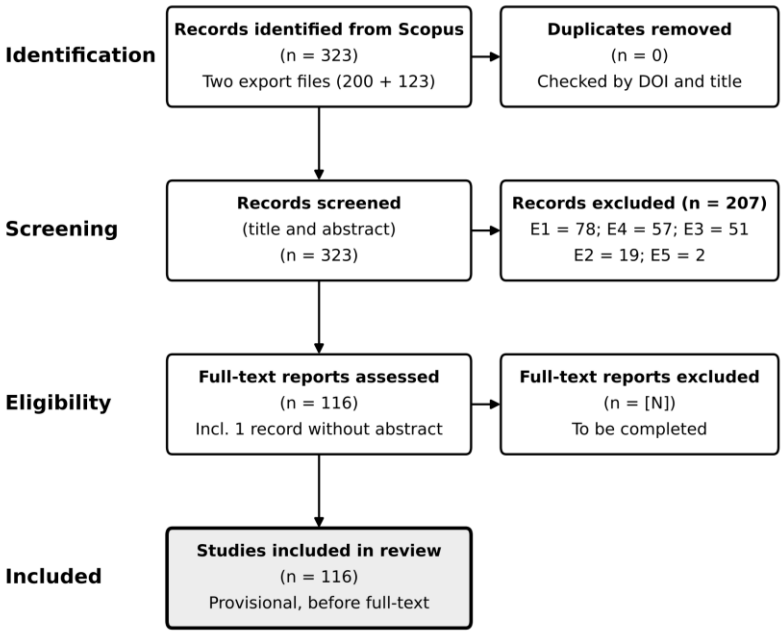


Figure 1
PRISMA 2020 Flow Diagram

Note. E1 = not primary empirical; E2 = not MSMEs; E3 = data construct not tested; E4 = outcome not performance; E5 = duplication. [N] = to be completed after full-text assessment.

Table 1 Characteristics of the 116 Included Studies

Characteristic	Category	*n*	%
Design	SEM (PLS or CB)	79	68.1
	Regression and other statistical tests	17	14.7
	Mixed methods, case study, or qualitative	11	9.5
	Field or natural experiment	3	2.6
	Other (descriptive, optimization, no abstract)	6	5.2
Outcome	General or operational performance	40	34.5
	Sustainability or environmental	33	28.4
	Financial performance or sales	30	25.9
	Innovation or competitive advantage	13	11.2
Role of data construct	Direct predictor	81	69.8
	Mediator or moderator	30	25.9
	Descriptive, covariate, or unclear	5	4.3

Note. SEM = structural equation modeling; PLS = partial least squares; CB = covariance based.

Forms of Data Use (RQ2)

Advanced analytics dominated, whereas basic statistical skills were almost never examined (Table 2). Big data analytics (K5) was mostly measured as an organizational capability within green supply chain or circular economy models, and data-driven decision making (K6) usually acted as a mediator channeling technology into performance (Magableh et al., 2024; Riaz et al., 2026).

Table 2 Data-Use Constructs and Direction of Findings

Code	Construct	*n*	%	Positive	Mixed	Neg./ns
K5	Digital analytics (big data, business analytics, BI)	90	77.6	76	9	3
K6	Data-driven decision making or culture	17	14.7	16	1	0
K2	Record keeping, bookkeeping, accounting information	17	14.7	12	5	0

Code	Construct	*n*	%	Positive	Mixed	Neg./ns
K4	Data-based forecasting and planning	10	8.6	8	2	0
K1	Individual statistical or data literacy	1	0.9	1	0	0
K3	Simple data analysis	1	0.9	1	0	0

Note. Studies may carry more than one code; percentages are of 116 studies. Two K5 studies could not be assessed for direction. BI = business intelligence; Neg./ns = negative or nonsignificant.

Record keeping (K2), studied only in developing countries, provided the strongest causal evidence for microenterprises. Across seven developing countries, business practices including record keeping and financial planning explained variation in sales, profits, and productivity, and panel data linked better practices to survival and sales growth (McKenzie & Woodruff, 2017). A randomized experiment in Mozambique found that improved bookkeeping drove profit gains for female, but not male, microentrepreneurs (Batista et al., 2022). Record keeping was the strongest predictor of success in Nepal ($\beta = 0.467$; Khadka et al., 2025) and of female microentrepreneurs' performance in Uzbekistan ($\beta = 0.407$; Kuchkorova et al., 2026), with similar results in Indonesia, Nigeria, Ethiopia, and Mauritius (Bangarigadu & Nunkoo, 2023; Endris & Kassegn, 2023; Iramani et al., 2018; Tumba et al., 2022). Effects were not uniform: Records management policies had no significant effect in Ghana (Mintah et al., 2022), and financial literacy was unrelated to bookkeeping practice (Mabula & Ping, 2018).

For forecasting and planning (K4), business and financial planning and budgeting literacy predicted sales and profit growth (Bangarigadu & Nunkoo, 2023; Iramani et al., 2018), and predictive analytics and budgetary control were positively associated with performance (Bhavikatta, 2026; Ebhota et al., 2024), whereas cash forecasting was nonsignificant in Somalia and Uzbekistan (Kuchkorova et al., 2026; Osman et al., 2026). Only one study touched individual data literacy (K1), through a data governance maturity model for Vietnamese SMEs (Hai, 2025); the closest individual construct was bookkeeping and budgeting literacy (Iramani et al., 2018). One action research study (K3) reported a roughly 300% rise in monthly revenue over 4 years from analyzing small customer data (Peixoto et al., 2025).

Relationship With Performance (RQ3)

Of the 116 studies, 97 (83.6%) reported positive relationships, 14 (12.1%) mixed, two (1.7%) negative, one (0.9%) nonsignificant, and two could not be assessed. The strongest causal evidence came from three experiments: An eBay analytics dashboard raised seller revenue by 3.6%, over one third of it through actively monitoring performance (Bar-Gill et al., 2024); analytics adoption by more than 370,000 sellers raised revenue by 18.8%, especially for smaller sellers (Yuan et al., 2025); and the Mozambique trial described above (Batista et al., 2022). Studies with objective or large-scale data also found positive associations (Dong & Yang, 2020; Savimäki et al., 2026; Vajjhala & Strang, 2024; Zhao et al., 2025), with stronger analytics effects for SMEs than for large firms (Dong & Yang, 2020).

Effects were mostly indirect, through decision quality (Ghaleb & Juhari, 2026), data-driven decisions (Riaz et al., 2026), innovation, and sustainability capabilities, and were not automatic: Data analytics was negatively associated with return on assets in Portugal,

interpreted as an early-adoption cost (Guimarães et al., 2026), weakened the link between entrepreneurial competence and environmental performance in Mozambique (Cumba et al., 2026), and was unrelated to ESG performance in China (Lu et al., 2026). Of the seven Indonesian studies, the five recent ones examined analytics capability (Bansal, 2024; Huda et al., 2025; Muafi et al., 2026; Primadasa et al., 2026; Putritamara et al., 2025), and two earlier ones examined bookkeeping (Hendriani et al., 2016; Iramani et al., 2018); none measured statistical literacy.

Barriers and Quality of Evidence (RQ4)

Recurring barriers were skills and information technology costs beyond MSME capacity (Tawil et al., 2024), technology integration and data security (Effer et al., 2025), and organizational readiness after adoption (Ho et al., 2026). Methodologically, 68.1% of the studies used cross-sectional structural equation modeling with perceptual measures; only five were time-lagged, three experimental, one panel based, and five used objective data. MMAT ratings: [N] high, [N] moderate, and [N] low quality.

Discussion

The central finding is a mismatch between the data sophistication studied and the reality of most MSMEs. Analytics dominates (78%), and the focus has shifted from record keeping (10 of 25 studies before 2024) to analytics (75 of 91 since 2024), yet the strongest causal evidence for microenterprises comes from record keeping and basic business practices (Batista et al., 2022; McKenzie & Woodruff, 2017), and analytics benefits are largest for the smallest sellers (Yuan et al., 2025). Missing between record keeping and big data is the owner's ability to turn simple data into decisions, which is where statistical literacy acts as a bridge. Consistent with the dynamic capabilities view, data create value only when converted into action: Monitoring performance, a basic statistical habit, explained over one third of the dashboard effect (Bar-Gill et al., 2024), whereas analytics without supporting capabilities lowered short-term returns (Guimarães et al., 2026), and cash forecasting may fail when owners cannot interpret projections (Kuchkorova et al., 2026; Osman et al., 2026).

We therefore propose the model in Figure 2, in which statistical literacy precedes data use, which affects performance through data-driven decisions, moderated by firm size, digital infrastructure, and training access (Mere, 2026; Tawil et al., 2024). Theoretically, statistical literacy should be measured as a construct distinct from financial and digital literacy, for instance by adapting Sajoodi et al.'s (2025) managerial data literacy instrument. Practically, statistics and business programs can offer applied training in reading sales trends, calculating margins, and setting stock from average demand, and local governments can embed data literacy modules in MSME programs. Methodologically, future studies should use objective performance data, longitudinal or experimental designs, and full reporting of effect sizes.

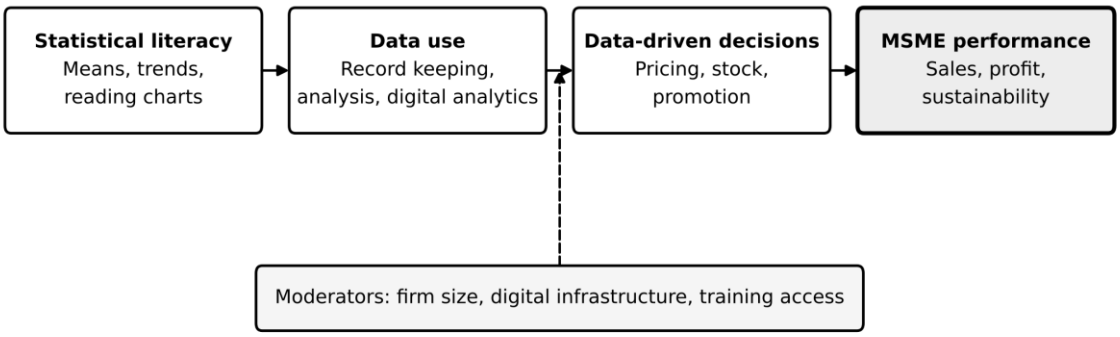


Figure 2 Proposed Conceptual Model

Note. Solid arrows indicate proposed direct paths; the dashed arrow indicates proposed moderation.

CONCLUSION

Across 116 studies, research on MSME data use has grown rapidly since 2024, is concentrated in Asia, relies on cross-sectional structural equation modeling, and increasingly emphasizes big data analytics over record keeping (RQ1–RQ2). Most studies report positive, largely indirect effects on performance, and three experiments confirm causal gains, although effects depend on readiness (RQ3). Skills, costs, data security, and readiness are the main barriers (RQ4). The priority is to develop a statistical literacy scale for Indonesian MSME owners and to test the proposed model with objective performance data and longitudinal or experimental designs, including evaluations of statistics training. This review is limited by its use of a single database (Scopus; national SINTA/Garuda journals were not covered), single-reviewer AI-assisted screening without interrater verification, abstract-based initial extraction, possible publication bias, and the predominance of perceptual performance measures.

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