

THE EFFECT OF TECHNOLOGICAL, ORGANIZATIONAL AND ENVIRONMENTAL FACTORS ON ARTIFICIAL INTELLIGENCE ADOPTION AMONG MALAYSIA MSMEs: A PRELIMINARY ANALYSIS

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Abstract: *This is a preliminary study aims to determine the effect of technological, organizational and environmental factors on artificial intelligence (AI) adoption among Malaysia MSMEs. This study embarks on the Technology-Organization-Environment (TOE) framework. Using a questionnaire adopted from a previous study, this study obtains 34 responses from MSMEs in Malaysia which have been selected using convenience sampling. Data are tested using correlation and multiple regression analysis. Findings show a significant correlation between organizational and environmental factors with AI adoption at a significant level of 0.05. Moreover, the multiple regression analysis reveals that the model is statistically significant and explains the variation in AI adoption by 18.8%. However, organizational factor is the only predictor that has a significant positive effect on AI adoption, implying that top management support towards AI trainings to increase employees' awareness and readiness are critical for successful AI adoption in MSMEs. Therefore, this study provides valuable preliminary insights to Malaysian policymakers and companies on how to enhance AI adoption among Malaysia MSMEs for the future economic growth.*

Keywords: *TOE framework, AI adoption, MSMEs*

Introduction

Artificial intelligence (AI) is a new technology which gains increasing attention from business players and scholars in the recent years. AI leverages big data, machine learning, data mining, deep learning, image recognition and natural language processing to transforms data into meaningful information for more informed business decisions. Previous studies noted that AI increased organizational performance by improving customer experience and business decision making process. AI enables better customer behaviour prediction (Slavchanyk et al., 2024; Shankar et al., 2021; Cao, 2021), optimizes operations and supply chain management (Riad et al., 2024; Mao, 2025; Iseri et al., 2025), and improve risk management (Nguyen et al., 2025; Wong et al., 2024; Kalogiannidis et al., 2024). Therefore, in this digitalized society and rapidly evolving business world, companies including micro, small and medium enterprises (MSMEs) should adopt AI to remain competitive.

In line with increasing awareness toward AI benefits for business competitiveness, McKinsey and Company survey among 1,491 respondents from 101 countries exhibited a growing trend of AI adoption in business as depicted in Figure 1. The top three business functions which embedded AI are information technology, marketing and sales, and service operations, while the bottom three business functions which incorporated AI are manufacturing, strategy and corporate finance, and supply chain/inventory management (Singla et al., 2025).

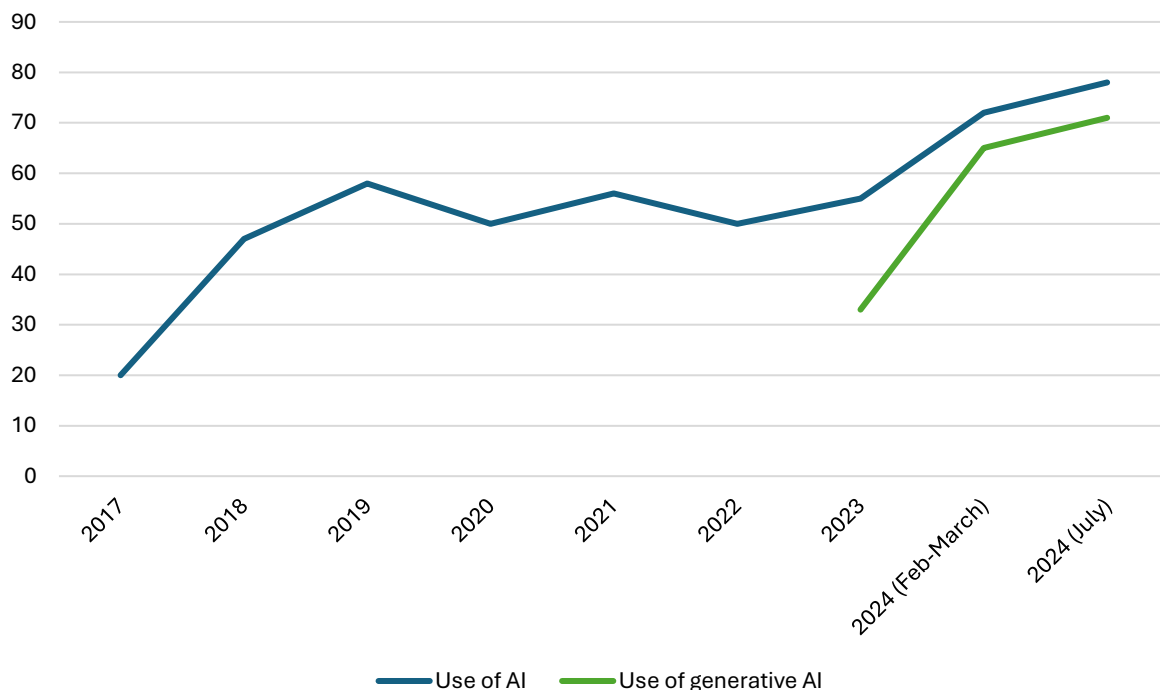


Figure 1: Share of Business Respondents (%) Who Reported AI Use In At Least One Function

Source: Singla et al. (2025)

In Malaysia, the Ministry of Science, Technology and Innovation launched the National Artificial Intelligence Roadmap 2021-2025 (AI-RMap) to flourish innovation and entrepreneurship for economic prosperity (Ministry of Science, Technology and Innovation, 2021). However, 80% of Malaysian companies were at the most basic level of technology adoption (Malaysia Productivity Corporation, 2022). Moreover, a recent survey among retailers of consumer goods currently selling via e-commerce platform indicated that Malaysia is the lowest in AI adoption for business (26%), compared to the other Southeast Asian countries, such as Indonesia (42%), Vietnam (42%), Singapore (39%), Thailand (39%), and Philippines (32%) (Lazada South East Asia Pte. Ltd., 2025). The report provided further evidence (refer Figure 2) showing that AI being less adopted in important business functions including returns and refunds, employers' acceptance, product bundling, campaign optimization, and multichannel interaction (Lazada South East Asia Pte. Ltd., 2025).

On that note, although AI adoption is generally accepted as a source of competitive advantage leading to better organizational performance (Hong et al., 2025; Chen & Tajdini, 2025), AI adoption among Malaysian companies remains a complex and multifaceted issues stemming from behavioural, financial or many external factors. Therefore, drawing from the Technology-Organization-Environment (TOE) framework, this study argues that AI adoption is affected by how organization perceived about the usefulness and compatibility of AI (technological factor), top management support and overall organizational readiness (organizational factor), and external competitive pressure, policies and supply chain members' readiness (environmental factor).

TOE framework dominated previous studies which investigated AI adoption in business (e.g., Ikumoro & Jawad, 2019; Lada et al., 2023; Badghish & Soomro, 2024; Sharma et al., 2022; Ingalagi et al., 2021; Nguyen et al., 2022; Abaddi, 2024; Rawashdeh et al., 2023) and less studies embarked on Unified Theory of Acceptance and Use of Technology (UTAUT) and Technology Acceptance Model (TAM). However, these studies are mostly concentrated on India (Sanjeev, 2021; Patnaik & Bakkar, 2024; Polisetty et al., 2024) and Saudi Arabia (Badghish & Soomro, 2024; Alateeg et al., 2023; Baabdullah, 2024) while other emerging economies such as Malaysia have been given less attention.

Considering the unique context of MSMEs from Malaysia that are governed by different policy structures and constraints than India and Saudi Arabia, therefore, this study attempts to determine the effect of factors drawing from TOE framework on AI adoption. To author's knowledge, this is one of the first studies which reexamines the factors contributing to AI adoption among Malaysian MSMEs after the five-year AI-RMap was introduced. Therefore, this study provides significant evidence on the effectiveness of AI-RMap in catalysing AI adoption in Malaysia.

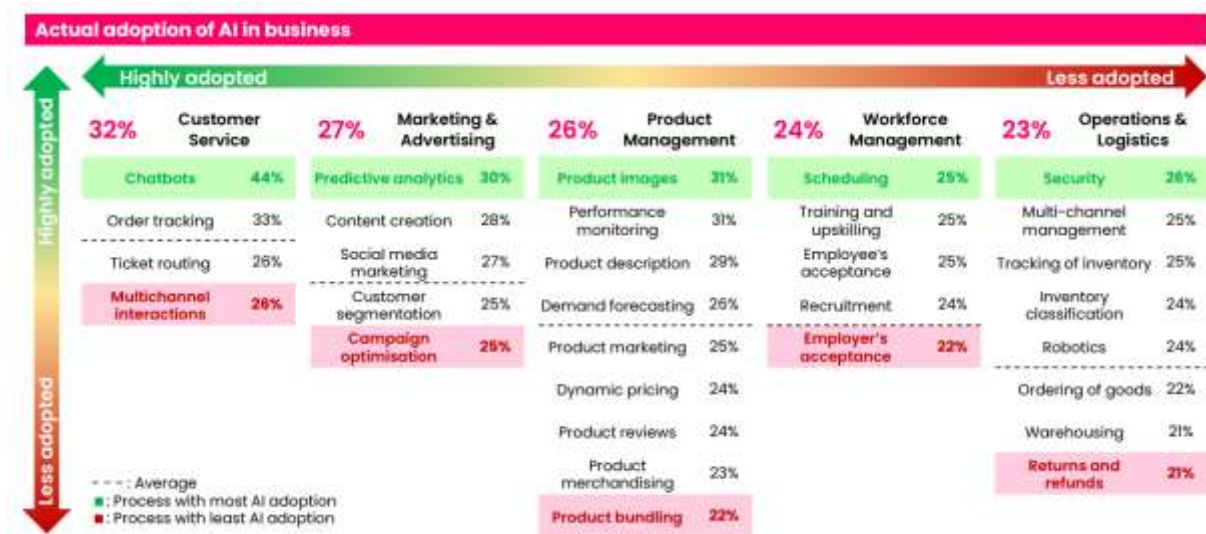


Figure 2: Actual AI Adoption in Malaysian Businesses

Source: Lazada South East Asia Pte. Ltd. (2025)

Literature Review

Technology-Organization-Environment (TOE) Framework

TOE framework was introduced by Tornatzky and Fleischer (1990). This organizational-level theory posits that the adoption of technology is dependent upon three different factors in firm context, i.e., technological factor, organizational factor, and environmental factor. Technological factor is related to the cost of adopting a technology, technology complexity, compatibility with the existing system, and its relative advantage (Badghish & Soomro, 2024). Alternatively, Ayinaddis (2025) stated that technological factor comprised of technology readiness, customization/flexibility, AI tools and need, and data requirements. Conversely, organizational factor pertains to firm resources, such as skills and expertise, top management support, and surplus funds for technology adoption (Badghish & Soomro, 2024; Ayinaddis, 2025). Regulatory environment, industry structure, and availability of technology service providers represent the environmental factor (Baker, 2011). Similarly, Ayinaddis (2025) suggested market dynamics and competitive pressure, external support and collaboration, and regulatory and ethical compliance as the measures of environmental factor. In general, environmental factor comprises government support as well as market and customer factors (Badghish & Soomro, 2024).

Although UTAUT, TAM and diffusion of innovation (DOI) had been the underlying theories in the past technology adoption studies, TOE framework offers organizational-level perspectives which offers more comprehensive and actionable strategies to support widespread adoption compared to UTAUT and TAM, which focus on individual-level adoption behaviour. Moreover, TOE framework is more versatile in capturing the intricate adoption decisions between limited firm's competencies and financial resources with the urgency to adopt technology in competitive environment. Therefore, although TOE framework has been criticized for the lack of socioeconomic and cultural considerations in technology adoption (Ayinaddis, 2025), this study argues that TOE framework is better to understand the MSMEs' context.

Technological Factor and AI Adoption

Badghish and Somroo (2024) investigated the effect of technological factor measured by complexity, compatibility, cost and relative advantage, and found significant effects of compatibility and relative advantage on AI adoption. Similarly, the effects of perceived cost, perceived complexity and perceived relative advantage were found to be significant in a study by Sharma et al. (2022). In the same vein, Nguyen et al. (2022) confirmed that technical compatibility, relative advantage, technical complexity, and technical capability of AI contributed to its adoption. Abaddi (2024) also reported that perceived benefits had significantly increased AI adoption, but perceived cost did not show a significant effect. Rawashdeh et al. (2023) lent further support as they found compatibility, readiness for the challenge, efficiency-improving, and saving time as the primary significant factors affecting AI adoption in SMEs. Relative advantage, cost-effectiveness, compatibility, and AI strategic alignment were significant determinants of AI adoption (Horani et al., 2025). Therefore, based on the evidence on the effect of technological factors on AI adoption, the following hypothesis is developed:

H1: Technological factor has a significant effect on AI adoption.

Organizational Factor and AI Adoption

An analysis of the effect of organizational factors proxied by perceived employee capability, perceived availability of financial support, and perceived top management support on AI adoption revealed that these factors significantly affected AI adoption (Sharma et al., 2022). Likewise, Lada et al. (2023) verified that organizational commitment and readiness played a critical role in AI adoption among SMEs. In addition, Badghish and Somroo (2024) found a significant effect of sustainable human capital on AI adoption. On the same note, Sanjeev (2021) showed that employee adaptability was linked to AI adoption. Furthermore, Jameel (2023) proven facilitating conditions and top management support as the antecedents of AI adoption. Meanwhile, Nguyen et al. (2022) bolstered other studies when they found that managerial capability and organizational readiness increased AI adoption. Management support and firm leadership was repeatedly confirmed as an important factor leading to AI adoption (Horani et al., 2025; Patnaik & Bakkar, 2024; Sechabe & Malatji, 2025; Abaddi, 2024). Hence, based on the relationships between organizational factors and AI adoption tested in previous studies, the following hypothesis is proposed:

H2: Organizational factor has a significant effect on AI adoption.

Environmental Factor and AI Adoption

Environmental factors are often represented by competitive pressure, external support and regulatory compliance (Ayinaddis, 2025). Accordingly, an investigation by Lada et al. (2023) revealed that competitive pressure and external support influenced AI adoption. Similarly, Badghish and Somroo (2024) verified that government support, market and customer pressured firms to adopt AI. Sanjeev (2021) also stated that external support had shown an impact on AI adoption in SMEs. In addition, Jameel (2023) discovered that SMEs experienced social influence prior to AI adoption. In Vietnam, Nguyen et al. (2022) found that AI adoption increased due to government involvement, particularly when vendor partnership and market uncertainty were present. In further support, Arroyabe et al. (2024) confirmed that business environment was critical in determining AI adoption. Significant relationships were also found between competitive pressure and vendor support with AI adoption (Horani et al., 2025). Accordingly, the following hypothesis is developed:

H3: Environmental factor has a significant effect on AI adoption.

Based on the proposed hypotheses, the links between technology, organization and environmental factors with AI adoption are summarized in Figure 3 below.

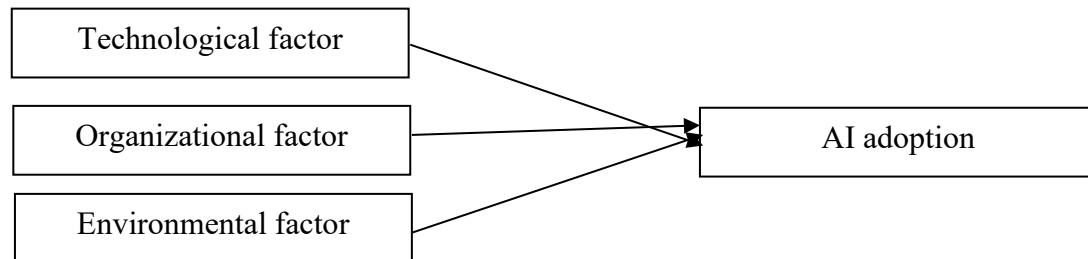


Figure 3: Research framework

Methodology

This study attempts to analyse AI adoption among Malaysian MSMEs. MSMEs were selected by this study due to its consistent contribution to Malaysia economy. According to the Department of Statistics Malaysia (2025), 39.5% of Malaysia GDP (RM652.4 billion in value added) was contributed by MSMEs.

The sample size was determined using Cohen (1988) which suggested a minimum of 34 samples for $3k^b$ at power=0.8 and $\alpha=0.05$. Questionnaire items were adopted from Badghish and Somroo (2024), summarized in Table 1. The items were rated at 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

By using the convenience sampling technique, data were collected from owners/managers of MSMEs. The researchers explained to the respondents about the objectives of the study and gained verbal consent before distributing the questionnaires. All respondents may withdraw from the study and personal information were kept confidential. The survey required about 10-15 minutes to be completed.

Data were analysed using descriptive analysis to understand the profiles of the MSMEs. In addition, correlation analysis was performed to test the strength of the relationships. This study interpreted Pearson correlation coefficient (r) based on Cohen (1988). $0.10 \leq r \leq 0.29$ indicates weak relationships, $0.30 \leq r \leq 0.49$ signifies moderate relationships, while $0.50 \leq r \leq 1.00$ means strong relationships. Finally, multiple regression analysis was conducted to determine the effect of technology, organization and environmental factors on AI adoption at $\alpha=0.05$.

Table 1: Questionnaire Items

Factors	Items
Technological factor	Implementing an AI-based system is very expensive.
	Implementation of AI reduces operation cost in the long term.
	Understanding the AI system is difficult.
	Sharing knowledge of the AI based system is difficult
	Integrating an AI system within the company's existing system is easy.

	AI-based machine learning models are compatible with our existing logistics and manufacturing operations. AI technology can provide higher economic benefits. AI technology can provide better operational performance.
Organizational factor	Our employees are ready with skills necessary for AI implementation. Our employees work in teams to implement AI technology. Our employees have less knowledge related to machine learning algorithms and AI-based predictive models. Our employees receive full support to get training to learn new skills to implement AI technology. Top management encourages employees to learn big data analytics-powered artificial intelligence. Our company provides rewards for employees that have skills and knowledge related to AI-based systems. Our company provides resources for employees to learn big data analytics-powered artificial intelligence.
Environmental factor	Government provides financial support (subsidies) for adopting AI. Government provides technical assistance for adopting AI. Government provides support in training manpower with AI technologies. A financial credit loan from banks for AI implementation is easy for SMEs. Our customers require us to improve our products through AI. AI can work as an incentive to capture a significant market share for a firm. Potential gain of publicity and advertising for AI is higher
AI adoption	My firm is willing to adopt AI to improve firm performance My firm adopts new technologies. My firm cannot make use of AI.

Source: Badghish and Somroo (2024)

Findings and Discussion

Company Profiles

Data were collected in August and September, 2024 and 34 valid responses were received. Based on Table 2, 52.9% ($n=18$) of the samples are MSMEs located in Selangor, whereas 20.6% ($n=7$) and 11.8% ($n=4$) are located in Perak and Johor respectively. In terms of the number of workers, the mean number of workers hired by the sampled MSMEs is 13.6 ($\sigma=14.3$) with a minimum of 1 worker and a maximum of 60 workers (refer Table 3). Moreover, the descriptive analysis shows that the MSMEs have been established for an average of 7.15 years ($\sigma=4.55$).

Based on Table 2, 59.8% ($n=58$) of the MSMEs are in food and beverage industry, representing the largest sub-sector in the study samples. This is followed by the cosmetics and personal care sector, which represents 16.5% ($n=16$) of the samples. Modest fashion, pharmaceutical, Islamic finance, logistics services, Muslim-friendly hospitality, and others each have less representation in the total samples.

Table 2: Company Location

Company Location	Frequency	Percentage
Johor	4	11.8%
Kedah	1	2.9%
Kuala Lumpur	3	8.8 %
Perak	7	20.6%
Sarawak	1	2.9%
Selangor	18	52.9%
Total	34	100.0%

Table 3: Number of Workers and Years of Establishment

	Number of workers	Years of Establishment
N	34	34
Mean	13.6	7.15
Median	9.00	5.00
Standard deviation	14.3	4.55
Minimum	1	2
Maximum	60	21

Correlation Analysis

Table 4 exhibits the results of the correlation analysis. AI adoption had a significant and strong positive correlation with organizational factor ($r=0.524$, $p=0.001$), and moderate and positive correlation with environmental factor ($r=0.366$, $p=0.0034$). However, technological factor had no significant correlation with AI adoption ($r=0.128$, $p=0.472$).

Table 4: Correlation Matrix

		Technological Factor	Organizational Factor	Environmental Factor	AI Adoption
Technological Factor	Pearson's r	—			
	Df	—			
	p-value	—			
Organizational Factor	Pearson's r	0.091	—		
	df	32	—		
	p-value	0.609	—		
Environmental Factor	Pearson's r	0.168	0.633	—	
	df	32	32	—	
	p-value	0.341	<.001	—	
AI Adoption	Pearson's r	0.128	0.524	0.366	—
	df	32	32	32	—
	p-value	0.472	0.001*	0.034*	—

* $\alpha = 0.05$

Multiple Regression Analysis

Table 5 depicts the global test for the multiple regression model. The model was found to be significant ($p=0.018$, $\alpha=0.05$) with $R^2=0.282$ and adjusted $R^2=0.211$. Therefore, technological, organizational and environmental factors explained AI adoption by 21.1% only. It implies that more variables should be included in the model to predict AI adoption.

Table 5: Model Fit Measures

Model	R	R ²	Adjusted R ²	Overall Model Test			
				F	df1	df2	p
1	0.531	0.282	0.211	3.94	3	30	0.018

Note. Models estimated using sample size of N=34

On the other hands, Table 6 shows the multiple regression results. Only one predictor. i.e., organizational factor had a significant positive effect on AI adoption ($\beta=0.5339$, $p=0.020$) at a significance level of 0.05. This finding concurred with earlier studies which found significant effect of management support (Horani et al., 2025; Patnaik & Bakkar, 2024; Sechabe & Malatji, 2025; Abaddi, 2024) and employee adaptability (Sharma et al., 2022; Badghish & Somroo, 2024; Sanjeev, 2021) on AI adoption.

The other two predictors (technological factor and environmental factor) did not have significant effects on AI adoption at $\alpha=0.05$. However, this evidence also supported prior studies such as Lada et al. (2023), Sharma et al. (2022), and Sechabe and Malatji (2025) who revealed insignificant effects of competitive pressure, customer pressure, and vendor support on AI adoption.

Table 6: Multiple Regression Results

Predictor	Estimate	SE	t	p
Intercept	0.9461	1.199	0.789	0.436
Technological Factor	0.1467	0.303	0.484	0.632
Organizational Factor	0.5339	0.217	2.457	0.020*
Environmental Factor	0.0420	0.201	0.209	0.836

Note. Independent variable = AI Adoption

* $\alpha = 0.05$

Accordingly, the following model is developed based on the multiple regression results:

$$Y = 0.9461 + 0.5339\beta_1$$

where,

$Y = \text{AI adoption}$

$\beta_1 = \text{Organizational factor}$

On the whole, this study confirmed that organizational factor is the most important aspect in ensuring widespread AI adoption among Malaysian MSMEs. Government agencies and MSMEs should focus on allocating larger investments in hiring AI experts to increase AI adoption in business operations. For existing employees, more upskilling programs focusing on enhancing knowledge on big data analytic-powered AI, machine learning algorithm, and AI-based predictive models would improve their readiness to embrace AI in business. Reward and incentives could also be introduced as a catalyst in promoting AI implementation among the employees.

Conclusion

The primary objective of this study is to determine the effect of technological, organizational and environmental factors on AI adoption. Based on multiple regression analysis, this study found that organizational factor increased AI adoption in MSMEs, whereas another two factors were not statistically significant. Thus, this study partially confirmed the TOE framework for AI adoption in the context of MSMEs. The findings signify that organizational factor, represented by organizational support and competent employees are key success factors in embedding AI into firms' existing systems.

From the managerial lens, MSMEs are recommended to provide upskilling programs for current employees in order to nurture better acceptance towards new technology, and enhance readiness to transform work procedures. To ensure successful implementation, top management commitment is necessary to introduce new AI policy in workplace, commence reward system for adopting AI, and invest in AI.

This study is not without limitations. With small number of samples, the findings of this study should be interpreted with cautions. Furthermore, this study investigated AI adoption phenomenon only from TOE perspectives, and ignored other possible factors rooting from socioeconomic and cultural aspects. Despite such limitations, this is a preliminary attempt to verify the importance of strategies throughout the 5-year in AI-RMap. Apparently, understanding the benefits of AI are no longer an issue among MSMEs, in line with Lazada South East Asia Pte. Ltd. (2025). Moreover, pressure from business competition as well as government AI assistance are not a critical consideration in adopting AI among Malaysian MSMEs. For future research, this study suggests the incorporation of TOE framework with DOI and other relevant theories to capture the complexity of AI adoption issues.

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