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Adoption Of Business Intelligence Systems in Small and Medium Enterprises: An Integrated TAM-TOE Perspective

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ABSTRACT

This study investigates the factors influencing the adoption of business intelligence (BI) systems among small and medium enterprises (SMEs). By integrating the Technology Acceptance Model (TAM) with the Technology-Organization-Environment (TOE) framework, this research proposes a comprehensive model that was empirically tested using data collected from 312 SME managers across multiple industries in Indonesia. A quantitative approach was employed using an online survey instrument, and the data were analyzed using Structural Equation Modeling with Partial Least Squares (PLS-SEM). The results indicate that perceived usefulness, organizational readiness, and competitive pressure are the strongest predictors of BI adoption intention among SMEs. Interestingly, perceived ease of use has a weaker effect than expected, suggesting that SME managers prioritize strategic value over usability when considering BI adoption. Furthermore, top management support positively moderates the relationship between organizational readiness and BI adoption intention. This study extends the theoretical understanding of technology adoption in resource-constrained settings and provides practical recommendations for BI vendors and policymakers targeting the SME market.

Keywords: *business intelligence; technology adoption; TAM; TOE framework; small and medium enterprises*

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1. Introduction

Digital transformation is changing how firms collect, interpret, and use information for operational and strategic decisions. For small and medium enterprises (SMEs), the ability to convert increasingly abundant business data into practical insights is particularly important because resource restrictions make inefficient decisions relatively costly. Business intelligence (BI) systems combine technologies, analytical applications, data-management practices, and reporting interfaces to transform data into information that supports managerial decision-making (Chen et al., 2012). BI can therefore become an important capability for SMEs seeking to improve decision quality, detect market patterns, monitor performance, and respond more quickly to changes in customer and competitive conditions.

The relevance of BI is increasing as SMEs become more digitally connected through e-commerce, digital payments, cloud applications, customer relationship management systems, and social media platforms. These digital activities generate data that can support more evidence-based management. However, having data does not automatically create business value. SMEs need suitable analytical tools, organizational capabilities, technical infrastructure, managerial commitment, and a sufficient understanding of BI's strategic benefits before adoption becomes realistic. Recent research on technology use among Indonesian micro, small, and medium enterprises (MSMEs) similarly stresses the importance of strengthening digital and technical capabilities to improve business decision-making (Rahayu et al., 2025).

The adoption challenge is especially important in Indonesia because SMEs represent a major component of economic activity and employment. At the same time, many smaller firms face constraints related to finance, information technology expertise, data quality, and managerial capacity. These constraints can make sophisticated analytical technologies appear expensive or difficult to implement even when the potential strategic benefits remain significant. As a result, understanding why SME owners and managers intend to adopt BI requires a conceptual framework that captures both individual perceptions of technology and organizational conditions surrounding adoption.

The Technology Acceptance Model (TAM) provides a well-established explanation of technology acceptance at the individual level. TAM posits that perceived usefulness and perceived ease of use shape behavioral intention to use technology (Davis, 1989). In the BI context, perceived usefulness reflects the extent to which managers expect BI to improve decision quality, productivity, or business performance. In contrast, perceived ease of use reflects the effort required to learn and operate the system. TAM is therefore valuable for explaining how decision makers evaluate BI from the user perspective. Nevertheless, TAM alone does not fully represent firm-level adoption decisions because organizational resources and outside pressures can limit or enable adoption even when individual managers view a technology favorably.

The Technology–Organization–Environment (TOE) framework complements TAM by stressing the wider organizational context of technology adoption (Tornatzky & Fleischer, 1990). TOE identifies technological conditions, organizational readiness, and environmental forces as important determinants of organizational innovation. For SMEs, technology infrastructure reflects the installed digital foundation on which BI can operate; organizational

readiness reflects the availability of financial, technical, and human resources; and competitive pressure captures the external incentive to adopt technologies used by rivals. Integrating TAM and TOE therefore allows the study of BI adoption intention at both individual and organizational levels, rather than treating adoption as a purely user-level decision (Awa et al., 2015).

A recent systematic review of BI adoption research identified a broad set of determinants. It concluded that integrated perspectives combining individual and organizational factors are increasingly important for explaining BI adoption (Al-Daraba et al., 2025). Contemporary evidence also shows renewed interest in combining TAM and TOE for BI adoption in digitally transforming organizations. For example, Alkhwaldi (2026) reports that perceived usefulness remains highly influential, while organizational and environmental conditions such as top management support and competitive pressure also shape BI adoption. These data show that the theoretical value of TAM–TOE integration does not lie merely in adding predictors, but in explaining how user perceptions, organizational capacity, and external pressure jointly shape adoption decisions.

Despite this progress, three gaps remain relevant. First, empirical studies focusing specifically on BI adoption intention among SMEs in developing economies remain less extensive than research on large organizations or other digital technologies. Second, research integrating TAM and TOE often examines their predictors as parallel determinants without sufficiently explaining when organizational resources translate into adoption intention. Third, top management support is frequently modeled as a direct antecedent, while its contingent role in strengthening the effect of organizational readiness has received less attention. In SMEs, where owners and senior managers typically exercise concentrated authority over resource assignment, top management support may determine whether available resources are actually mobilized for BI initiatives.

Accordingly, this study develops and tests an integrated TAM–TOE model of BI adoption intention among Indonesian SMEs. The study investigates the consequences of perceived usefulness and perceived ease of use, organizational readiness, technology infrastructure, and competitive pressure on BI adoption intention, and tests whether top management support strengthens the relationship between organizational readiness and adoption intention. The study adds by combining individual-level acceptance beliefs and firm-level adoption conditions in one model and by conceptualizing managerial support as a boundary condition that can convert organizational readiness into stronger adoption intention. This focus is directly aligned with the digital business agenda because BI adoption concerns the organizational capacity to transform digitally generated business data into decision-support capabilities.

From a digital-business perspective, BI adoption is consequential because SMEs increasingly generate transactional and behavioral data through digital payments, e-commerce, customer relationship management applications, social media, and cloud-based operational systems. The ability to convert this dispersed data into actionable intelligence can determine whether digitalization remains a collection of isolated tools or becomes an integrated managerial capability. Accordingly, examining BI adoption intention provides insight into a key transition from basic digital participation to data-based decision-making among SMEs.

The study therefore contributes in three ways. Theoretically, it integrates user-oriented TAM beliefs with organizational-level and environmental TOE conditions rather than treating adoption as either an individual acceptance problem or a purely organizational decision. Empirically, it evaluates this integrated explanation using responses from Indonesian SME decision makers across several industries. Managerially, it tests whether top management support strengthens the extent to which organizational readiness translates into adoption intention, noting that resources create adoption potential only when leadership is willing to mobilize them.

2. Literature Review

2.1. Business Intelligence Systems

Business intelligence encompasses analytical tools, data architectures, applications, and managerial practices that convert raw business data into meaningful information for decision support (Chen et al., 2012). Business intelligence systems commonly include data warehouses, dashboards, online analytical processing, reporting tools, and data-mining capabilities. More recent BI environments also integrate cloud services, self-service analytics, and artificial intelligence-assisted functions, making analytical capability progressively accessible to smaller firms (Tio et al., 2026).

For SMEs, BI is strategically relevant because it can reduce dependence on intuition alone and support more systematic monitoring of sales, customers, operations, finance, and marketplace performance. However, adoption is not simply a technical acquisition. The value of BI depends on data availability, digital infrastructure, managerial competence, organizational readiness, and willingness to use analytical information in decisions. A systematic review by Ain et al. (2019) showed that BI research spans adoption, utilization, and success, indicating that initial acceptance is only one stage in a wider process of assimilation and value creation. More recent evidence similarly emphasizes that multiple individual, technological, organizational, and environmental determinants shape BI adoption (Al-Daraba et al., 2025).

2.2. Technology Acceptance Model (TAM)

The Technology Acceptance Model developed by Davis (1989) is one of the most widely used frameworks for explaining user acceptance of information technology. TAM argues that perceived usefulness (PU) and perceived ease of use (PEOU) are central beliefs that shape behavioral intention. PU refers to the extent to which a person considers that using a system will improve job performance, whereas PEOU refers to the degree to which using the system is expected to be free of effort. TAM also proposes that technologies perceived as easier to use are more likely to be perceived as useful because lower effort can increase the system's practical value.

In the SME BI context, PU represents managers' expectations that BI will improve decision quality, responsiveness, productivity, and competitive performance. Because SMEs regularly operate with limited managerial and analytical resources, visible business value should matter more in adoption decisions. Managers may be willing to invest in unfamiliar analytical tools if they expect the system to produce actionable information and improve outcomes. Therefore, perceived usefulness is expected to be positively related to BI adoption intention.

H1: Perceived usefulness has a positive and significant effect on BI adoption intention in SMEs.

PEOU reflects managers' perceptions of the effort required to learn and operate BI applications. Intuitive, understandable systems that match users' skills can reduce learning costs and resistance. In smaller firms without specialized IT teams, ease of use can be especially relevant because managers and employees may need to operate analytical tools directly. Accordingly, greater perceived ease of use is expected to increase adoption intention.

H2: Perceived ease of use has a positive and significant impact on BI adoption intention in SMEs.

TAM further proposes that ease of use can shape perceptions of usefulness. When a BI system is easier to learn, configure, and interpret, managers may be better able to recognize how the technology supports decision-making. Ease of use therefore has both a potential direct role in adoption intention and an antecedent function in shaping usefulness perceptions.

H3: Perceived ease of use has a positive and significant effect on perceived usefulness.

2.3. Technology–Organization–Environment (TOE) Framework

The TOE framework explains organizational innovation adoption through three contextual domains: technology, organization, and environment (Tornatzky & Fleischer, 1990). Unlike TAM, which focuses primarily on user beliefs, TOE captures the conditions under which an organization can and will implement a technology. This distinction is important for BI because adoption may require investment in infrastructure, data preparation, staff capability, and managerial coordination.

Organizational readiness refers to the extent to which a firm possesses the financial resources, technical competence, human capability, and managerial arrangements required to implement a new technology (Iacovou et al., 1995). In SMEs, readiness can determine whether a favorable attitude toward BI translates into a credible adoption plan. Firms with adequate resources are more likely to evaluate BI as feasible and therefore show greater adoption intention.

H4: Organizational readiness has a positive and significant effect on BI adoption intention.

Technology infrastructure refers to the firm's existing digital foundation, including hardware, software, connectivity, data systems, and related technical resources (Zhu et al., 2006). A stronger infrastructure reduces implementation barriers because BI applications can build on existing digital systems and data flows. For SMEs with weak infrastructure, the additional investment needed to prepare data and systems can discourage adoption.

H5: Technology infrastructure has a positive and significant effect on BI adoption intention.

Competitive pressure represents the extent to which a firm perceives pressure to adopt a technology because competitors are employing similar technologies or because market conditions reward digitally enabled decision-making (Oliveira et al., 2014). Competitive pressure can motivate SMEs to adopt BI to protect market status, respond faster to customers, benchmark performance, and avoid technological disadvantage.

H6: Competitive pressure has a positive and significant effect on BI adoption intention.

2.4. The Moderating Role of Top Management Support

Top management support refers to the extent to which senior leadership actively champions a technology initiative, assigns resources, communicates its importance, and facilitates implementation (Liang et al., 2007). In SMEs, leadership support can be especially influential because ownership and strategy-related decision authority are frequently concentrated in a small number of individuals. A technically ready organization may still fail to pursue BI if the owner or senior manager does not prioritize the initiative.

This study therefore treats top management support not simply as another direct predictor but as a condition that can strengthen the conversion of organizational readiness into adoption intention. When management support is high, available financial, technical, and human resources are more likely to be directed toward BI acquisition, learning, and implementation. When support is weak, the same resources may remain unused or be allocated to competing priorities. This contingency logic underpins the moderation hypothesis.

H7: Top management support positively moderates the relationship between organizational readiness and BI adoption intention, such that the relationship is stronger when top management support is higher.

2.5. Integrated TAM–TOE Perspective

TAM and TOE explain different but complementary layers of the BI adoption problem. TAM addresses the cognitive evaluation made by potential users or managerial decision makers: whether the system is useful and sufficiently easy to use. TOE addresses whether the firm possesses the technological base, organizational resources, and environmental incentives that make adoption feasible and strategically relevant. Integrating the two systems is therefore appropriate when the adoption decision involves both individual interpretation and organizational commitment.

This assimilation is particularly relevant for SMEs because owners or senior managers often make technology decisions, and budget limitations make organizational feasibility highly salient. A manager may perceive BI as useful but still postpone adoption because the firm lacks data readiness, personnel, infrastructure, or budget. Conversely, a technically ready SME may not adopt if decision makers do not perceive a clear strategic benefit. The integrated model therefore treats adoption intention as the outcome of aligned perceptions, resources, infrastructure, and competitive conditions rather than a single-category decision.

The model also recognizes leadership as a boundary condition. Organizational readiness captures whether resources exist, whereas top management support captures whether those resources are given priority and mobilized. This distinction strengthens the model's explanatory logic because it allows two SMEs with similar resource profiles to show different adoption intentions when senior management commitment differs.

2.6. BI Adoption as an Organizational Capability

BI adoption must be distinguished from simple acquisition of a digital application. A BI system produces value only when firms can connect data sources, establish routines for data preparation, interpret analytical outputs, and incorporate those outputs into recurring managerial decisions. This distinction is especially important for SMEs because limited

specialization may blur the boundary between the decision to purchase technology and the organizational capability required to use it effectively. The adoption decision therefore contains an implicit assessment of whether the firm can convert technological functionality into managerial action.

The BI literature has progressively moved from questions of system adoption toward utilization, assimilation, and success (Ain et al., 2019). This progression suggests that intention is an important but intermediate outcome. Strong adoption intention can indicate that decision makers perceive a favorable alignment between expected value and organizational feasibility, but it does not guarantee implementation quality. Data fragmentation, weak governance, insufficient analytical skills, and low managerial follow-through can limit value realization after the purchase decision. For that reason, the present model best explains readiness to move toward BI rather than the full BI value-creation process.

The capability perspective also helps explain why TAM and TOE complement each other. Perceived usefulness captures BI's anticipated contribution to managerial work, while perceived ease of use captures the expected effort required to interact with the technology. TOE factors describe whether the organization has the resources and external motivation necessary to act on those perceptions. When these conditions reinforce one another, adoption intention should be more robust because managers see both a reason to adopt and a feasible pathway for implementation. When they conflict, adoption can be delayed even if one set of conditions is favorable.

For resource-limited SMEs, this alignment itself matters strategically. Firms often cannot invest simultaneously in software, data infrastructure, staff development, process redesign, and external consulting. They therefore need to sequence digital investments. BI may become attractive when earlier digitalization has produced sufficient data, connectivity, and managerial demand for more systematic analysis. In this sense, BI adoption can represent a higher stage of digital maturity, in which firms shift from recording transactions electronically to using accumulated data for forecasting, monitoring, comparison, and strategic choice.

2.7. SME Context and the Logic of Adoption Intention

SMEs differ from large organizations not only in size but also in decision structure, resource slack, specialization, and exposure to implementation risk. Owners and senior managers may act as strategic decision makers, technology sponsors, and intended users at the same time. This concentration of roles makes their perceptions especially influential: a favorable evaluation of BI can accelerate adoption, while uncertainty regarding costs or value can delay it without the layered approval processes common in larger firms. The same concentration also makes leadership support theoretically important because managerial commitment can directly influence budget allocation, employee participation, and the priority assigned to data-related initiatives.

Resource restrictions sharpen the distinction between desirability and feasibility. Managers may believe that BI would improve decisions but still judge adoption impractical if internal data are incomplete, employees lack analytical competence, or existing systems cannot provide usable inputs. Organizational readiness and technology infrastructure therefore capture

separate but connected aspects of feasibility. Readiness reflects whether the firm has the financial and human capacity to undertake the initiative, whereas infrastructure reflects whether a sufficient technological foundation already exists. Both conditions reduce the additional organizational effort required to move from intention toward implementation.

Competitive pressure adds an external timing mechanism. An SME can postpone a potentially useful technology when current routines appear adequate. Still, delay becomes more costly when competitors use analytics to respond faster, personalize offers, manage inventories, or identify market shifts. Competitive pressure can therefore transform BI from an optional improvement into a strategic reaction. The TOE perspective is valuable because it captures this external stimulus alongside the internal conditions described above, permitting the model to explain why similar managerial perceptions may produce different adoption intentions in different competitive contexts.

2.8. Conceptual Framework

Figure 1 summarizes the hypothesized relationships. Perceived usefulness and perceived ease of use represent the TAM components. Organizational readiness, technology infrastructure, and competitive pressure represent the organizational and environmental conditions obtained from TOE. Perceived ease of use is also linked to perceived usefulness, while top management support moderates the relationship between organizational readiness and BI adoption intention.

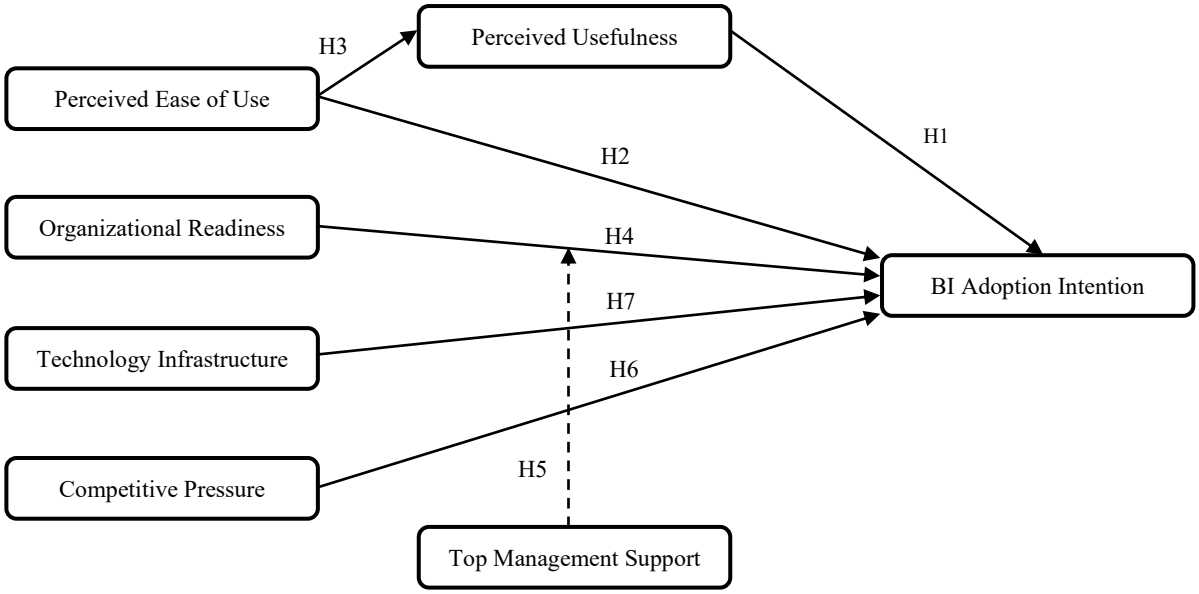

Figure 1: Integrated TAM–TOE Research Framework
Source: Authors

3. Methodology

3.1. Research Design

This study uses a quantitative, cross-sectional survey design to examine hypothesized associations among individual-level technology acceptance beliefs and organizational-level adoption conditions. Because the data were collected at a single point in time, the analysis tests theoretically specified relationships rather than establishing definitive temporal causality. The

unit of analysis is the SME, represented by an owner or manager involved in technology-related decision-making.

3.2. Population, Sampling, and Respondent Eligibility

The target population comprises SME owners and managers in Indonesia operating in trade, manufacturing, services, and information technology. Respondents were eligible if they were involved in technology-related decision-making, represented firms with at least five employees, and possessed sufficient familiarity with business information systems to evaluate the questionnaire statements. Purposive sampling was used to reach respondents who met these eligibility requirements. After screening, 312 valid questionnaires were retained for analysis.

The sampling frame classified participating organizations as SMEs and required respondents to represent firms with at least five employees. The respondent profile also contains a category of firms with 100 employees or more. Because the dataset does not include the asset- or revenue-based information needed for an alternative formal reclassification, the study retains the SME classification used during data collection. This operational definition is considered when interpreting external validity.

The study aimed at approximately 300 valid responses using the PLS-SEM sample-size guidance adopted during research design (Hair et al., 2019), and retained 312 valid questionnaires after screening. The research documentation did not include an a priori statistical-power calculation or a complete response-flow log. Accordingly, we report the achieved sample size and sampling procedure directly, while noting the lack of a power-based design calculation as a methodological limitation.

3.3. Measurement Instruments and Questionnaire Procedure

We measured all constructs using seven-point Likert scales ranging from 1 (strongly disagree) to 7 (strongly agree), adapted from established instruments. We measured perceived usefulness and perceived ease of use with four items each, adapted from Davis (1989). We measured organizational readiness with four items adapted from Iacovou et al. (1995). Technology infrastructure was measured with three items adapted from Zhu et al. (2006), competitive pressure with three items adapted from Oliveira et al. (2014), top management support with four items adapted from Liang et al. (2007), and BI adoption intention with four items adapted from Venkatesh et al. (2003). The questionnaire was translated into Bahasa Indonesia using a back-translation procedure (Brislin, 1970), and a pilot test with 35 respondents was conducted to assess clarity and initial reliability.

The measures represent reflective perceptions of technology acceptance and organizational adoption conditions. Using previously validated scales supports content continuity with the underlying theoretical literature, while the back-translation and pilot procedures were intended to reduce ambiguity in the Indonesian-language instrument. The analysis retained the construct-level measurement statistics generated in SmartPLS 4.

3.4. Data Analysis Technique

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4 (Ringle et al., 2022). PLS-SEM was selected because the study stresses explaining and predicting BI adoption intention and includes a moderation relationship within an

integrated model. The analysis proceeded in two stages: assessing the reflective measurement model and assessing the structural model. We evaluated the measurement model using indicator loadings, internal consistency reliability, convergent validity, and discriminant validity. We evaluated the structural model using inner-model collinearity, path coefficients, bootstrapped significance tests, explained variance (R^2), Stone–Geisser predictive relevance (Q^2), and SRMR. We operationalized the moderation effect as an interaction term between organizational readiness and top management support. We used bootstrapping with 5,000 resamples to assess the statistical significance of the structural paths.

The reported analysis includes construct-level reliability and validity statistics, HTMT information, structural coefficients, R^2, Q^2, and SRMR. Bootstrap confidence intervals, f^2 effect sizes, PLSpredict statistics, and a simple-slope plot were not available for reporting. We therefore treat their absence as a methodological and reporting limitation and a priority for future model validation.

4. Findings

4.1. Respondent Profile

Table 1 summarizes the demographic and organizational characteristics of the 312 respondents. Men represented 57.4% of the sample and women 42.6%. The largest age group was 30–39 years (36.2%), followed by 40–49 years (28.5%), 20–29 years (22.4%), and 50 years and above (12.9%). More than half of respondents held a bachelor's degree (55.1%), while 23.7% held a diploma, 14.4% a postgraduate qualification, and 6.8% had completed high school or equivalent.

The industry distribution was trade (32.1%), services (26.9%), manufacturing (21.8%), and information technology (19.2%). Firm-size categories were 5–19 employees (26.3%), 20–49 employees (35.6%), 50–99 employees (23.1%), and 100 employees or above (15.0%). Regarding BI status, 67.3% reported not having adopted a formal BI system, while 32.7% had adopted at least one form of BI system. This composition is important to understand the dependent construct because the study measures BI adoption intention rather than actual first-time adoption.

Table 1: Respondent Profile (n = 312)

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	179	57.4
	Female	133	42.6
Age	20–29 years	70	22.4
	30–39 years	113	36.2
	40–49 years	89	28.5
	50 years and above	40	12.9
Education	High school	21	6.8
	Diploma	74	23.7
	Bachelor's degree	172	55.1
	Postgraduate	45	14.4
Industry	Trade	100	32.1

	Services	84	26.9
	Manufacturing	68	21.8
	Information Technology	60	19.2
Firm Size	5–19 employees	82	26.3
	20–49 employees	111	35.6
	50–99 employees	72	23.1
	100 employees and above	47	15.0
BI System Adoption	No formal BI system adopted	210	67.3
	Adopted at least one form of BI system	102	32.7

Source: Primary data processed, 2026

The presence of both non-adopters and respondents from firms that had already adopted at least one BI system requires prudent interpretation. For non-adopters, adoption intention naturally reflects prospective adoption. For existing adopters, the same intention items may reflect continued, expanded, or deeper use. Because we did not conduct measurement invariance testing or multi-group analyses to separate these stages, we interpret the structural results as overall BI adoption intention across the combined sample rather than as a pure first-adoption model.

4.2. Measurement Model Assessment

We evaluated the reflective measurement model using indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. As Table 2 reports, the outer loadings range from 0.762 to 0.903, exceeding the commonly used 0.708 guideline. Composite reliability values range from 0.897 to 0.941, and Cronbach's alpha values range from 0.847 to 0.924, indicating satisfactory internal consistency. All reported AVE values exceed 0.50, supporting convergent validity at the construct level.

Table 2: Measurement Model Results

Construct	Items	Loading Range	CR	AVE	Alpha
PU	4	0.798–0.891	0.926	0.758	0.903
PEOU	4	0.774–0.867	0.912	0.721	0.882
OR	4	0.762–0.854	0.905	0.704	0.872
TI	3	0.812–0.889	0.897	0.744	0.847
CP	3	0.824–0.876	0.904	0.737	0.856
TMS	4	0.781–0.872	0.918	0.712	0.891
AI	4	0.809–0.903	0.941	0.612	0.924

Source: SmartPLS 4 output, 2026

Note: PU = Perceived Usefulness; PEOU = Perceived Ease of Use; OR = Organizational Readiness; TI = Technology Infrastructure; CP = Competitive Pressure; TMS = Top Management Support; AI = BI Adoption Intention.

Discriminant validity was assessed using the Heterotrait–Monotrait (HTMT) ratio (Henseler et al., 2015). All HTMT values were reported below 0.85, with the highest value of 0.832 occurring between perceived usefulness and BI adoption intention. Under the stated criterion, the results support empirical distinctiveness among the constructs. Because the reporting

dataset did not include the full HTMT matrix, the discussion is limited to the maximum reported value.

4.3. Structural Model Assessment

Before testing the structural links, we assessed inner-model collinearity using variance inflation factor (VIF) values. All reported VIF values were below 3.0, indicating no material collinearity concern under the adopted criterion. We then evaluated the hypotheses using 5,000 bootstrap resamples. Table 3 reports the standardized path coefficients, t-values, p-values, and hypothesis decisions.

Table 3: Structural Model Results

Hypothesis	Path	Beta	t-value	p-value	Decision
H1	PU → AI	0.347	6.824	< 0.001	Supported
H2	PEOU → AI	0.118	2.156	0.031	Supported
H3	PEOU → PU	0.423	8.917	< 0.001	Supported
H4	OR → AI	0.286	5.437	< 0.001	Supported
H5	TI → AI	0.167	3.218	0.001	Supported
H6	CP → AI	0.241	4.763	< 0.001	Supported
H7	OR × TMS → AI	0.132	2.847	0.004	Supported

Source: SmartPLS 4 output, 2026

Note: PU = Perceived Usefulness; PEOU = Perceived Ease of Use; OR = Organizational Readiness; TI = Technology Infrastructure; CP = Competitive Pressure; TMS = Top Management Support; AI = BI Adoption Intention.

All seven reported hypotheses are statistically supported at the 5% level. Perceived usefulness has the largest direct standardized association with BI adoption intention ($\beta = 0.347$, $t = 6.824$, $p < 0.001$), supporting H1. Perceived ease of use has a smaller but significant direct association with adoption intention ($\beta = 0.118$, $t = 2.156$, $p = 0.031$), supporting H2. Perceived ease of use is also positively associated with perceived usefulness ($\beta = 0.423$, $t = 8.917$, $p < 0.001$), supporting H3.

Among the TOE factors, organizational readiness is positively associated with BI adoption intention ($\beta = 0.286$, $t = 5.437$, $p < 0.001$), supporting H4. Technology infrastructure is also positively associated with adoption intention ($\beta = 0.167$, $t = 3.218$, $p = 0.001$), supporting H5, while competitive pressure has a positive association ($\beta = 0.241$, $t = 4.763$, $p < 0.001$), supporting H6. Finally, the interaction between organizational readiness and top management support is positive and significant ($\beta = 0.132$, $t = 2.847$, $p = 0.004$), supporting H7.

The interaction term's coefficient remains positive and statistically significant. This supports the proposed moderation hypothesis in directional terms: the association between organizational readiness and BI adoption intention becomes stronger as top management support increases. Because a simple-slope plot and confidence intervals for conditional effects were not available, the moderation result is interpreted from the interaction coefficient and bootstrap significance.

4.4. Explanatory and Predictive Assessment

Table 4 summarizes the explanatory and predictive indicators. The model explains 61.4% of the variance in BI adoption intention ($R^2 = 0.614$) and 17.9% of the variance in perceived usefulness ($R^2 = 0.179$). The reported Stone–Geisser Q^2 values are positive for BI adoption intention (0.453) and perceived usefulness (0.131), indicating predictive relevance under the blindfolding-based criterion. The reported SRMR is 0.057, below the stated 0.08 reference value.

Table 4: Structural Model Explanatory and Predictive Indicators

Endogenous Construct / Index	R^2	Q^2	Interpretive Note
BI Adoption Intention	0.614	0.453	Substantial explained variance; positive predictive relevance
Perceived Usefulness	0.179	0.131	Modest explained variance; positive predictive relevance
SRMR	0.057	—	Below the reported 0.08 reference value

Source: SmartPLS 4 output, 2026

The R^2 of 0.614 indicates that the combined TAM–TOE predictors and interaction term account for a substantial proportion of variation in BI adoption intention within the sample. The lower R^2 for perceived usefulness is expected because perceived ease of use is the only modeled antecedent of that construct. Positive Q^2 values indicate that the endogenous constructs have predictive relevance under the reported blindfolding procedure. Interpret these statistics as in-sample explanatory and blindfolding-based predictive evidence, not as a substitute for out-of-sample prediction.

5. Discussion

This study merges TAM and TOE to explain BI adoption intention among Indonesian SMEs. The results show that perceived business value, organizational capacity, technological foundations, external competitive conditions, and leadership support shape adoption intention. This integrated pattern matters because it shows that neither individual acceptance beliefs nor organizational readiness alone fully explains BI adoption intention.

5.1. Perceived Usefulness as the Dominant Direct Predictor

Perceived usefulness has the strongest direct association with BI adoption intention ($\beta = 0.347$). This supports TAM's central proposition that users are more likely to accept a technology when they expect it to improve job or corporate performance (Davis, 1989). In the SME context, the result suggests that managers prioritize BI's strategic and decision-support value. Because SMEs operate under budget limitations, they likely evaluate investments by their visible contributions to decision quality, sales monitoring, customer insight, business efficiency, or competitive responsiveness.

This finding also corresponds with recent BI adoption research that emphasizes perceived usefulness as a key driver of acceptance in integrated adoption models (Alkhwaldi, 2026). For BI vendors, this means product communication should move beyond technical features and show how dashboards, analytics, and reporting capabilities solve concrete managerial problems. For SME managers, this implies that adoption initiatives should start with clearly defined business use cases rather than technology acquisition for its own sake.

5.2. Perceived Ease of Use: Significant but Secondary

Perceived ease of use has a statistically significant but comparatively small direct association with BI adoption intention (β = 0.118). This indicates that usability matters, but it is less influential than perceived usefulness. One plausible interpretation is that SME managers are prepared to tolerate some learning effort when the expected strategic benefits are compelling. This does not imply that ease of use is unimportant. The significant PEOU → PU path (β = 0.423) indicates that ease of use is strongly associated with managers' perceptions of usefulness, consistent with TAM.

The practical implication is that BI providers should not position usability as the sole value proposition. User-friendly interfaces, guided analytics, and simplified dashboards can help users recognize business value more quickly, but adoption communication should connect ease of use to decision effectiveness. Importantly, this study does not claim a statistically tested mediation effect because the specific indirect PEOU → PU → AI path was not reported in the available output.

5.3. Organizational Readiness and Technology Infrastructure

Organizational readiness is the strongest TOE-related direct predictor of BI adoption intention (β = 0.286). This result indicates that intention is higher when SMEs perceive they have the financial, human, and technical resources needed to implement BI. This finding reinforces the argument that positive user perceptions cannot translate into organizational adoption decisions without sufficient resource capacity. In SMEs, resource limitations may be especially consequential because technology investments compete directly with other operating priorities.

Technology infrastructure is also positively associated with adoption intention (β = 0.167). Existing hardware, software, connectivity, and data systems reduce the incremental effort required to deploy BI. The smaller coefficient relative to organizational readiness suggests that infrastructure is necessary but not sufficient: a firm may possess digital tools yet still lack skilled personnel, financial commitment, or implementation capability. This distinction matters for decision makers because digitalization programs that focus only on equipment or connectivity may not drive BI adoption unless they are paired with capability development.

5.4. Competitive Pressure and the External Environment

Competitive pressure is positively associated with BI adoption intention (β = 0.241), showing that environmental conditions matter alongside internal readiness. When competitors use analytics to improve responsiveness, customer targeting, pricing, or operational control, SMEs may perceive BI as increasingly necessary to protect their competitive position. This finding is consistent with the environmental logic of TOE and can also be interpreted through institutional isomorphism, where organizations respond to recognized practices and expectations in their competitive field (DiMaggio & Powell, 1983).

For policy and ecosystem actors, this implies that demonstration effects may accelerate BI diffusion. Industry associations, local business networks, and digital transformation programs can make successful BI applications more visible, thereby increasing awareness of competitive consequences and reducing uncertainty about implementation.

5.5. Top Management Support as a Boundary Condition

The study's most distinctive theoretical outcome is the significant positive interaction between organizational readiness and top management support ($\beta = 0.132$). It indicates that organizational readiness is more strongly associated with BI adoption intention when top management support is higher. In SMEs, where owners or senior managers often set resource allocation and strategic priorities, leadership commitment can determine whether available resources are mobilized for technology adoption.

This finding expands a simple additive TAM–TOE model by introducing a contingency mechanism. Organizational readiness represents potential capacity, while top management support determines how much of that capacity is activated. The contribution is therefore best framed around resource mobilization rather than merely stating that management support is important. Future replications should visualize the interaction through simple-slope analysis to assess its form and substantive magnitude across several levels of top management support.

5.6. Integrated Interpretation of the TAM–TOE Findings

Taken together, the results suggest that usability perceptions alone do not adequately explain BI adoption intention in SMEs. Perceived usefulness has the largest direct coefficient among the predictors of adoption intention, while organizational readiness and competitive pressure also show meaningful positive associations. This pattern indicates that decision makers evaluate BI simultaneously as a managerial tool, an organizational investment, and a response to competitive conditions.

The relatively smaller coefficient for perceived ease of use should not be read as evidence that usability is irrelevant. Ease of use remains significantly associated with adoption intention and is strongly positively associated with perceived usefulness. Rather, the pattern suggests a hierarchy of considerations: managers may first ask whether BI can improve decisions and performance, after which ease of implementation and use affects how readily that value can be realized. This interpretation corresponds to respondents' roles as owners or managers rather than ordinary end users.

The TOE variables also clarify why favorable technology beliefs do not automatically translate into corporate adoption. Organizational readiness captures the internal capacity to act, technology infrastructure represents the digital platform on which BI can operate, and competitive pressure provides an external incentive to move. The simultaneous significance of these factors supports a contextual explanation of adoption in which intention becomes stronger when feasible implementation conditions and market pressure accompany perceived business value.

The moderation finding adds a leadership mechanism to this explanation. Organizational readiness describes available potential, but top management support determines whether that potential is likely to be mobilized. In SMEs, where strategic authority can be concentrated in owners and senior managers, leadership commitment can influence budget allocation, staff participation, priority setting, and willingness to change decision routines. This positive interaction explains why similarly resourced SMEs may differ in BI adoption intention.

5.7. Interpretation of Relative Predictor Strength

The relative size of the standardized coefficients provides additional insight beyond the supported-versus-not-supported classification. Perceived usefulness has the largest direct coefficient for BI adoption intention, indicating that expected performance value is the most salient modeled consideration for respondents. This result is consistent with the functional character of BI: unlike many consumer technologies, BI is typically evaluated as an investment intended to improve decisions, coordination, and business performance. Managers emphasize what the system can help the firm accomplish.

Organizational readiness is the next strongest direct predictor, strengthening the distinction between perceived desirability and implementation feasibility. A technology can be valuable yet difficult to pursue if financial, technical, or human resources are inadequate. The result implies that adoption programs directed at SMEs should not assume that awareness of BI benefits is sufficient. Adoption intention becomes stronger when managers can connect the expected benefit to an organizationally credible implementation pathway.

Competitive pressure also has a comparatively strong coefficient. This shows that adoption intention is partly relational: firms evaluate technology not only against their internal needs but also against changes in the competitive field. For SMEs, visible adoption by competitors can provide both evidence of feasibility and a warning about potential disadvantage. Competitive pressure may therefore operate through a mixture of learning, imitation, and strategic concern. This interpretation is consistent with the broader institutional logic used in the discussion, while the present model retains competitive pressure as the direct TOE environmental construct.

Technology infrastructure has a smaller but significant direct effect. This pattern is reasonable because infrastructure is an enabling condition rather than the final reason for adopting BI. Hardware, connectivity, software, and data systems make implementation more feasible, but firms are unlikely to adopt simply because infrastructure exists. Its contribution becomes strategically relevant when the infrastructure supports a technology that managers already regard as useful and when organizational resources are sufficient to exploit it.

Perceived ease of use has the smallest direct coefficient among the significant direct predictors of adoption intention. For managerial respondents, this does not imply that usability is unimportant. Instead, it suggests that respondents evaluate usability within a broader business-value calculation. Managers may accept some learning effort if the system is expected to generate valuable insights. In contrast, an easy-to-use system offers little reason for adoption if its strategic contribution is unclear. The significant PEOU-to-PU path supports this interpretation because ease of use can enhance perceived usefulness even when its direct contribution to intention is comparatively modest.

6. Conclusion

This study set out to explain why small and medium enterprises in Indonesia form the intention to adopt business intelligence systems, and it did so by combining technology-acceptance beliefs with the organizational and environmental conditions that surround an adoption decision. The results show that adoption intention rests far more on perceived business value than on ease of operation. Managers were most inclined to adopt when they could see how

analytics would improve concrete decisions, and this perception outweighed every other factor in the model. Organizational readiness and competitive pressure followed as substantial contributors, while the technology infrastructure already available to the firm offered further support. Ease of use still mattered, although largely because it shaped how useful the system was believed to be. Leadership proved decisive: where owners and senior managers actively sponsored the initiative, the influence of organizational readiness on adoption intention grew stronger, suggesting that resources translate into adoption only when leadership mobilizes them.

The study therefore contributes an integrated account of BI adoption in which individual technology beliefs and firm-level adoption conditions operate together, and in which top management support functions as a boundary condition rather than as one more predictor. Practically, the findings reframe BI adoption as a capability-building decision rather than a software purchase. Managers are advised to begin from the decisions they wish to improve, to audit their data and skills before acquisition, and to implement in stages; vendors are better served by demonstrating measurable decision improvements than by competing on interface simplicity; and support institutions should pair technology access with analytical capability development and visible peer examples. Understood in this way, adoption intention signals whether a smaller firm is prepared to manage based on data.

7. Limitations and Future Study

Several limitations qualify these findings. The design is cross-sectional, so the reported relationships describe association rather than temporal causation, and the dependent variable is adoption intention rather than realized implementation, intensity of use, or business performance. All constructs rely on self-reported managerial perceptions collected through a single questionnaire, which leaves room for common method variance. The sample also spans several industries and firm-size groups. It combines firms that have not yet adopted formal BI with firms already using some form of it, so that that intention may mean different things across behavioral stages. In addition, the operational definition of SMEs follows the category used during data collection rather than a formal regulatory classification based on asset or revenue thresholds.

These limitations point to several directions for future work. First, longitudinal designs could trace how intention develops into implementation, routine use, and realized business value, and would allow the causal ordering of the relationships to be tested. Second, comparative and multi-group studies across industries, firm sizes, regions, and adopter versus non-adopter groups could establish whether the relative weight of technology and organizational factors remains stable. Third, future models could incorporate constructs such as data quality, digital literacy, perceived cost, and vendor support, and complement perceptual measures with objective indicators of system use.

Author Contributions

Conceptualization: Dorris Yadewani; Methodology: Dorris Yadewani and Hendrik Permana; Questionnaire development and validation: Hendrik Permana and Marjohan; Data collection

and data curation: Hendrik Permana and Marjohan; Formal analysis: Dorris Yadewani and Salamiah Muhd Kulal; Writing—original draft: Dorris Yadewani; Writing—review and editing: Salamiah Muhd Kulal, Hendrik Permana, and Marjohan; Supervision and project administration: Dorris Yadewani. All authors have read and agreed to the submitted version of the manuscript.

Declarations

Conflict of Interest: The authors declare no conflict of interest.

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Data Availability: The questionnaire data supporting the findings of this study are not publicly available because they contain firm-level information collected under a confidentiality assurance given to respondents. The anonymized dataset and the measurement instrument are available from the corresponding author on reasonable request.

Ethical Approval: This study involved human participants, including SME owners and managers, who completed a voluntary, self-administered questionnaire. Respondents were informed of the purpose of the study; participation was voluntary and could be withdrawn at any time; informed consent was obtained before completion; and all responses were anonymized and reported only in aggregate form.

Use of AI Tools: Generative AI tools were used only for language editing and readability improvement of text written by the authors. They were not used for study design, data analysis, interpretation of results, or generating citations or references. The authors reviewed and verified all content and remain fully responsible for the accuracy, originality, citation integrity, and overall integrity of the manuscript.

References

Ain, N., Vaia, G., DeLone, W. H., & Waheed, M. (2019). Two decades of research on business intelligence system adoption, utilization and success: A systematic literature review. Decision Support Systems, 125, 113113. https://doi.org/10.1016/j.dss.2019.113113

Al-Daraba, K., Al-Shami, S. A., Rashid, N., & Qureshi, M. I. (2025). Systematic review of factors influencing adoption of business intelligence systems. Discover Sustainability, 6, 936. https://doi.org/10.1007/s43621-025-01876-5

Alkhwaldi, A. F. (2026). Driving digital transformation in banking: Assessing the factors influencing business intelligence adoption. Journal of Enterprise Information Management, 1–25. https://doi.org/10.1108/JEIM-03-2026-0356

Awa, H. O., Ojiabo, O. U., & Emecheta, B. C. (2015). Integrating TAM, TPB, and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs. Journal of Science & Technology Policy Management, 6(1), 76–94. https://doi.org/10.1108/JSTPM-04-2014-0012

Brislin, R. W. (1970). Back-translation for cross-cultural research. Journal of Cross-Cultural Psychology, 1(3), 185–216. https://doi.org/10.1177/135910457000100301

Chen, H., Chiang, R. H. L., & Story, V. C. (2012). Business intelligence and analytics: From big data to big impact. MIS Quarterly, 36(4), 1165–1188. https://doi.org/10.2307/41703503

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340. https://doi.org/10.2307/249008

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. American Sociological Review, 48(2), 147–160. https://doi.org/10.2307/2095101

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. European Business Review, 31(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Iacovou, C. L., Benbasat, I., & Dexter, A. S. (1995). Electronic data interchange and small organizations: Adoption and impact of technology. MIS Quarterly, 19(4), 465–485. https://doi.org/10.2307/249629

Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2007). Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. MIS Quarterly, 31(1), 59–87. https://doi.org/10.2307/25148781

Ministry of Cooperatives and SMEs. (2023). Report on the development of micro, small, and medium enterprises (MSMEs) and large enterprises data—Ministry of Cooperatives and SMEs of the Republic of Indonesia.

Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. Information & Management, 51(5), 497–510. https://doi.org/10.1016/j.im.2014.03.006

Rahayu, F. S., Risman, A., Firdaus, I., & Haningsih, L. (2025). The behavioral finance of MSMEs in Indonesia: Financial literacy, financial technology (Fintech), and financial attitudes. International Journal of Digital Entrepreneurship and Business, 4(2), 95–107. https://doi.org/10.52238/ideb.v4i2.127

Ringle, C. M., Wende, S., & Becker, J.-M. (2022). SmartPLS 4. SmartPLS. https://www.smartpls.com

Tio, L., Kulal, S. M., & Yadewani, D. (2026). The role of artificial intelligence in personalizing digital marketing strategies: A systematic literature review.

International Journal of Integrated Business Management Research, 5(2). https://doi.org/10.54099/ijibmr.v5i2.1624

Tornatzky, L. G., & Fleischer, M. (1990). The processes of technological innovation. Lexington Books.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425–478. https://doi.org/10.2307/30036540

Zhu, K., Kraemer, K. L., & Xu, S. (2006). The process of innovation assimilation by firms in different countries: A technology diffusion perspective on e-business. Management Science, 52(10), 1557–1576. https://doi.org/10.1287/mnsc.1050.0487