

Ulupui, I Gusti Ketut Agung; Zairin, Gentiga Muhammad; Musyaffi, Ayatulloh  
Michael; Sutanti, Febe Dwi

## Article

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# Navigating uncertainties: a tri-factorial evaluation of risk management adoption in MSMEs

I Gusti Ketut Agung Ulupui , Gentiga Muhammad Zairin ,  
Ayatulloh Michael Musyaffi  and Febe Dwi Sutanti

Accounting Department, Faculty of Economics, Universitas Negeri Jakarta, Jakarta, Indonesia

## ABSTRACT

The study explores the implementation of risk management in Micro, Small, and Medium Enterprises (MSMEs) in Indonesia, with the objective of enhancing their adoption and fostering sustainable business practices. Despite the overarching goal, many MSMEs in Indonesia still lag in the implementation of risk management. The research specifically targets MSMEs without existing internal control and risk management systems. The questionnaire was distributed to 200 MSME representatives through an online Google Form. Out of these, we received 140 completed responses. After a thorough review for completeness and relevance to the study criteria, 111 responses were deemed suitable for analysis, resulting in a response rate of 70%. After the data is obtained, it is analyzed using partial least squares using smart-pls 4.0. Relative advantage (RA) is the most influential indicator on Adoption of Risk Identification (ARI). Other important factors are complexity (COMX), and security (SECU) for MSMEs. Conversely, organizational readiness (OR) and competitive pressure (CP) were found not to have a significant impact on ARI, suggesting these are not primary factors in enhancing risk identification adoption and business sustainability. These findings provide insightful implications for the strategic prioritization of risk management components in the Indonesian MSME sector.

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## 1. Introduction

Micro, small, and medium enterprises (MSMEs) have long been recognized as the backbone of many economies, and their role in Indonesia's economic landscape is particularly pronounced (Sha et al., 2023). Historically positioned at the nexus of growth and development, MSMEs in Indonesia have not only thrived but also showcased commendable resilience against systemic shocks, one of the most poignant being the economic upheavals triggered by the COVID-19 pandemic (Kaya, 2022). This resilience can be attributed to the sector's agility and adaptability.

Furthermore, the contribution of Indonesian MSMEs transcends mere numerical economic growth. Their multifaceted role encompasses job generation, enhancement of labor absorption rates, influencing the trajectories of the gross domestic product, and fortifying export regimes (Arshad et al., 2023). Their proficiency in maneuvering through complex regulatory processes and quickly adjusting to the unpredictable market requirements exemplifies the fundamental entrepreneurial expertise that characterizes this industry (Dambiski Gomes De Carvalho et al., 2021). Moreover, their adeptness at adjusting to environmental shifts underscores their pivotal function in ensuring the sustainable development of regional economies.

**CONTACT** I Gusti Ketut Agung Ulupui  [igka-ulupui@unj.ac.id](mailto:igka-ulupui@unj.ac.id)  Accounting Department, Faculty of Economics, Universitas Negeri Jakarta, Jakarta, Indonesia.

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Within the larger framework of socio-economic discussion, MSMEs are widely recognized as crucial agents in facilitating both economic and societal change (Endris & Kassegn, 2022). Illuminating this assertion, data sourced from the Coordinating Ministry of Economic Affairs of the Republic of Indonesia for the year 2023 delineates a vivid picture: with 64.2 million active MSME units, these enterprises are projected to account for a remarkable 61.9% of the Gross Domestic Product (GDP), furthermore, in the employment spectrum, MSMEs stand as predominant employers, poised to engage a staggering 97% of the national workforce (Limanseto, 2023). Such data not only underscores the weight of the MSME sector in the national economic machinery but also underscores its irreplaceable role in sustaining the Indonesian economic fabric, notably in its capacity to galvanize labor markets and augment GDP trajectories.

The success and survival of the MSME sector in Indonesia is crucial for the country's overall economic and social development. The government recognizes the importance of MSMEs and has implemented policies and programs to support their growth and development (Handrito et al., 2020). These government policies include providing training programs for new MSME actors, creating a favorable regulatory environment, and offering financial assistance and incentives to promote entrepreneurship (Ugwu-Oju et al., 2020). This can encourage economic growth in Indonesia. MSMEs not only contribute to a country's economy, but also serve as a benchmark for the success of government policies in developing an entrepreneurial culture in the economy (Nasir et al., 2017). The government plays a direct role in advancing the economy by making policies that support MSME actors to increase their business, such as hosting training for MSME actors who are just entering the world.

Although the number of MSMEs in Indonesia continues to increase, judging by their performance, MSMEs in Indonesia can still be said to be low. MSMEs in Indonesia are currently unable to contribute to other businesses and develop (Sanistasya et al., 2019). This is because many MSMEs have not implemented an internal control system, risk management, and have not properly managed financial data. The development of MSMEs can be threatened due to financial constraints (Mina et al., 2021). MSMEs often experience problems in managing finances, which can threaten the development of MSMEs. The problem that often occurs in most MSME actors is the difficulty in implementing financial records for their business operations due to a lack of understanding of the basics of financial bookkeeping (Wardi et al., 2020). MSMEs need to improve their financial bookkeeping system to start improving the internal control system and risk management in other parts of their business.

To enhance the performance trajectory of MSMEs, the role of the internal control system is pivotal. An organization's efficiency quotient is often anchored to a robust internal control system which ensures the delivery of premium-quality information, curbing discrepancies in operational endeavors (Cheng et al., 2018). When MSMEs operationalize efficacious internal controls, it acts as a bulwark against procedural mishaps. Conceptualized as a confluence of organizational architectures, methodologies, and coordinated measures, the internal control system is geared towards preserving organizational assets, validating the veracity of accounting intel, fostering operational efficiency, and buttressing alignment with managerial directives (Mulyadi, 2016). For every organization, this system stands as a beacon, outlining policies while stimulating policy-driven efficiency. Delving into empirical studies illuminates the positive correlation between internal control and organizational performance (Nursyamsi et al., 2015; Satria & Dewi, 2019). Collectively, these studies underscore the indispensable role of the internal control system in sculpting the risk identification and sustainability roadmap for MSMEs.

Diving into the financial literacy spectrum, Putri et al. (2022) identify key indicators encompassing financial comprehension, credit and saving dynamics, investment strategies, and insurance acumen (Putri et al., 2022). Echoing these insights, Susan (2020) affirm the instrumental role of financial literacy in influencing MSME performance metrics. Mastery in financial literacy underpins MSME performance enhancement. In tandem with this, an adept internal control system can invigorate organizational aims, especially in disseminating credible financial data, thereby safeguarding vital assets (Francis & Imiete, 2018). This enriched financial repository augments MSME operational efficiency, paving the way for goal realization.

Risk management's imprint on performance metrics is incontestable, given its encompassing roles spanning design, consolidation, alignment, and critical appraisal, especially in formulating risk-centric strategies. This sentiment is further cemented by Kulathunga et al. (2020), who attest to the positive ripple effect of Entrepreneurial Risk Management on MSME performance. Strategizing to

preemptively address potential adversities is a critical attribute of risk management within the MSME ecosystem.

Current technological paradigms cast a profound influence on MSME performance contours. With innovation at the helm, digital intel acts as a catalyst in the global commercial arena (Omiunu, 2019). MSMEs are adept at assimilating technological advancements into their *modus operandi* to realize operational efficacies. The digital age's technological marvels offer boundless opportunities for MSMEs, from marketing prowess and transactional ease to meticulous financial record-keeping (Pramono et al., 2020). Ensuring MSME sustainability amidst this technological maelstrom necessitates specialized acumen (Kulathunga et al., 2020). Armed with a nuanced grasp of IT, MSMEs can capitalize on the benefits ushered in by this technological renaissance.

This research emphasizes the innovative dimensions of the study, highlighting its contribution to the existing scholarly landscape concerning Micro, Small, and Medium Enterprises (MSMEs). The study focuses on an integrated approach, encompassing technological, organizational, and environmental aspects, along with an in-depth exploration of internal control and risk management within the context of Indonesian MSMEs. This research uses empirical data with an exhaustive analysis of technological factors (relative advantage, complexity, and security), organizational factor (organizational readiness), and environmental factor (competitive pressure). This method diverges from the existing literature, which typically examines these elements in isolation, thus providing a more comprehensive understanding of the multifaceted challenges and opportunities confronting MSMEs.

The study contributes significantly to the research field through the development of a novel framework that integrates a variety of factors impacting MSME risk management adoption. This framework emanates from extensive fieldwork, detailed analysis, and the synthesis of diverse theoretical models, marking a notable advancement in the discourse surrounding MSME development in Indonesia.

The central objective of this scholarly research is to unravel the complex interactions among technological, organizational, and environmental dimensions, focusing particularly on internal control and risk management in MSMEs. There exists a notable gap in the existing body of research that specifically addresses the intersection of technology and financial literacy, despite their incontrovertible impact on the performance of MSMEs as highlighted by Mabula and Han (2018). This study endeavors to critically assess various determinants, including technological, organizational, and environmental factors that potentially impact the adoption of risk identification processes within Micro, Small, and Medium Enterprises (MSMEs).

## 2. Literature review

The development of MSMEs today is rapidly increasing. This will certainly have a positive impact on the economy in Indonesia. Although MSMEs continue to grow rapidly, there are problems faced, namely, low productivity levels. The internal problems faced by MSMEs, namely, unqualified human resources, low knowledge of technology and marketing, MSME access to capital, are limited, lack of information, and other production factors (Nurpuspita et al., 2019). These problems can have an impact on decreasing the level of MSME performance. The ability to assess knowledge-based resources is essential to improve organ performance (Kubr, 2002). The basic knowledge possessed by MSMEs is very influential on the performance of MSMEs because the resources used have advantages for business continuity.

This is supported by the research conducted by Hadiyati (2010), which states that a BPS-based survey analyses various problems and weaknesses faced by MSMEs based on their priorities, namely, the difficulty to market products, the number of competitors in the same industry, the difficulty of obtaining raw materials, lack of knowledge and experience in the field of production and expertise, and less qualified human resources. Many small businesses are unable to support risk management activities due to a lack of resources and capabilities (Hobijn & Jovanovic, 2001). This is very common, especially for businesses that are just starting up.

One of the reasons MSMEs do not apply risk management to their business is because the ability of their resources is still incompetent. Furthermore, lack of capital and knowledge about management in MSMEs, including accounting and finance, can affect their performance. Financial literacy significantly affects the performance of MSMEs, both in developed and developing countries (Wise, 2013). Good

performance can be seen from the knowledge and understanding of finance. Most financial mistakes are due to lack of financial knowledge (Lusardi & Mitchell, 2014). The information in the MSME report will be considered for decision making. If the resulting financial statements are incompetent, it will affect the performance of MSMEs. Financial literacy is essential to invest efficiently (Davidson et al., 2004). In addition to providing benefits for decision making, good financial information will be useful for increasing investment and increasing business capital.

There are a multitude of primary concerns pertaining to the sustainability of MSME businesses. Initially, it is noteworthy that micro, small, and medium enterprises (MSMEs) encounter challenges in effectively managing and mitigating various types of risks, including those originating from within the organization as well as those originating from external sources. It has been acknowledged by actors in the MSME sector that the absence of risk analysis and the implementation of suitable risk management techniques might render their internal systems more susceptible (Virglerova et al., 2020). The absence of risk management implementation in MSMEs may give rise to significant challenges and concerns. The resolution of the issue can be achieved by the application of the Technology-Organization-Environment Framework (TOE Framework) approach, which involves the identification of the different hazards present.

Furthermore, a significant number of micro, small, and medium enterprises (MSMEs) fail to adopt internal control mechanisms and risk management systems. The primary objective of implementing risk management is to mitigate potential hazards to optimize outcomes (Buganová & Šimíčková, 2019). The efficient execution of operational tasks might yield advantages for Micro, Small, and Medium Enterprises (MSMEs). Thirdly, the generation of financial statements that deviate from the prescribed accounting standards owing to insufficient understanding of accounting and finance principles. The enhancement of financial literacy among micro, small, and medium enterprises (MSMEs) within the business environment might lead to improved performance by bolstering fundamental organizational knowledge (Jappelli & Padula, 2013). A comprehensive understanding of accounting and finance is important to effectively assemble financial statements with the aim of enhancing the operational efficacy of micro, small, and medium enterprises (MSMEs).

In the context of emerging markets, particularly focusing on Indonesia, the interplay between knowledge management and risk-taking displays a positive influence on the financial performance of Small and Medium Enterprises (SMEs). One of the factors most often used to detect MSME bankruptcy is financial performance (Cheraghali & Molnár, 2023). Intriguingly, there exists a mediating effect due to negative innovation outcomes in this correlation (Games & Rendi, 2019). Ascertains that the adoption of enterprise risk management (ERM) methodologies significantly drives competitive advantage, subsequently enhancing the performance metrics of SMEs (Yang et al., 2018). Beyond traditional financial ratios and payment behavior variables, our findings show that the incorporation of change in management, employee turnover, and mean employee tenure significantly improve the model's predictive accuracy (Altman et al., 2023). The implementation of ERM needs to be continuously encouraged since the early MSMEs were established so that business actors are familiar with this concept.

In a parallel line of inquiry, Tan and Lee (2022) directed their focus on SMEs situated in Malaysia, endeavoring to comprehend the extent of ERM practice integration. The crux of their study is two-fold: firstly, pinpointing the predominant risks challenging SMEs, and secondly, gauging the degree of ERM incorporation. Through their findings, a potent message is delivered SMEs must be agile and responsive in recognizing and adjusting to potential risks in a volatile business milieu, and efficacious management of ERM can be a catalyst for gaining a competitive edge.

Shifting the focus towards corporate sustainability practices, Das et al. (2020) underscores the scenario within Asian emerging markets. A conspicuous observation from their study is the oversight in SMEs concerning social and environmental initiatives. They posit that a synergetic approach encompassing cooperative endeavors, shaping governmental policies, and nurturing a conducive organizational culture has the potential to enhance sustainability performance substantially. In another strand of SME research, Mainardes et al. (2022) propound that adept marketing strategies can empower SMEs to deliver superior value propositions in their products and services, even under resource constraints.

In the context of a Latin American backdrop, Kolbe et al. (2022) delve deep into how market orientation dovetailed with innovation capacity impacts the export metrics of SMEs. They elucidate the



criticality of both proactive and reactive market stances and the potency of innovative prowess, especially pertinent for SMEs navigating through emerging market challenges.

Collectively, these scholarly pursuits weave a rich tapestry of understanding about risk management paradigms within SMEs in burgeoning markets. The panorama stretches from exploring the ramifications of knowledge management and risk-taking strategies on financial outcomes, the indispensable role of ERM, barriers to risk management effectiveness, to the quintessence of marketing adeptness and sustainability stratagems. However, it's noteworthy, as highlighted by Chakabva et al. (2021) that the depth of scholarship on risk management in SMEs of emerging markets remains somewhat nascent, beckoning further exploration and insights.

The concept of an internal control system extends beyond mere procedural formalities. It is an intricate amalgamation of organizational structures, systematic methodologies, and strategic measures meticulously orchestrated to preserve organizational assets, validate the veracity and trustworthiness of financial records, bolster operational efficiency, and ensure adherence to prescribed managerial policies (Mulyadi, 2016). Defined more succinctly, internal control manifests as a pivotal instrument geared towards actualizing organizational objectives (Odunko, 2022).

When management policies are astutely tailored and applied, they can substantially augment the operational prowess of Micro, Small, and Medium Enterprises (MSMEs), propelling them towards goal realization. The nexus between internal control and organizational performance has been the focal point of several scholarly investigations. For instance, empirical studies by Nursyamsi et al. (2015) and Satria and Dewi (2019) unequivocally establish that robust internal control mechanisms can significantly enhance overall performance.

Complementing these findings, research spearheaded by Bahar and Ginting (2018) underscores the profound impact of the internal control system on the sustainability trajectory of MSMEs. A critical barometer for discerning the sustainability of MSMEs rests in their adeptness at assimilating and executing internal control systems within their daily operational frameworks. It becomes evident that an MSME's performance and sustainability are inextricably linked to the rigor and efficacy of its internal controls. In essence, an MSME that prioritizes and refines its internal control infrastructure is better poised to excel in its business endeavors.

A deeper examination of corporate governance unveils its quintessential role in amplifying the efficacy of the internal control system. According to Musah et al. (2022), stellar corporate governance practices have been identified as potent moderators in the nexus between the internal control system and financial metrics. The incorporation of robust corporate governance paradigms not only bolsters the proficiency of the internal control system but also acts as a linchpin in enhancing the financial performance trajectory of MSMEs.

Another paramount facet intertwined with the performance of MSMEs is risk identification. Risk management has its tentacles spread across a gamut of activities ranging from designing and consolidating to balancing and critically appraising, especially within the purview of risk management stratagems. Corroborating this stance, Kulathunga et al. (2020) elucidate that Entrepreneurial Risk Management has a pronounced positive impact on the performance metrics of MSMEs. The reason of risk management assimilation, as highlighted by Ogutu et al. (2018), is to seamlessly embed risk perspectives within an organization's structural and decision-making matrix. Such integrative processes empower MSME stakeholders to augment performance and steer decision-making through a risk management lens. Building on the principles of the broaden-and-build theory, Mchiri (2022) posits that entrepreneurs can cultivate their transient psychological resources to attain enhanced performance levels, thereby diminishing the effects of external shocks and navigating through significant crises, including the ongoing COVID-19 pandemic. The propositions offer valuable perspectives for practitioners, policymakers, and scholars.

Beyond the contours of risk and governance, sustainability emerges as a key determinant of business success. An MSME exhibiting commendable performance metrics showcases resilience, thriving even amidst economic tumult. (Putri et al., 2022) ventures into the realm of financial literacy, pinpointing indicators such as financial comprehension, credit and saving insights, investment acumen, and insurance knowledge as metrics for evaluation. An enriched understanding of these financial facets capacitates MSMEs to judiciously steward their finances. Consequently, as (Susan, 2020) affirm, such financial literacy

prowess significantly influences the performance continuum of MSMEs. Mastery in financial literacy thus evolves as an instrumental determinant in managerial deliberations (Allgood & Walstad, 2016). This ensures that decisions sculpted by MSMEs are predicated upon financial intel meticulously crafted per prevailing norms.

In particular, the approach adopted in SMEs for Risk Management (RM) seems not to be specifically studied and understood (Ferreira de Araújo Lima et al., 2020). Diving into the realm of innovation and technology, the theoretical model, colloquially termed the TOE (Technology-Organization-Environment) framework, underscores the adoption of tech-driven novelties (Tornatzky et al., 1990). Maroufkhani et al. (2020) proffer a detailed exposition, cataloging seven cardinal facets instrumental in risk identification and its ensuing influence on MSME adoption of risk management. These encompass top managerial involvement, institutional support, observability dynamics, experimental viability, the spectra of uncertainty and insecurity, and the intricacies of complexity, external backing, and organizational preparedness. Skafi et al. (2020) further elaborate on this by signaling that the TOE framework, particularly its security and complexity constituents, can catalyze the adoption of risk identification modalities. Collectively, these elements, curated under the TOE framework's aegis, become pivotal drivers, accentuating the significance of innovation and technology in the MSME landscape.

The Technology-Organization-Environment (TOE) framework plays a significant role in influencing the adoption of risk identification in organizations. Wallace et al. (2020) and Ullah et al. (2021) both propose extended TOE frameworks that include new dimensions and factors, such as cyber catalysts and practice standards, which are crucial in the context of cybersecurity and sustainable smart city governance. Mishra et al. (2019) further emphasizes the importance of the TOE framework in enterprise risk management using the resource-based view to link risks to organizational resources. Khalilzadeh et al. (2019) highlight the role of the TOE framework in identifying and prioritizing factors influencing risk tolerance.

In this study, the technology variables used are relative advantage, complexity, and security, which are the most common, relevant, and significant positive characteristics (Idris & Mohamad, 2017). Technology is an added value for MSMEs in terms of relative advantages, complexity, and security. For the organizational context used in this study is organizational readiness. The environmental context used in this study is the pressure of the competitors.

### 3. Research method

#### 3.1. Data selection

This study used a quantitative approach. The target respondents of this study are MSMEs that have not implemented the internal control system correctly and appropriately. The researchers took samples using the sampling method using non-probability sampling with an accidental sampling approach. Researchers use the G\*power method to determine the minimum number of samples to be taken. The sample size rate in the study was 0.95% or 5%, so the total of the minimum number of samples needed was 111 respondents (J. F. Hair et al., 2019).

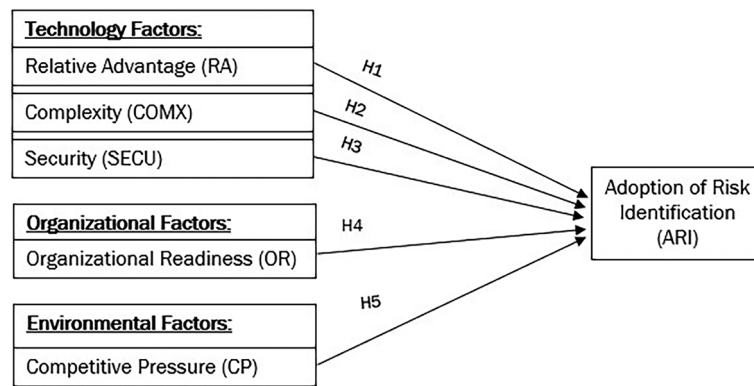
The questionnaire was distributed to 200 MSME representatives through an online Google Form. Out of these, we received 140 completed responses. After a thorough review for completeness and relevance to the study criteria, 111 responses were deemed suitable for analysis, resulting in a response rate of 70%.

#### 3.2. Data measurement

After the sample is determined, the researcher will distribute the questionnaire online to obtain the necessary data. Each questionnaire indicator is adopted from the TOE framework consisting of technological, organizational, and environmental points of view (Bany Mohammad et al., 2022). The questionnaire consists of 5 answers that correspond to the Likert scale with a value of 1=strongly disagree up to a value of 5=strongly agree.

After collecting all data, researchers used the SEM-PLS method to assess all data with the help of Smartpls 4.0. The stages in PLS consist of 3, namely, the measurement model, which is used to measure





**Figure 1.** Conceptual Framework.  
Source: Own.

the validity and reliability of the data. The measurement of each variable can be seen in the [Appendix](#). Second, by analyzing the structural model to see whether the model that has been built meets the criteria that have been set (Musyaffi et al., 2022). Finally, evaluate the hypothesis that has been proposed (Figure 1).

### 3.3. Conceptual framework and hypothesis development

This research uses a hybrid model with technology-organizational-environmental (TOE) method as a theoretical basis. Using the TOE framework, the factors (internal and external) can be explained that influence the adoption of risk management in MSMEs. In addition, the framework can also help MSMEs improve performance by adopting risk management.

Based on previous research, a conceptual framework was created according to the TOE framework that adopts risk management. There are several TOE factors that are proven to affect technology adoption, but in this study, the research team focused only on technology factors (relative advantage, complexity, and security), organizational factors (organizational readiness), and environmental factors (competitive pressure).

#### 3.3.1. Technology factor

According to the diffusion theory of innovation (DOI), relative advantage can be defined as a user considers the extent to which an innovation will be better than previous methods or competing technologies and positively affect users applying it periodically (Rogers et al., 2014). The relative level of excellence can be expressed as the degree to which the adoption of a new adoption can be felt. The use of IT provides positive value for management strategies related to aspects of communication, access to information, decision making, data management, and knowledge management in an organization (Adeosun et al., 2008). A business that applies relative advantages as the adoption of risk management will affect its performance. Business performance will be considered to have an advantage when the business actor applies risk management.

H1: The relative advantage has a positive effect on Adoption of Risk Identification.

It is important for MSME actors to be able to understand risk management to improve Adoption of Risk Identification. Compared to other indicators, complexity has been shown to positively affect the Adoption of Risk Identification. The challenge of implementing risk management arises when the MSME actors do not know and understand risk management thoroughly. Thus, if the MSME actors understand risk management well, the Adoption of Risk Identification will increase because the level of difficulty in implementing risk management is reduced.

H2: A high level of risk management complexity has a positive relationship with Adoption of Risk Identification.

Another indicator to consider in this study is safety. By implementing risk management, it is hoped that later MSME actors can maintain data security, both financial and operational activities that will affect the level of performance. Implementing risk management for data security is very necessary. Research

conducted by Asiaei and Ab. Rahim (2019) states that the adoption of data-related innovations requires security guarantees.

H3: Data security has a positive effect on the Adoption of Risk Identification.

### **3.3.2. Organizational factors**

This research was conducted to test the readiness of organizations to face existing challenges and obstacles. The readiness of MSMEs to face existing obstacles can be seen in the application of risk management in these MSMEs. Organizational readiness in SMEs has been shown to have a significant relationship with MSME performance previous research (Asiaei & Ab. Rahim, 2019). With the implementation of good risk management, business actors can face existing obstacles. This will certainly affect the improvement of Adoption of Risk Identification.

H4: Organizational readiness to face obstacles has a positive effect on Adoption of Risk Identification.

### **3.3.3. Environmental factors**

Based on the TOE framework, competitor pressure can affect the Adoption of Risk Identification. The pressure of competitors that is often experienced by MSME players in terms of the products produced is similar to that sold. Additionally, competitor pressure can also take the form of price competition. In related studies, several studies show that competition has a significant effect on Adoption of Risk Identification (Grandon & Pearson, 2004). Therefore, it is necessary to implement risk management that will help manage the risks experienced by competitors. If competitor pressure can be overcome properly, the Adoption of Risk Identification will increase.

H5: Competitive pressure has a positive effect on the Adoption of Risk Identification.

## **4. Data analysis**

This study used SmartPLS to test the effect of each hypothesis. SmartPLS is a multivariate statistical approach that allows one to estimate significant variables simultaneously that can be solved by linear regression or a combination of regression analysis and factor analysis. Techniques with this model can work effectively and allow analysis of complex models, containing variables with moderate or mediation relationships, and with relatively smaller sample sizes (Alqudah et al., 2019). Therefore, we use SmartPLS testing techniques to test the relationship of each hypothesis to analyze the data. Techniques for path modelling are needed for this integration. This is in response to the researchers' advice that PLS-SEM should be utilized if the study aims to make predictions or expand on an existing hypothesis (J. F. Hair et al., 2019). This technique can be used to assess the validity and dependability of existing variables after studying the structure model.

## **5. Results and interpretation**

### **5.1. Assessment of the measurement model**

The first step in performing an analysis with PLS is the measurement model to check the validity of the data with outer loading and AVE. The next step is CA and CR to check the reliability of the data.

The initial stages use SEM-PLS to check the data by performing a validity check (J. Hair & Alamer, 2022). This validity test was conducted to evaluate the AVE value and outer loading with value levels of 0.5 and 0.7, respectively. If the value is above the recommended one, then it means that every variable in the study meets the requirements of good validity. Based on the results of the validity test in Table 1 above, the value of the smallest outer load is 0.707 in COMX2. As for the largest outer loading value, COMX3 is 0.949. When viewed from the point of view of the evaluation of outer loading, all indicators in this study have values greater than 0.7 (the smallest value is 0.707). This indicates that the indicators in this study are valid. However, an AVE evaluation needs to be done to reinforce this. As a comparison and reinforcement of the data validity test results, the highest value of the AVE results is found in the

**Table 1.** Results of the PLS algorithm in evaluating the adoption of risk identification.

Item	Outer loading	CA	CR	AVE
Relative advantage (RA)		0.835	0.890	0.671
RA1	0.864			
RA2	0.826			
RA3	0.843			
RA4	0.738			
Complexity (COMX)		0.838	0.905	0.764
COMX1	0.944			
COMX2	0.707			
COMX3	0.949			
Security (SECU)		0.855	0.902	0.699
SECU1	0.766			
SECU2	0.893			
SECU3	0.899			
SECU4	0.776			
Organizational readiness (OR)		0.809	0.875	0.637
OR1	0.745			
OR2	0.755			
OR3	0.896			
OR4	0.786			
Competitive pressure (CP)		0.774	0.869	0.690
CP1	0.768			
CP2	0.830			
CP3	0.890			
Adoption of risk identification (ARI)		0.841	0.903	0.757
ARI1	0.911			
ARI2	0.904			
ARI3	0.789			

Source: Author's calculation with SEM-PLS.

**Table 2.** Fornell-Lercker adoption of risk identification.

	RA	COMX	SECU	OR	CP	ARI
RA	0.819					
COMX	0.122	0.874				
SECU	0.527	0.101	0.836			
OR	0.509	0.146	0.565	0.798		
CP	0.442	0.195	0.520	0.407	0.831	
ARI	0.668	0.189	0.594	0.431	0.449	0.870

Source: Author's calculation with SEM-PLS.

COMX indicator, which is 0.764. The lowest value is found in the OR indicator of 0.637. Thus, based on the results of the outer loading and AVE evaluation, all indicators meet the criteria of good validity.

The next stage is to evaluate the reliability of each indicator through CR and CA which have a minimum level value. 0.7 (J. Hair & Alamer, 2022). When viewed in Table 1 above, the lowest CR value is in the CP indicator, which is 0.869. For the highest CR value, it is in the COMX indicator, which is 0.905. Based on the test results, CR meets the data reliability. Then, in CA, the highest value is in the SECU indicator, which is 0.855. The lowest value is in the CP indicator, which is 0.774. So, based on the CR and CA tests, it can be concluded that the indicators in this study meet the requirements of good data reliability.

The next stage in measuring the data model is to analyze the validity of the discriminant by evaluating it from Fornell-Lercker. Based on Table 2 above, we can see the output of SEM-PLS regarding Fornell-Lercker. To meet the discriminant validity condition, the value of the square root AVE between the same indicator must exceed the value of the indicator with other different indicators. For example, the value of Fornell-Lercker RA – RA (0.819) must have a value greater than COMX – RA (0.122), SECU – RA (0.527), OR – RA (0.509), CP – RA (0.442), ARI – RA (0.668). RA results - When compared to other indicators, RA has a higher value. Based on the description in Table 2, the indicator values of COMX – COMX (0.874), SECU – SECU (0.836), OR – OR (0.798), CP – CP (0.831), and ARI – ARI (0.870) exceed the values of each indicator with other indicators. Thus, it can be concluded that the data in this study passed the Fornell-Lercker discriminant validity test.

The next step is to ensure the correlation between items that have size with other items by cross-loading evaluation. When the cross-loading value of each item against the indicator is greater than the cross-loading value, then the item meets the criteria of good discriminant validity through cross-loading evaluation. For example, based on Table 3, the values of the RA indicator for items RA1

**Table 3.** Cross-loading adoption of risk identification.

	RA	COMX	SECU	OR	CP	ARI
RA1	0.864	0.102	0.441	0.355	0.379	0.610
RA2	0.826	0.043	0.385	0.474	0.315	0.519
RA3	0.843	0.106	0.420	0.480	0.379	0.527
RA4	0.738	0.149	0.480	0.369	0.374	0.524
COMX1	0.112	0.944	0.091	0.170	0.199	0.195
COMX2	0.099	0.707	0.050	0.060	0.112	0.136
COMX3	0.110	0.949	0.119	0.136	0.191	0.156
SECU1	0.342	0.164	0.766	0.422	0.484	0.470
SECU2	0.450	0.160	0.893	0.531	0.491	0.516
SECU3	0.557	0.076	0.899	0.500	0.462	0.586
SECU4	0.387	-0.100	0.776	0.428	0.271	0.384
OR1	0.426	0.001	0.510	0.745	0.376	0.395
OR2	0.372	0.191	0.426	0.755	0.297	0.268
OR3	0.426	0.197	0.447	0.896	0.333	0.347
OR4	0.385	0.109	0.402	0.786	0.276	0.340
CP1	0.434	0.101	0.341	0.344	0.768	0.340
CP2	0.308	0.287	0.401	0.255	0.830	0.342
CP3	0.365	0.112	0.534	0.403	0.890	0.427
ARI1	0.704	0.197	0.613	0.473	0.420	0.911
ARI2	0.577	0.139	0.489	0.330	0.424	0.904
ARI3	0.413	0.151	0.419	0.292	0.313	0.789

Source: Author's calculation with SEM-PLS.

**Table 4.** Heterotrait-Monotrait ratio (HTMT) adoption of risk identification.

	RA	COMX	SECU	OR	CP
COMX	0.147				
SECU	0.616	0.190			
OR	0.619	0.188	0.671		
CP	0.553	0.246	0.619	0.502	
ARI	0.772	0.219	0.678	0.499	0.544

Source: Author's calculation with SEM-PLS.

(0.864), RA2 (0.826), RA3 (0.843), RA4 (0.738). While the value of the RA1, RA2, RA3 and RA4 items against several indicators such as COMX (0.102, 0.043, 0.106, 0.149), SECU (0.441, 0.385, 0.420, 0.480), OR (0.355, 0.474, 0.480, 0.369), CP (0.379, 0.315, 0.379, 0.374), and ARI (0.610, 0.519, 0.527, 0.524) is more significant than RA. Other indicators have better values compared to other indicators.

HTMT performance evaluation is conducted to measure criteria from hetero-traits to mono-traits. For correlation to occur, HTMT must have a value below 0.9 (Henseler et al., 2015). Based on Table 4 above, the range of HTMT values ranges from 0.147 (COMX – RA) to the largest value of 0.772 (ARI – RA). All HTMT values in Table 5 are below 0.9. Thus, it can be implied that there are no correlated indicators.

## 5.2. Structural model

The next stage is the structural model. To evaluate the framework of the model that has been created, a structural model evaluation is carried out. This stage is done by predicting the model through predictive relevance ( $Q^2$ ) and R-square ( $R^2$ ).

The minimum level for R-squares is 0.19 low, 0.33 medium, and 0.67 high. In Table 5, the  $R^2$  on the ARI indicator is in the medium category because the value of the  $R^2$  is 0.543 or 54.3%. So, it can be concluded that the magnitude of the variance of the ARI variable that can be explained by RA, COMX, SECU, OR, and CP is 54.3% and is included in the category of moderate or moderate influence levels. Next, assess the value of  $Q^2$  to predict the framework model that has been prepared with a recommendation value greater than 0 (Henseler et al., 2015). When viewed in Table 5, the value of ARI3 has the smallest value (0.171). The largest value is in ARI1, which is 0.521. Furthermore, the value of the RMSE in the PLS is lower than the value of the RMSE in the LM. For example, in the ARI1 indicator, the RMSE PLS value is 0.491, while the RMSE LM value is 0.546. So, it can be concluded that all elements of endogenous variable measurement (ARI) of the proposed PLS model have a lower RMSE value compared to the LM (linear regression) model, then the proposed PLS model has medium predictive power.

**Table 5.** Evaluation of  $Q^2$  and  $R^2$ .

	$Q^2$ predict	PLS-SEM_RMSE	LM_RMSE	$R^2$	Decision
ARI				0.543	Moderate
ARI1	0.521	0.491	0.546		Moderate
ARI2	0.330	0.595	0.652		Moderate
ARI3	0.171	0.631	0.739		Moderate

Source: Author's calculation with SEM-PLS.

**Table 6.** Hypothesis result.

Hypothesis		Path	P-values	Decision
H1	RA -> ARI	0.439	0.000	Accepted
H2	COMX -> ARI	0.098	0.059	Accepted
H3	SECU -> ARI	0.316	0.001	Accepted
H4	OR -> ARI	-0.039	0.337	Rejected
H5	CP -> ARI	0.055	0.235	Rejected

Source: Author's calculation with SEM-PLS.

### 5.3. Hypothesis test results

This section is carried out to test the hypothesis proposed by the researcher with details of the results of SEM-PLS according to the following Table 6.

Based on the table above, 5 hypotheses are proposed in this study. However, of the 5 hypotheses, there are 2 hypotheses that are rejected, namely H4 about the OR - ARI indicator (0.337) and H5 about the CP - ARI indicator (0.235). This is because both hypotheses do not meet the criteria that have been set in general to determine the hypothesis, namely the min.  $P$ -value of 0.05. Compared to  $P$ . H1, H2, and H3 there is a positive influence on ARI. This is because RA (0.000), COMX (0.059), and SECU (0.001) have a  $P$ -value below 0.05. Thus, it can be concluded that 3 hypotheses are accepted, while the other 2 hypotheses are rejected.

The highest value in the path is 0.439 contained in the 1st hypothesis (RA - ARI). This means that the RA indicator has a significant positive relationship of 43.9% with ARI. Meanwhile, the second largest relationship is found in the third hypothesis, namely SECU - ARI, with a significance value of 31.6% (path = 0.316). Thus, it can be implied that there are 2 hypotheses that have no significant effect (H4 and H5), and the rest have a significant positive impact.

## 6. Discussion

This study expands the TOE model by identifying other characteristics that affect the adoption of risk identification, especially RA, COMX, and SECU. RA proved to be the most positive variable on ARI, which was 43.9%. This shows that MSMEs are aware of the importance of implementing risk identification, so that it can be a relative advantage for their business sustainability. The main factor for someone wanting to use technology is their desire to use it (Venkatesh et al., 2012). The higher the intention of MSME actors, the more likely they are to use technology to implement risk identification, to facilitate their business operations. This is also supported by previous research, where the willingness to use can continue to increase its use (Damodharan & Ahmed, 2022); (Martinez & McAndrews, 2022).

Drawing parallels from the seminal work of Venkatesh et al. (2012), the underlying motivation for individuals to adopt technology largely rests on their inherent desire to utilize it. Extending this logic, as the intentionality of MSME stakeholders heightens, there's a commensurate increase in their proclivity to deploy technology for risk identification, thereby streamlining their business functionalities. This intention-behavior nexus finds resonance in preceding studies, which emphasize that an enhanced willingness invariably drives heightened usage.

Delving deeper, this study elucidates that the principal rationale behind championing risk identification is to smoothen operational intricacies. Given the primary goal of enhancing MSME efficiency, it becomes indisputably necessary for MSME stakeholders to acquire and effectively implement risk management solutions (Baral et al., 2022). It is evident from previous research that the purpose of implementing risk management is to minimize risk and get maximum results (Buganová & Šimíčková, 2019).

The difficulties experienced by MSME actors can be properly overcome if they implement good risk management as well. Another study that supports these results is that MSME actors can minimize the occurrence of risks by implementing appropriate risk management (Virglerova et al., 2020). The performance of MSMEs can increase if the risk management applied to MSMEs is appropriate, so that the operational activities carried out can run effectively and efficiently.

In addition to relative advantages and complexity, another factor that improves the adoption of risk identification is security. MSME actors need to implement internal control systems and risk management. By implementing an internal control system, data security, be it financial statements or other reports, can be well maintained (Ríos-Manríquez, 2021). However, there are still many small businesses that do not support or even implement risk management due to lack of competent resources (Hobijn & Jovanovic, 2001). Competent resources are needed to maintain the confidentiality of business data and affect the performance of MSMEs (Talaulikar et al., 2022). This is supported by previous research, namely the adoption of data-related innovations that require security guarantees (Asiaei & Ab. Rahim, 2019). With competent resources, the adoption of risk identification can increase due to the guarantee of business data security.

Another factor that can improve the adoption of risk identification is the organization readiness to face the upcoming obstacles. Implementing good risk management will affect the performance of MSMEs because risk management is involved in designing, compiling, equalizing, and evaluating activities, especially in strategies to overcome future risks (Ríos-Manríquez, 2021). However, the use of risk identification did not result in a substantial impact on the performance of MSMEs in relation to organizational readiness (Kyal et al., 2021). MSMEs will be ready to face risks in the future with the implementation of good risk management. However, the results of this study produce different things with this hypothesis, where OR does not have a significant effect on ARI. This is because the OR does not see ARI improving MSME performance based on the adoption of risk identification. This is also supported by previous research, where OR is not a factor that causes an increase in MSME performance (Hanum & Sinarasri, 2018). The performance of MSMEs can be improved not only by organizational readiness but also by risk management and a good and orderly control system, which can be achieved if the resources owned are competent and superior.

This research also shows that competition pressure does not have a significant effect on the adoption of risk identification. There are many reasons why competition pressure does not affect MSMEs performance, one of which is the implementation of good risk management. Even if the products sold have similarities with competitors, if MSME players have good risk management, then it is not a problem. In fact, there will be an opportunity for MSME players to develop new product innovations. MSMEs can still thrive and develop new product innovations even in the presence of competition if they have good risk management practices (Singh et al., 2023). Efficiency in an organization can be influenced by effective internal control to improve the performance of MSMEs (Cheng et al., 2018). Operational activities can run smoothly if internal control is carried out effectively. This is supported by previous research that states that the internal control system affects the sustainability of MSMEs (Bahar & Ginting, 2018). The factors that increase MSME performance are internal control and good risk management. These findings suggest that internal control and risk management are crucial factors that can positively impact the performance of MSMEs, regardless of competition pressure (Latifah et al., 2021).

## 7. Conclusions and recommendations

In conclusion, this study significantly extends the current understanding of MSME risk management adoption by integrating variables such as RA, COMX, and SECU into the TOE model. This approach not only demonstrates the originality of the article but also provides a comprehensive framework for examining MSME risk management adoption behavior. Theoretically, this research contributes to the broader discourse on technology adoption and risk management in small and medium enterprises, offering fresh perspectives that challenge and expand upon traditional models.

Practically, the findings provide MSME stakeholders with critical insights into the importance of risk management and internal control systems, highlighting actionable strategies for improving operational efficiency and data security. Furthermore, the study underscores the societal impact of robust risk management practices in MSMEs. It highlights how effective risk management can contribute to the broader economic stability and growth, especially in developing economies where MSMEs play a crucial role.



Additionally, the findings have significant policy implications. They suggest the need for supportive regulatory frameworks and policies that encourage and facilitate the adoption of advanced risk management practices among MSMEs. This can lead to a more resilient and competitive MSME sector, which is vital for economic development.

Despite its contributions, this study acknowledges certain limitations, such as its regional focus, which may limit the generalizability of its findings. Future research could thus explore these variables in different geographical contexts or through longitudinal studies to understand the long-term impact of these factors on MSME risk management.

Based on the limitations and findings, future research should also consider examining the role of cultural factors in the adoption of risk management practices and how they influence MSME performance in various socio-economic settings.

Finally, this research underscores the vital role of comprehensive risk management in enhancing the performance and sustainability of MSMEs, offering a valuable reference point for both scholars and practitioners in the field. It contributes to the ongoing dialogue on sustainable business practices, highlighting how MSMEs can navigate challenges and seize opportunities in an increasingly complex business environment.

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## Authors' contributions

This article represents a collaborative effort among all authors, who have each made significant contributions to the development and completion of this study. I Gusti Ketut Agung Ulupui: Conceived and designed the study, coordinated the research project, and contributed to the final approval of the version to be published. Also responsible for drafting the article and revising it critically for important intellectual content. Gentiga Muhammad Zairin: Played a key role in the analysis and interpretation of data, contributed to the drafting of the article, and provided critical revisions for intellectual content. Ayatulloh Michael Musyaffi: Assisted in the conception and design of the study, played a significant role in the analysis of data, and was involved in drafting and revising the manuscript. Febe Dwi Sutanti: Contributed to data collection, analysis, and interpretation, and assisted in drafting and revising the manuscript critically for important intellectual content. All authors have read and approved the final version of the manuscript to be published. Each author agrees to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

## Disclosure statement

The authors declare that they have no competing interests in relation to this research. There are no conflicts of interest, financial or otherwise, that could have influenced the work reported in this manuscript.

## About the authors

**I Gusti Ketut Agung Ulupui** is a distinguished academician and lecturer with a profound dedication to the field of accounting and finance based at Accounting Department, Faculty of Economics, Universitas Negeri Jakarta. Her expertise and passion for teaching have seen her impart knowledge across various prestigious institutions in Indonesia from 1995 until now.

**Gentiga Muhammad Zairin** is a dedicated lecturer and researcher based in Indonesia, specializing in the fields of sustainability, corporate governance, risk management, and accounting. Holding a position at Accounting Department, Faculty of Economics, Universitas Negeri Jakarta, he actively contributes to the academic community through both teaching and comprehensive research.

**Ayatulloh Michael Musyaffi** is a lecturer at the Accounting Department, Faculty of Economics, Universitas Negeri Jakarta. He is a lecturer and researcher focusing on financial technology and accounting information system.

**Febe Dwi Sutanti** is an accounting study program student at Faculty of Economics, Universitas Negeri Jakarta. Her research centers on taxation, accounting management, and SME's research in accounting.

## ORCID

I Gusti Ketut Agung Ulupui  <http://orcid.org/0000-0001-8597-6851>  
 Gentiga Muhammad Zairin  <http://orcid.org/0000-0003-0991-467X>  
 Ayatulloh Michael Musyaffi  <http://orcid.org/0000-0001-7335-0261>

## Data availability statement

The datasets generated and/or analyzed during the current study are not publicly available due to ethical and privacy concern. However, they are available from the corresponding author on reasonable request. The data supporting the findings of this study are contained within the manuscript. Further detailed data or materials related to this research may be requested from the corresponding author, I Gusti Ketut Agung Ulupui. Requests for access to these data will be considered by the author team, and data will be shared in a manner that adheres to ethical standards and respects confidentiality and privacy obligations. In cases where data cannot be shared openly due to ethical or privacy concerns, the authors commit to retaining the data and making them available upon reasonable request, subject to necessary approvals and conditions.

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## Appendix

Variable	Item	Measurements	Source
Adoption of risk identification (ARI)	ARI1	My business will conduct the identification of risk management.	Tu (2018)
	ARI2	My efforts will be to identify risks consistently.	
	ARI3	I would recommend the use of risk management to others.	
Relative advantage (RA)	RA1	By identifying risks, my business can better manage operational activities.	Agrawal (2015)
	RA2	By identifying risks, it is possible to utilize the remaining production waste.	
	RA3	By identifying risks, my business can compete with competitors.	
	RA4	By identifying risks, it allows my business to deliver goods on time.	
Complexity (COMX)	COMX1	I did not find it difficult to identify risks to my business	Lai et al. (2018)
	COMX2	I did not find it difficult to identify risks in my business	
	COMX3	I did not find it difficult to understand and apply risk identification to my business	
Security (SECU)	SECU1	My business requires the implementation of risk identification that focusses on the security of my business data.	Salleh and Janczewski (2016)
	SECU2	My business requires the implementation of risk identification to manage my business financial information.	
	SECU3	My business requires the application of risk identification for the management of raw materials for my business.	
	SECU4	By implementing risk identification, I can map risks that can improve the security of my business.	
Organizational readiness (OR)	OR1	The lack of business capital can hinder my business because I do not apply risk identification to my business.	Chen et al. (2015)
	OR2	The lack of information technology can hinder my business because I do not implement risk identification.	
	OR3	Lack of risk identification skills can hinder my efforts.	
	OR4	The lack of skills in resources can hinder my efforts by not implementing risk identification.	
Competitive Pressure (CP)	CP1	My business applies risk identification because I see many competitors in this industry.	Lai et al. (2018)
	CP2	Many competitors apply risk identification so that my business is threatened with closure because my business does not apply risk identification.	
	CP3	My business applies risk identification to determine the advantages of competitors	

Source: Adoption from TOE framework.