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Assessing the Moderating Role of Intellectual Capital on the Relationship Between Natural Disasters, Enterprise Risk Management, And Performance in Indonesian MSMEs

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Abstract

The effective implementation of enterprise risk management and the optimal utilization of intellectual capital are increasingly recognized as essential factors in enhancing the resilience and sustainability of Small and Medium Enterprises (SMEs) operating in disaster-prone environments. This study investigates the influence of natural disasters and enterprise risk management on the performance of Indonesian SMEs while also examining the moderating role of intellectual capital in these relationships. The research was conducted among SMEs operating in the XY region of Indonesia, an area characterized by considerable exposure to natural disaster risks. Employing a quantitative research design, data were collected through structured questionnaires distributed to XX SMEs selected using purposive sampling techniques. The proposed relationships were assessed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The results reveal that natural disasters, enterprise risk management, and intellectual capital each exert a significant positive influence on SME performance. The findings further indicate that the moderating effect of intellectual capital is not uniform across the proposed relationships. While intellectual capital does not significantly strengthen the relationship between natural disasters and SME performance, it significantly enhances the positive effect of enterprise risk management on SME performance. These findings suggest that both enterprise risk management and intellectual capital play important roles in improving organizational performance, particularly for SMEs operating under conditions of disaster-related uncertainty and risk.

Keywords: *Intellectual Capital, Natural Disasters, Enterprise Risk Management, Performance, Indonesia MSMEs, SME performance.*

INTRODUCTION

The growing occurrence and severity of natural disasters have become a major threat to the continuity and resilience of micro, small, and medium enterprises (MSMEs) in Indonesia. Hazard events, including

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earthquakes, floods, landslides, and tsunamis, often disrupt business operations and generate substantial economic and operational consequences for affected enterprises. These consequences may extend beyond financial losses to include supply chain interruptions, reduced market access, and damage to organizational resources. Given Indonesia's geographical location and high exposure to natural hazards, a considerable number of MSMEs remain vulnerable to disaster-related disruptions. Consequently, strengthening risk preparedness and adaptive capacity has become an essential requirement for maintaining business sustainability in disaster-prone regions (Jayasundara et al., 2019).

To enhance organizational preparedness against such uncertainties, MSMEs increasingly require a structured approach to risk governance. Enterprise Risk Management (ERM) offers an integrated framework that enables organizations to systematically identify, assess, monitor, and respond to potential risks across various business functions. Through the implementation of ERM, MSMEs can improve their ability to anticipate adverse events and minimize the negative consequences associated with natural disasters. Nevertheless, the effectiveness of ERM in improving organizational outcomes may depend on the availability of strategic internal resources. One important resource is intellectual capital, which encompasses the knowledge, competencies, expertise, and experience embedded within individuals and organizational systems. As an intangible strategic asset, intellectual capital can strengthen risk-management capabilities, support organizational learning, and improve the capacity of MSMEs to respond effectively to environmental uncertainties and disaster-related challenges (Shatnawi et al., 2019).

Recent studies have shown that MSMEs in Indonesia are significantly affected by natural disasters, resulting in operational disruptions and challenges in maintaining sustainability (Lestari et al., 2023). Enterprise Risk Management frameworks facilitate proactive management practices that potentially reduce the negative consequences of unpredictable environmental shocks, thereby enhancing organizational resilience (Iskandar et al., 2024). Despite its recognized benefits, the effectiveness of Enterprise Risk Management (ERM) implementation among MSMEs remains inconsistent across organizations, as differences in internal capabilities, resource availability, and managerial competencies may influence the extent to which ERM contributes to organizational performance. Prior studies suggest that internal organizational capabilities especially intellectual capital play a critical role in determining how effectively risk management translates into enhanced firm performance. Intellectual capital encompasses intangible resources such as human skills, organizational knowledge, and relational assets, which combined can strengthen adaptive capacity and strategic decision-making (Nazir et al., 2024). In this respect, intellectual capital extends beyond traditional financial or physical assets and can be a pivotal driver of organizational resilience. Recent empirical

evidence also indicates that intellectual capital improves disaster management capability and responsiveness, particularly when integrated with ERM practices (Abdalatif & Yamin, 2025). Furthermore, studies focusing on MSMEs in Indonesia demonstrate that intellectual capital positively influences the performance of MSMEs, with components such as human capital, structural capital, and customer capital showing significant relationships with firm performance that provide strategic advantages in improving overall business outcomes (Mulyadi & Basuki, 2024).

The issues related to the relationship between natural disasters, corporate risk management, and stock returns in Indonesian MSMEs that are not addressed can have significant impacts. Firstly, financial losses are the primary risks faced by MSMEs. Natural disasters can cause losses of physical assets, disrupted production, and high recovery costs. Without effective risk management, MSMEs may not be prepared to face these losses, which can ultimately negatively impact their stock returns. Secondly, loss of customers and market share is also a serious consequence. Poorly addressed natural disasters can cause MSMEs to lose customers and market share due to their inability to meet customer demand resulting from disrupted production or damaged infrastructure. Thirdly, the reputation of MSMEs may be tarnished due to poor handling of natural disasters. This can damage customer trust and loyalty, making it difficult for MSMEs to restore their image in the future. Fourthly, a decline in financial performance may also occur (Sofia et al., 2021).

Research in other contexts has highlighted the positive influence of intellectual capital on disaster management capabilities. Recent findings indicate that intellectual capital significantly enhances firms' ability to manage disaster risk and improve responsiveness to external disruptions (Abdalatif & Yamin, 2025; Nazir et al., 2024). Additionally, in the small business setting, intellectual capital has been linked to improved risk identification, enhanced adaptive capacity, and stronger overall performance outcomes, especially when integrated with formal risk management practices. These studies underscore the potential moderating effect of intellectual capital on the relationship between ERM and performance outcomes, yet there remains limited investigation of this interplay within the specific context of natural disaster risk in Indonesian MSMEs.

Issues related to natural disasters and corporate risk management left unaddressed can impact the overall financial performance of MSMEs, reflected in declining stock returns and reduced company value. Fifthly, growth limitations can also occur. Without proper handling of natural disaster risks, MSMEs may experience constraints in their growth and business development, hindering their potential to compete and thrive in an increasingly competitive market. Lastly, social and environmental impacts also need to be considered. Unaddressed issues related to natural disasters can have serious social and environmental impacts, such as environmental damage, loss of lives, and other social losses that can affect the wider community. By understanding the implications if

these issues are not addressed, it is hoped that MSMEs and other stakeholders will pay more attention to the importance of corporate risk management in facing natural disasters and maintaining overall company performance.

Existing studies have emphasized the importance of intangible organizational resources and governance mechanisms in enhancing risk-management effectiveness and organizational outcomes. Khan and Ali (2017) demonstrated that intellectual capital can strengthen the relationship between strategic management practices and firm performance, suggesting its potential role as a moderating factor in risk-management contexts. Similarly, Sutrisno et al. (2023) highlighted the significance of internal governance mechanisms in mitigating organizational risks through effective monitoring and control processes. Supporting this perspective, Yolanda & Efriyenti (2021) argued that sound governance practices contribute to greater operational efficiency and foster stronger relationships among managers, boards, shareholders, and other stakeholders. Building on these findings, this research examines how intellectual capital interacts with natural disasters and Enterprise Risk Management (ERM) in influencing MSME performance in Indonesia.

The study focuses on whether knowledge-based organizational resources enable MSMEs to respond more effectively to disaster-related uncertainty and improve the effectiveness of risk-management practices. By exploring these relationships, the research seeks to explain the organizational conditions that support MSME resilience and sustainability in disaster-prone environments. The study also provides empirical insight into the integration of ERM and intellectual capital within the Indonesian MSME context, while offering practical considerations for strengthening business adaptability and long-term organizational performance.

LITERATURE REVIEW

Natural Disaster

Disasters are generally understood as events that significantly disrupt the functioning of communities and create substantial social, economic, environmental, and psychological consequences. In the Indonesian context, Law No. 24 of 2007 defines disasters as occurrences arising from natural, non-natural, or human-induced factors that threaten public safety, damage infrastructure and the environment, and adversely affect community livelihoods (BNPB, 2019). Such events often generate multidimensional impacts, causing physical destruction, financial losses, and persistent disruption to socioeconomic activities. Based on the Indonesian disaster management framework, disasters can be categorized into natural and non-natural disasters.

Natural disasters originate from environmental and geological processes, including earthquakes, volcanic eruptions, floods, storms, landslides, and other naturally occurring hazards. These events

frequently disrupt economic activities, damage physical assets, and weaken the resilience of affected communities.

In contrast, non-natural disasters result from factors associated with human activities or technological systems, such as industrial accidents, technological failures, epidemics, and disease outbreaks. Regardless of their origin, both categories of disasters pose significant challenges to organizational sustainability and require effective risk-management strategies to minimize their adverse impacts. These disasters also have serious impacts on communities. Complex disasters occur due to a combination of natural and non-natural disasters, resulting in negative impacts on community life. Examples include environmental pollution, disease epidemics, ecosystem damage, and others. Here are the dimensions and indicators (Ainuddin et al., 2015):

Table 1. Dimensions and indicators of Natural Disasters

No	Dimensions	Indicator
1.	Material Losses	Financial losses (in the form of direct and indirect losses)
		Infrastructure losses
		Loss of economic assets
2.	Environment	Damage to the natural environment (deforestation, habitat destruction)
		Ecosystem damage
		Environmental pollution
3.	Economy	Economic losses (losses in the agricultural, industrial, tourism sectors)
		Impact on economic productivity

Recent studies highlight that natural disasters not only affect physical infrastructure and economic assets but also disrupt supply chains, reduce SME productivity, and hinder long-term business sustainability. In Indonesia, MSMEs are particularly vulnerable due to limited risk management capabilities, low disaster preparedness, and dependence on localized markets (Ramada, 2024; Utami et al., 2021). Furthermore, the social and psychological impacts on entrepreneurs and employees can exacerbate operational inefficiencies and increase business closure risk after severe disaster events.

Enterprise Risk Management

Risk management refers to organizational efforts aimed at anticipating uncertainty and minimizing potential disruptions that may affect business activities and strategic objectives. These efforts include identifying potential threats, evaluating their possible consequences, and implementing appropriate actions to reduce organizational vulnerability, implementing risk-control measures, and continuously monitoring their effectiveness. According to Djojosoedarso, risk management represents the application of managerial functions in dealing with various forms of risk encountered by organizations, households, and society (Agustin et al., 2022). Consequently, risk management involves integrated organizational actions aimed at reducing exposure to uncertainty

through coordinated decision-making, strategic control, and continuous monitoring of potential risks. to ensure that potential threats can be managed effectively and organizational sustainability can be maintained (Putra et al., 2023). Below are its dimensions and indicators (Lundqvist, 2014).

Table 2. Dimensions and Indicators of Enterprise Risk Management

No	Dimensions	Indicators
1.	Risk Identification	Risk identification process, number of risks identified, level of risk urgency.
2.	Risk Evaluation	The risk evaluation method used, the level of risk assessed, the impact and probability of the risk.
3.	Risk Assessment	Determination of risk level (high, medium, low), determination of risk mitigation actions.
4.	Crisis Management	Company preparedness in facing a crisis, effectiveness of response to a crisis, post-crisis evaluation
5.	Risk Monitoring and Reporting	Implemented risk monitoring system, quality of risk reporting to related parties.

ERM has been shown to improve organizational resilience in SMEs by enhancing preparedness and structured response mechanisms during crises. Recent literature highlights that SMEs with formal ERM frameworks are better positioned to identify, assess, and respond to complex business shocks, embedding risk processes into decision-making and contributing to long-term organizational continuity and adaptation (Koporcic et al., 2026; Wieczorek-Kosmala & Henschel, 2022). Moreover, ERM sophistication is associated with higher risk awareness and dynamic capabilities that enable firms to respond to external shocks, supporting organizational adaptability and crisis resilience (Koporcic et al., 2026).

Performance

Organizational performance reflects the ability of a business to maintain operational stability, achieve business targets, and respond effectively to environmental challenges. For MSMEs, performance is closely associated with business continuity, financial capability, market adaptability, and the capacity to remain competitive under uncertain conditions. Enterprises with stronger performance are generally more capable of improving operational effectiveness, sustaining growth, and responding to external pressures. In dynamic business environments, the effective utilization of organizational resources becomes increasingly important. Both tangible and knowledge-based resources can strengthen business resilience, encourage innovation, and support the development of long-term competitiveness among MSMEs. The dominant factor that can determine performance is the resources of SMEs. The performance of SMEs must receive special attention if the company wants to grow and be competitive.

Table 3. Dimensions and Indicators of Performance

No	Dimension	Indicator
1.	Market Growth	The rate of increase in sales or revenue over time, market share growth, number of new customers acquired, number of products or services sold.
2.	Productivity	Production level per unit of time or resources used, efficiency in the use of resources, such as labor, good materials and time, level of quality of products or services produced, level of smoothness of the production process.
3.	Brand Reputation	Level of brand awareness in the market, level of customer trust and loyalty to the brand, customer perception of product or service quality, positive reputation among business partners or within a particular industry.
4.	Customer Satisfaction	Level of customer satisfaction with the product or service provided, level of customer retention or rate of returning customers, level of positive feedback from customers, level of recommendation of the product or service to others.

Recent empirical studies indicate that structured risk management practices and the development of intellectual resources have a positive influence on MSME performance. Systematic evidence suggests that risk management frameworks help firms identify and mitigate operational risks, leading to improved operational effectiveness and organizational resilience, which in turn support performance outcomes (Yuwono & Rachmawati, 2024). Additionally, comprehensive reviews of intellectual capital research demonstrate that knowledge-based organizational resources such as human expertise, structural capability, and relational assets tend to support stronger SME performance, enhancing competitive advantage and long-term sustainability (Adhikary & Ghosh, 2025).

Intellectual Capital

Intellectual Capital (IC) has emerged as a critical organizational resource in the knowledge-based economy, where intangible assets increasingly determine an organization's ability to create value and sustain competitive advantage. The concept of intellectual capital extends beyond physical and financial resources by emphasizing the strategic importance of knowledge, expertise, innovation, organizational processes, and relational networks. As a result, intellectual capital has become a widely used framework for evaluating knowledge-based assets that contribute to organizational performance and long-term sustainability. The literature presents various perspectives on the definition and components of intellectual capital. In the Indonesian context, the concept is closely associated with the recognition of intangible assets as regulated under PSAK No. 19. This standard

characterizes intangible assets as identifiable non-monetary resources without physical substance that provide future economic benefits and support organizational activities (Asiaei et al., 2023). From a broader managerial perspective, intellectual capital encompasses the collective knowledge and capabilities embedded within individuals, organizational structures, and stakeholder relationships that enable firms to enhance innovation, improve decision-making quality, and achieve superior performance outcomes. Below are its dimensions and indicators (Mavridis & Vatalis, 2012):

Table 4. Dimensions and indicators of Intellectual Capital

No	Dimensions	Indicators
1.	Human Capital	Level of employee education and qualifications, level of employee satisfaction and loyalty, investment in employee training and development.
2.	Structural	Existing systems and procedures in the company, success of information systems and information technology, success of product and process innovation.
3.	Customer Relations	Customer satisfaction, customer loyalty, success in maintaining long-term relationships with customers.
4.	Intellectual Property	The number and quality of patents, trademarks, copyrights and other intellectual assets owned by the company.
5.	Innovation	Level of product and process innovation, success in creating new products and services, investment in research and development.

Intellectual capital is increasingly viewed as an important organizational resource that supports MSME performance and business sustainability. The effective use of knowledge, organizational capability, and external relationships enables firms to improve innovation capacity, strengthen operational effectiveness, and respond more adaptively to environmental change. Previous studies have emphasized that the major dimensions of intellectual capital, including human capability, organizational systems, and relational networks, contribute positively to organizational development and business performance(Adhikary & Ghosh, 2025). These resources support knowledge sharing, organizational learning, and collaborative interactions that help MSMEs maintain competitiveness and sustain long-term growth. Empirical evidence further indicates that firms possessing stronger intellectual resources are generally more capable of improving productivity, optimizing business processes, and adapting to changing market conditions. Consequently, intellectual capital plays an important role in strengthening organizational flexibility and supporting the long-term resilience of MSMEs, enabling firms to maintain performance in increasingly uncertain and competitive environments (Pratama et al., 2024).

METHOD

This study applied a quantitative research design to examine the relationships among natural disasters, Enterprise Risk Management (ERM), intellectual capital, and MSME performance in Indonesia. The respondents consisted of MSMEs operating in the XY region, selected through purposive sampling based on predetermined criteria. Data were collected using questionnaires supported by relevant documentation. The proposed model was analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) with SmartPLS software. The analysis included measurement-model evaluation and structural-model assessment. Construct adequacy was examined through validity and reliability indicators, while hypothesis testing was conducted using bootstrapping procedures to determine the significance of the proposed relationships. (Sarstedt et al., 2020; Hair et al., 2019) The analysis involved measurement-model evaluation followed by structural-model testing to assess the proposed relationships among the research variables.

Table 5. Instrument Validity and Reliability Tests

Instrument Testing	Tests Used
Validity Test	Convergent Validity AVE
Reliability Test	Cronbach Alpha Composite Reliability

Structural model evaluation focused on examining the relationships among the research constructs and measuring the model's explanatory strength using the coefficient of determination (R^2). Furthermore, the significance of the hypothesized paths was evaluated using bootstrapping procedures in SmartPLS, with statistical significance determined at the 5% level.

RESULTS

The findings of this study are presented and discussed in detail through several subsections, each addressing specific aspects of the proposed research model and hypothesis testing results.

Measurement Model Evaluation (Outer Model)

Figure 1 presents the outer loading values, indicating that the measurement constructs achieved acceptable validity and reliability criteria.

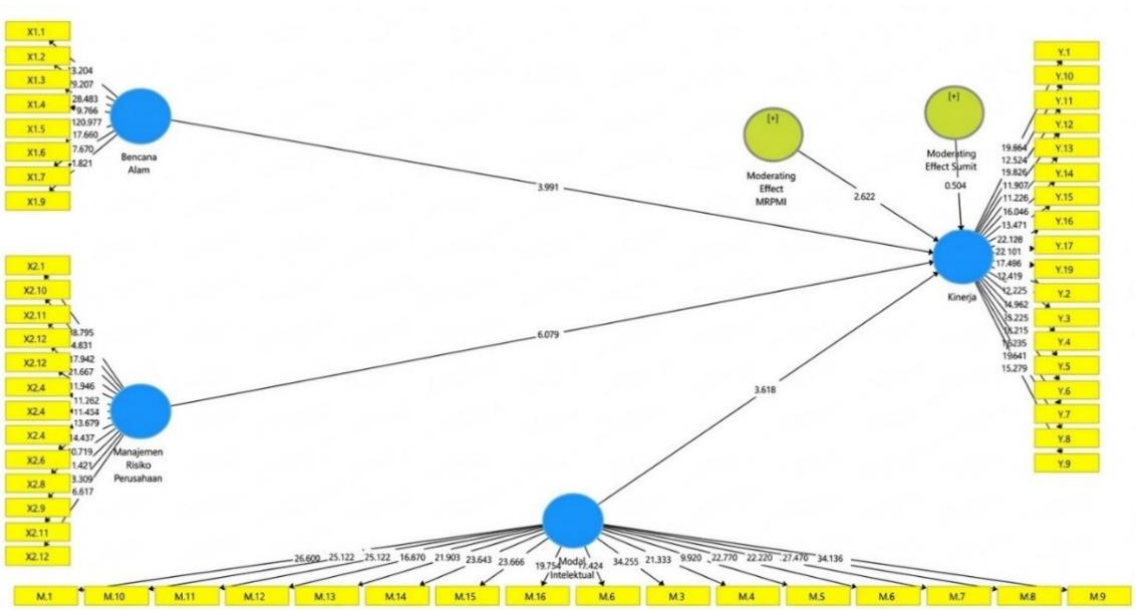

Figure 1. Outer Model

As presented in Figure 1, all indicator loadings exceeded 0.70, indicating that the measurement items adequately represent the associated latent constructs and satisfy the convergent validity requirement (Setjoatmadja et al., 2025).

Validity Test

The validity assessment confirmed that the measurement indicators achieved acceptable convergent validity and AVE criteria, indicating adequate representation of the associated constructs (Setjoatmadja et al., 2025). In exploratory PLS-SEM research it is acceptable to retain indicators with outer loadings between 0.50 and 0.70 if the AVE and composite reliability criteria are satisfied, and the indicator contributes theoretically to the construct (rule of thumb in PLS-SEM applications) (Batra, 2025).

Table 6. Results of Validity Test

Variable		Outer Loading	AVE	Description
Natural Disaster	X1.1	0.853	0.791	Valid
	X1.2	0.951		Valid
	X1.3	0.883		Valid
	X1.4	0.751		Valid
	X1.5	0.962		Valid
	X1.6	0.948		Valid
	X1.7	0.800		Valid
	X1.8	0.941		Valid
Corporate Risk Management	X2.1	0.890	0.754	Valid
	X2.10	0.915		Valid
	X2.11	0.959		Valid
	X2.12	0.947		Valid
	X2.13	0.917		Valid
	X2.2	0.749		Valid

	X2.3	0.804		Valid
	X2.4	0.789		Valid
	X2.5	0.820		Valid
	X2.6	0.905		Valid
	X2.7	0.938		Valid
	X2.8	0.800		Valid
	X2.9	0.820		Valid
Performance	Y.1	0.820	0.599	Valid
	Y.10	0.724		Valid
	Y.11	0.891		Valid
	Y.12	0.719		Valid
	Y.13	0.716		Valid
	Y.14	0.808		Valid
	Y.15	0.723		Valid
	Y.16	0.835		Valid
	Y.17	0.848		Valid
	Y.18	0.802		Valid
	Y.2	0.740		Valid
	Y.3	0.745		Valid
	Y.4	0.744		Valid
	Y.5	0.761		Valid
	Y.6	0.715		Valid
	Y.7	0.776		Valid
	Y.8	0.760		Valid
	Y.9	0.770		Valid
Intellectual Capital	M.1	0.831	0.663	Valid
	M.10	0.824		Valid
	M.11	0.894		Valid
	M.12	0.841		Valid
	M.13	0.793		Valid
	M.14	0.814		Valid
	M.15	0.857		Valid
	M.16	0.808		Valid
	M.2	0.843		Valid
	M.3	0.820		Valid
	M.4	0.787		Valid
	M.5	0.606		Valid
	M.6	0.810		Valid
	M.7	0.799		Valid
	M.8	0.837		Valid
	M.9	0.832		Valid
Natural Disasters * Intellectual Capital		0.942	1.000	Valid
Corporate Risk Management * Intellectual Capital		1.026	1.000	Valid

The validity test results demonstrate that all indicators satisfy the recommended loading criteria, confirming the adequacy of the measurement constructs for further hypothesis testing.

Reliability Test

The findings indicate that the measurement indicators achieved satisfactory levels of reliability across all constructs.

Table 7. Shows The Results of The Reliability Test

	Cronbach's Alpha	rho_A	Composite Reliability
Natural Disasters	0.961	0.973	0.968
Performance	0.960	0.961	0.964
Enterprise Risk Management	0.973	0.991	0.975
Intellectual Capital	0.966	0.970	0.969
Moderating Effect BA*MI	1.000	1.000	1.000
Moderating Effect MRP*MI	1.000	1.000	1.000

All constructs met the recommended reliability criteria, as indicated by Cronbach's Alpha and Composite Reliability coefficients exceeding 0.70. High reliability is crucial in ensuring measurement consistency across constructs, which is particularly important when using PLS-SEM in SMEs research (Setjoatmadja et al., 2025).

Evaluation of the Structural Model (Inner Model)

The proposed hypotheses were evaluated through structural-model analysis of the study variables:

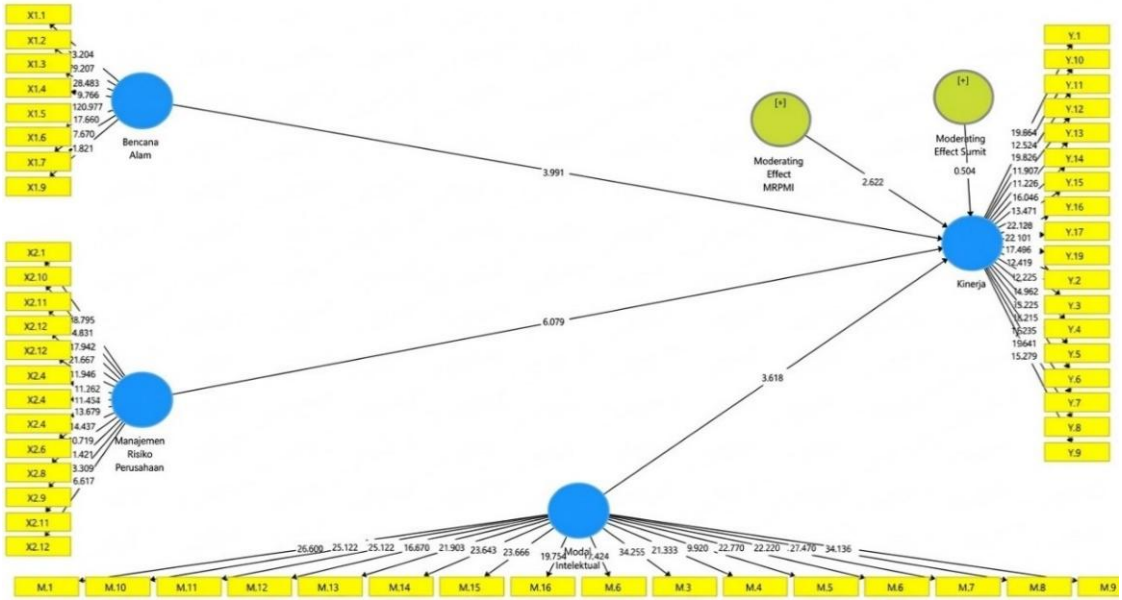

Figure 2:. Inner Model

Test R-Square

The R^2 results presented in Table 8 describe the explanatory power of the model:

Table 8. R-Square

	R Square	R Square Adjusted
Performance	0.648	0.622

The R^2 value of 0.648 indicates that natural disasters, Enterprise Risk Management (ERM), and intellectual capital account for 64.8% of the variance in SME performance, while the remaining variance is explained by factors not examined in this study within the context of this study (Setjoatmadja et al., 2025).

Hypothesis Testing

Hypothesis testing was conducted through structural-model analysis using bootstrapping procedures. The results are presented below:

Table 9. Research Hypothesis Testing

	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
Natural Disasters → Performance	0.335	3.881	0.000
Enterprise Risk Management → Performance	0.403	6.079	0.000
Intellectual Capital → Performance	0.276	3.618	0.000
Moderating Effect BA*MI → Performance	-0.040	0.504	0.615
Moderating Effect MRP*MI → Performance	-0.177	2.622	0.009

The empirical results suggest that exposure to natural disasters significantly influences SME performance in a positive direction ($\beta = 0.335$, $p < 0.001$). This finding suggests that SMEs operating in disaster-prone environments may develop adaptive capabilities and resilience mechanisms that enable them to sustain or even improve performance despite external disruptions. Exposure to disaster-related risks can encourage firms to strengthen preparedness strategies, improve resource allocation, and enhance organizational flexibility. These findings are consistent with previous studies emphasizing the role of environmental uncertainty in shaping organizational responses and business resilience (Utami et al., 2021).

The analysis further indicates that Enterprise Risk Management (ERM) has a significant positive effect on SME performance ($\beta = 0.403$, $p < 0.001$). This result highlights the importance of structured risk-management practices in supporting organizational effectiveness and long-term sustainability. By systematically identifying, evaluating, and responding to potential threats, SMEs can reduce uncertainty and improve decision-making quality. The finding supports prior evidence suggesting that effective ERM implementation contributes to both operational and financial performance improvements (Adenutsi & Whajah, 2023).

Intellectual capital was also found to positively influence SME performance ($\beta = 0.276$, $p < 0.001$). This result reinforces the view that intangible resources, including knowledge, skills, organizational

processes, and stakeholder relationships, represent important drivers of organizational success. Firms possessing stronger intellectual capital are generally better equipped to innovate, adapt to environmental changes, and maintain competitive advantage, ultimately leading to superior performance outcomes (Doloan et al., 2024).

Regarding the moderating relationships, intellectual capital does not significantly moderate the association between natural disasters and SME performance (β = -0.040, p = 0.615). The absence of a significant moderating effect suggests that the benefits derived from intellectual capital alone may be insufficient to mitigate the direct consequences of disaster-related disruptions. This finding may reflect the limited availability of disaster-specific preparedness mechanisms, financial resources, or recovery capabilities among SMEs, which can constrain the effectiveness of knowledge-based resources during extreme environmental events. Similar observations have been reported in resilience studies, which indicate that internal organizational capabilities do not always translate into effective disaster-response outcomes (Adenutsi & Whajah, 2023).

In contrast, intellectual capital significantly moderates the relationship between ERM and SME performance (β = -0.177, p = 0.009). This finding implies that the effectiveness of risk-management practices is influenced by the quality of organizational knowledge and capabilities embedded within the firm. SMEs with stronger intellectual capital are more likely to utilize risk information effectively, implement appropriate mitigation strategies, and integrate risk considerations into strategic decision-making processes. Consequently, intellectual capital serves as an important organizational resource that enhances the value generated from ERM implementation and contributes to improved performance outcomes (Doloan et al., 2024).

DISCUSSION

Natural Disasters → Performance

The findings indicate that natural disasters have a positive and statistically significant effect on SME performance, as reflected by a path coefficient (β) of 0.335 and a p-value below 0.05. This result suggests that SMEs operating in disaster-prone environments tend to develop adaptive capabilities and organizational resilience in response to external uncertainty. In the Indonesian context, natural disasters frequently create operational and financial disruptions, including supply-chain interruptions, declining demand, and limited access to financial resources (Shafi et al., 2020). Nevertheless, SMEs that possess stronger resilience capacity and strategic adaptability are generally more capable of maintaining business continuity and identifying growth opportunities during periods of crisis (Salvato et al., 2020). Government initiatives and resilience-oriented strategies also contribute to strengthening SME sustainability. Programs such as “Gerakan Bangga Buatan Indonesia” (BBI) and the implementation of Business Resilience Plans (BRPs) can support organizational preparedness and improve business continuity in

disaster-prone environments (Wibowo, 2023). Previous studies further emphasize that innovation capability, social capital, entrepreneurial resilience, and financial literacy are important factors supporting SME adaptability and long-term performance under uncertain conditions (Apasrawirote & Yawised, 2024).

In Indonesia, where MSMEs contribute significantly to the economy, strategies such as building social media-based knowledge ecosystems and leveraging mass collaboration can help generate new business ideas and enhance resilience against unexpected challenges like natural disasters (Yu et al., 2022). Moreover, the role of social capital, innovation, and capabilities has been identified as key factors influencing MSME resilience during economic hardships (Kussudyarsana et al., 2023). To improve the resilience of MSMEs in disaster-prone areas, sophisticated technology innovation capabilities and entrepreneurial resilience are essential (Panjaitan et al., 2022). Furthermore, enhancing financial literacy, fostering competitive advantages, and implementing effective business coaching can empower MSMEs to withstand the impacts of natural disasters and other crises (Resmi et al., 2019). In conclusion, the resilience of MSMEs in Indonesia against natural disasters is a multifaceted issue that requires a combination of policy support, innovation, social capital, and entrepreneurial skills. By addressing these aspects, MSMEs can better prepare for and recover from the adverse effects of natural disasters, ensuring their sustainability and growth in the long run.

Enterprise Risk Management → Performance

The analysis shows that Enterprise Risk Management (ERM) has a significant positive effect on SME performance ($\beta = 0.403$, $p < 0.05$), indicating that effective risk-management practices contribute to improved organizational performance and business stability. The results highlight the strategic importance of ERM in strengthening business resilience and supporting sustainable organizational growth. Through systematic risk identification, evaluation, and mitigation processes, SMEs are better positioned to minimize operational disruptions and enhance decision-making quality. Effective risk-management practices also enable firms to respond more adaptively to environmental uncertainty and external challenges, thereby improving operational efficiency and long-term performance outcomes.

The findings are consistent with prior studies emphasizing the positive contribution of ERM to organizational effectiveness and business sustainability among SMEs. Firms that integrate risk-management strategies into their managerial processes are generally more capable of maintaining stability, protecting organizational resources, and achieving competitive advantage in uncertain business environments (Simatupang et al., 2024).

The importance of financial literacy is also evident in its influence on SME performance. The level of financial literacy of SME owner-managers enables them to make rational financial decisions, which

ultimately can affect company performance. Additionally, earnings management can also affect the risk of corporate bankruptcy, where inappropriate earnings management practices can have a negative impact on company performance (Agyapong & Attram, 2019).

In addition to risk management and financial literacy, other factors such as capital structure, company size, and corporate governance also play a role in company performance. Capital structure and company size can affect company performance through their influence on tax savings and company size as a moderator in the relationship between risk management disclosure and corporate governance (Simatupang et al., 2024). Furthermore, corporate governance mechanisms can also affect earnings management and company financial performance (K. B. Putra et al., 2023).

Thus, to improve SME performance in Indonesia, it is important for companies to pay attention to risk management, financial literacy, proper earnings management practices, as well as other factors such as capital structure and corporate governance. A good integration of all these factors can help SMEs achieve better and sustainable performance.

Intellectual Capital → Performance

The The findings indicate that intellectual capital has a significant positive effect on SME performance ($\beta = 0.276$, $p < 0.05$). This result highlights the importance of knowledge-based resources in supporting organizational effectiveness, competitiveness, and long-term business sustainability among SMEs in Indonesia. The positive contribution of intellectual capital is consistent with previous studies emphasizing the strategic role of intangible assets in enhancing organizational value and financial performance (Widarjo 2011; Hasanah and Nurleli 2022) highlighted that intellectual capital disclosure contributes to firm value, while Hasanah and Nurleli (2022) Intellectual capital also supports organizational learning and knowledge-management practices that strengthen innovation capability and business adaptability in dynamic environments Susanto et al. (2023). Furthermore, SMEs possessing stronger intellectual resources are generally more capable of improving operational efficiency, maintaining competitive advantage, and responding effectively to environmental change. These findings reinforce the view that intellectual capital represents a critical organizational asset that contributes to sustainable business growth and organizational resilience Virgandhie et al (2021).

Moderating Effect BA*MI → Performance

The interaction between intellectual capital and natural disasters did not show a statistically meaningful effect on SME performance ($\beta = -0.040$, $p > 0.05$), indicating that intellectual capital does not significantly moderate the relationship. These findings imply that intellectual capital alone may not be sufficient to minimize the operational and economic disruptions caused by natural disasters among SMEs in Indonesia. Although intellectual capital represents an important intangible

organizational asset, its ability to strengthen disaster resilience may depend on additional supporting factors, including financial preparedness, crisis-management capability, operational flexibility, and external institutional support. In disaster-prone environments, knowledge-based resources may not immediately translate into effective recovery capacity when firms face severe physical and economic disruptions, such as financial preparedness, operational flexibility, disaster-response infrastructure, and external institutional support. Intellectual capital primarily reflects the knowledge, expertise, and organizational capabilities embedded within the firm (Febriany, 2020). However, during large-scale environmental disruptions, these intangible resources may not immediately translate into effective resilience strategies if organizations lack adequate recovery mechanisms or crisis-management systems.

The findings may also reflect the broader challenges faced by Indonesian SMEs, including economic uncertainty, limited access to resources, and institutional instability, which can weaken the ability of firms to utilize intellectual capital effectively during periods of crisis (Santikajaya, 2016). In addition, previous studies have suggested that organizational governance and managerial capability play important roles in determining how intellectual resources contribute to firm performance under uncertain conditions (Van et al., 2022).

Consequently, the absence of a significant moderating effect indicates that intellectual capital, while valuable for organizational development, may not independently strengthen SME resilience against the direct operational and economic impacts of natural disasters (Affandi & Meutia, 2021), underscores the vulnerability of businesses, including UMKMs, to external shocks like natural disasters. While intellectual capital can contribute to financial performance (Febriany, 2020), its ability to moderate the specific impact of natural disasters on UMKMs requires further investigation. In conclusion, while intellectual capital is a valuable resource for businesses, including UMKMs, its capacity to moderate the relationship between natural disasters and UMKM performance in Indonesia may be limited. Factors such as economic challenges, political instability, corporate governance, and financial vulnerabilities play significant roles in shaping the resilience of UMKMs in the face of natural disasters.

Moderating Effect MRP*MI → Performance

The moderation analysis indicates that intellectual capital significantly influences the relationship between Enterprise Risk Management (ERM) and SME performance. These findings suggest that SMEs possessing stronger knowledge-based resources and organizational capabilities are better able to utilize risk-management practices effectively, thereby improving organizational performance and competitiveness. Intellectual capital has been widely recognized as an important strategic resource that supports innovation capability, operational effectiveness, and organizational sustainability among SMEs

(Khalique et al., 2018). Firms with stronger intellectual resources are generally more capable of integrating managerial knowledge, organizational learning, and strategic responsiveness into their risk-management processes. Consequently, intellectual capital can strengthen the effectiveness of ERM implementation and support improved business performance in dynamic business environments. Previous studies have also emphasized the role of intellectual capital in enhancing innovation culture, competitive advantage, and organizational adaptability among SMEs (Mei et al., 2019).

Research suggests that higher intellectual capital positively correlates with innovation culture and SME performance (Dabić et al., 2020). Developing internal knowledge and capabilities is essential for SMEs to achieve sustainability. In Indonesia, SMEs are considered vital for the national economy (Widnyana et al., 2021). Proximity to customers enables SMEs to acquire knowledge more directly and swiftly compared to larger firms, emphasizing the importance of intellectual capital in SMEs. Dynamic SMEs that can respond rapidly to change and sense opportunities benefit from competitive advantages. Intellectual capital has been studied in various contexts, such as tourism SMEs, where it was found to impact business operations (Khalique et al., 2018). Additionally, Previous studies have highlighted that intellectual capital contributes significantly to innovation capability and operational effectiveness among SMEs (Jardon, 2018). These findings reinforce the view that intellectual capital represents an important organizational resource that can enhance the effectiveness of risk-management practices and support improved business performance. Through the effective utilization of knowledge, expertise, and organizational capabilities, SMEs are better positioned to strengthen competitiveness, encourage innovation, and sustain performance within dynamic business environments.

CONCLUSION

This study confirms that natural disasters, Enterprise Risk Management (ERM), and intellectual capital significantly influence MSME performance in Indonesia. The findings demonstrate that MSMEs operating in disaster-prone and uncertain environments require not only effective risk-management practices but also strong organizational capabilities to sustain business operations and maintain long-term performance. In this context, organizational adaptability and the effective utilization of internal resources become essential factors supporting business continuity and resilience. The results further indicate that intellectual capital does not significantly moderate the relationship between natural disasters and MSME performance. This finding suggests that intangible organizational resources alone may not be sufficient to reduce the direct operational and economic impacts caused by disaster-related disruptions. MSMEs facing environmental uncertainty may require additional forms of support, including financial preparedness,

technological capability, operational flexibility, and institutional assistance, to strengthen their resilience during periods of crisis.

Conversely, intellectual capital was found to strengthen the relationship between Enterprise Risk Management (ERM) and MSME performance. This result indicates that firms possessing stronger knowledge resources, managerial capability, and organizational learning capacity are better able to maximize the effectiveness of risk-management practices. Intellectual capital therefore plays an important role in supporting strategic decision-making, improving operational responsiveness, and strengthening organizational adaptability in dynamic business environments. The study highlights the importance of integrating ERM implementation with intellectual capital development as part of MSME business strategies in Indonesia. Strengthening human capability, organizational systems, and knowledge management practices can improve organizational resilience and support sustainable business growth. The findings also provide practical implications for MSME managers and policymakers by emphasizing the need to develop comprehensive business-resilience strategies that combine risk-management capability with organizational knowledge development. From a theoretical perspective, this research contributes to the growing discussion on disaster management, intellectual capital, and MSME performance by providing empirical evidence from the Indonesian context. The study demonstrates that intellectual capital does not always function as a direct buffer against environmental disruption, but it can strengthen the effectiveness of managerial and organizational processes that support business performance. Future studies are encouraged to examine additional moderating or mediating variables, such as organizational culture, technological readiness, financial literacy, and innovation capability, to obtain a broader understanding of MSME resilience in disaster-prone environments.

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