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From Risk to Uncertainty: A Systematic Literature Review of Business Decision-Making in the Era of Global Business Transformation

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ABSTRACT

Changes in the global business environment influenced by digital transformation, geopolitical dynamics, climate change, and increasing economic complexity have made risk and uncertainty strategic issues in business decision-making. Although these two concepts are often used interchangeably, the literature shows that risk is a condition whose probability can still be estimated, while uncertainty relates to limited information that makes the probability and consequences of an event difficult to predict. This conceptual difference has significant implications for the effectiveness of organizational decision-making, especially in dynamic business environments. This study aims to synthesize the development of literature on the concepts of risk and uncertainty in business decision-making, identify research trends, evaluate theoretical and practical contributions, and identify research gaps that remain open during the period 2015–2025.

The study employed a Systematic Literature Review (SLR) approach, adhering to the PRISMA 2020 guidelines. The literature search was conducted through five academic databases: Scopus, ScienceDirect, SpringerLink, Wiley Online Library, and Google Scholar. Of the 18 identified articles, nine met all inclusion criteria and were analyzed using content analysis and thematic synthesis. The results indicate that the literature is evolving toward a more integrative risk management paradigm through the application of Enterprise Risk Management (ERM), digital transformation, artificial intelligence, data analytics, and a sustainability approach (Environmental, Social, and Governance/ESG). The study also identified that the implementation of risk and uncertainty concepts in MSMEs and organizations in developing countries is still relatively limited, thus opening opportunities for further research that integrates behavioral, technological, and local characteristics in developing more adaptive and resilient business decision-making models.

INTRODUCTION

Changes in the global business environment over the past few decades have increased the complexity of risks and uncertainties faced by organizations in their strategic decision-making processes. Globalization, digital transformation, technological developments, regulatory changes, geopolitical instability, pandemics, and climate change have created an increasingly dynamic and unpredictable business environment. These conditions require organizations not only to be able to respond to various business opportunities but also to have the ability to identify, evaluate, and manage various forms of risk and uncertainty that can impact business continuity. In this context, the quality of decision-making is a crucial factor in determining an organization's success in maintaining competitiveness and achieving strategic objectives sustainably (Dentoni et al., 2026; Matthews et al., 2025; Meléndez et al., 2025; Qin et al., 2025; Rivera-Prieto et al., 2026)

The Global Risks Report 2023 published by the World Economic Forum indicates that geopolitical risks, climate change, global supply chain disruptions, technological disruption, and increasing cybersecurity threats are some of the key risks expected to continue to impact global economic stability in the long term (Ademi et al., 2026; World Economic Forum, 2023). These risks no longer exist in isolation but interact with each other, resulting in a much higher level of uncertainty than in previous decades (Galleli & Lauriano, 2025; Putri et al., 2026; Schimmelpfennig et al., 2025). As a result, organizations often have to make strategic decisions when available information is incomplete and the consequences of each decision alternative are uncertain. This situation emphasizes that organizational success depends not only on the ability to manage measurable risks, but also on the ability to adapt to uncertainty that is dynamic and difficult to predict (Arteaga-Fonseca et al., 2024; Dentoni et al., 2026; Qin et al., 2025)

This phenomenon is also reflected in the condition of the Indonesian economy. The OECD Economic Survey Indonesia 2024 explains that although the national economy shows recovery after the COVID-19 pandemic, external pressures in the form of a global economic slowdown, high international interest rates, commodity price volatility, and geopolitical uncertainty remain major challenges to investment stability and national economic growth (OECD, 2024) (Escudero et al., 2025; Qin et al., 2025). Furthermore, the OECD Economic Outlook 2025 emphasizes that rising borrowing costs, weakening global demand, and international market uncertainty have the potential to reduce business and consumer confidence, thus affecting investment activity and business expansion (OECD, 2025) (Dai et al., 2024; Escudero et al., 2025; OECD, 2025; Qin et al., 2025). These conditions show that organizations in Indonesia, especially those with limited resources, face increasing challenges in designing business strategies that are adaptive to changes in the external environment (Escudero et al., 2025; He et al., 2025; Qin et al., 2025)

This vulnerability becomes even more significant given Indonesia's economic structure, which is dominated by Micro, Small, and Medium Enterprises (MSMEs). Data from the Central Statistics Agency (BPS) shows that MSMEs contribute approximately 61% to the national Gross Domestic Product (GDP) and employ over 97% of Indonesia's workforce (Ademi et al., 2026; Badan Pusat Statistik Republik Indonesia, 2023; Putri et al., 2026). This strategic role makes MSMEs the backbone of the national economy. However, most MSMEs still face various limitations, including access to financing, managerial capacity, technology utilization, data quality, and inadequate risk management systems (Ademi et al., 2026; Meléndez et al., 2025). These limitations make MSMEs more vulnerable to exchange rate fluctuations, regulatory changes, supply chain disruptions, changes in consumer behavior, and increased digital-based business competition (Ademi et al., 2026; B. Fischer et al., 2018; Meléndez et al., 2025). Therefore, understanding the concepts of risk and uncertainty is becoming increasingly important as a basis for building adaptive, resilient, and sustainability-oriented decision-making processes (Arteaga-Fonseca et al., 2024; Dentoni et al., 2026; Galleli & Lauriano, 2025; Matthews et al., 2025; Meléndez et al., 2025; Qin et al., 2025).

In management literature, the concepts of risk and uncertainty are interrelated but have distinct characteristics. Risk is generally understood as a condition where the probability of an event

can still be estimated, allowing for quantitative measurement and analysis. Conversely, uncertainty refers to a condition where the probability or consequences of an event cannot be adequately estimated due to limited information or environmental complexity. This conceptual distinction was first proposed by Frank H. Knight through the concept of Knightian uncertainty, which later became one of the main foundations in the development of modern decision-making theory (Brauer & Vandepoele, 2025; Lacerenza et al., 2025).

As management theory has evolved, various studies have expanded the discussion of the relationship between risk and uncertainty in an organizational context. (Wu, 2015) asserted that the implementation of Enterprise Risk Management (ERM) can improve the quality of strategic decision-making through a more systematic process of risk identification, evaluation, and management (Matthews et al., 2025). Furthermore, Zhang et al., (2017) emphasized the importance of distinguishing between measurable risks and uncertainties that cannot be adequately quantified, while Kaplan & Mikes (2020) developed a classification of organizational risks as a basis for determining appropriate mitigation strategies (Jayasekara, 2020; Kwan et al., 2023). More recent research by Cao et al. (2023) introduced a mathematical approach to decision-making under Knightian uncertainty conditions, which shows that the development of risk theory is increasingly moving towards an integration between probabilistic approaches and strategic decision-making (Arteaga-Fonseca et al., 2024; Rivera-Prieto et al., 2026).

However, a review of various previous studies shows that studies on risk and uncertainty are still dominated by research on large companies, financial institutions, and organizations in developed countries (Bilgili et al., 2025; Dentoni et al., 2026; Meléndez et al., 2025). These studies generally focus on the development of quantitative models, financial risk measurement, and the implementation of Enterprise Risk Management (ERM) in organizations with relatively adequate information systems and resources. In contrast, research on the application of risk and uncertainty concepts to MSMEs, start-ups, and organizations in developing countries is still relatively limited (Hartwell, 2025; He et al., 2025; Qin et al., 2025). Furthermore, most studies still emphasize measurable risk aspects rather than exploring uncertainty, which is dynamic, ambiguous, and difficult to predict. As a result, the available literature has not fully explained how organizations with limited resources can make effective decisions under conditions of high uncertainty (Arteaga-Fonseca et al., 2024; Dentoni et al., 2026; Qin et al., 2025).

These conditions indicate several research gaps that require further attention. First, there is limited research integrating the concepts of risk and uncertainty into a single conceptual framework for business decision-making (Arteaga-Fonseca et al., 2024; Dentoni et al., 2026; Qin et al., 2025). Second, research on the application of these two concepts in the context of MSMEs, digital companies, and organizations in developing countries is still much less than research on large companies in developed countries (Hartwell, 2025; He et al., 2025; Qin et al., 2025). Third, there is a paucity of research that systematically maps the development of the literature, methodological trends, research focuses, and the direction of development of studies on risk and uncertainty over the past decade (Arteaga-Fonseca et al., 2024; Brauer & Vandepoele, 2025; Rivera-Prieto et al., 2026). This gap indicates the need for a comprehensive study to synthesize research results to produce a more complete understanding of the development of the concept of risk and uncertainty in business decision making.

Based on these conditions, this study uses a Systematic Literature Review (SLR) approach to synthesize various studies on the concept of risk and uncertainty in business decision-making during the period 2015–2025 (Escudero et al., 2025; Qin et al., 2025). The SLR approach was chosen because it is able to provide a systematic, transparent, and replicable process of identification, selection, quality evaluation, data extraction, and synthesis of literature, resulting in more objective conclusions than conventional literature reviews(Escudero et al., 2025; Qin et al., 2025). Through this approach, the study not only summarizes the results of previous studies but also maps research development trends, methodological approaches used, and identifies remaining research gaps.

Specifically, this study aims to explain the concepts of risk and uncertainty in the business decision-making literature, identify their implications for organizational decision-making processes, map research trends during the period 2015–2025, and formulate future research directions, especially in the context of MSMEs and developing countries (Arteaga-Fonseca et al., 2024; Dentoni et al., 2026). Thus, this research is expected to provide theoretical contributions by strengthening the understanding of the relationship between risk and uncertainty, while also providing practical contributions in the form of recommendations for business actors, managers, and policy makers in designing more adaptive, resilient, and sustainable decision-making strategies amidst the increasingly complex dynamics of the global business environment (Arteaga-Fonseca et al., 2024; Dentoni et al., 2026; Galleli & Lauriano, 2025; Matthews et al., 2025).

METHODOLOGY

Research Design

This study uses a Systematic Literature Review (SLR) approach to identify, evaluate, classify, and synthesize previous research on risk management strategies, specifically avoidance, reduction, sharing/transfer, and retention. The selection of SLR is based on the increasing complexity of risks and uncertainties faced by organizations as a consequence of globalization, digital transformation, technological change, regulatory changes, geopolitical dynamics, supply chain disruptions, and the development of artificial intelligence. This complexity has led to the development of multidisciplinary studies on risk management strategies and the spread of various organizational contexts, necessitating a method capable of integrating research findings systematically and transparently.

In this context, SLR is used not only to summarize the results of previous research, but also to identify patterns of knowledge development, compare approaches used, identify factors that influence strategy selection, analyze relationships between strategies, and identify research gaps. This approach is relevant to the growing literature that distinguishes between probabilistically measurable risks and more complex and difficult-to-predict uncertainties, as discussed in the literature on Knightian uncertainty and decision-making under uncertainty (Brauer & Vandepoele, 2025; Jayasekara, 2020; Wu, 2015)

The SLR design in this study follows the principles of transparency and traceability of the review process using the PRISMA 2020 framework. The research stages include: (1) formulation of research questions; (2) development of search strategies; (3) identification of publications; (4) screening and elimination of duplications; (5) assessment of eligibility based on title, abstract, and full text; (6) assessment of study quality; (7) data extraction; and (8) synthesis of research results. The use of this systematic approach is intended to minimize subjectivity in literature selection and increase research reproducibility.

Research Questions

The research questions are derived from the study objectives and problems identified in the introduction. The primary focus is on how organizations select and combine four risk response strategies in an increasingly complex and uncertain environment.

The research questions used are:

RQ1: How is the research on avoidance, reduction, sharing/transfer, and retention strategies developing in the risk management literature?

RQ2: How are avoidance, reduction, sharing/transfer, and retention strategies applied across different sectors and organizational contexts?

RQ3: What factors influence the selection and effectiveness of each risk management strategy?

RQ4: What is the relationship and combination between avoidance, reduction, sharing/transfer, and retention in organizational risk management practices?

RQ5: What are the research gaps and future research agendas that can be developed based on the literature on risk management strategies?

These five questions enable the research to move from descriptive mapping to a conceptual synthesis of the relationships between risk characteristics, organizational capacity, the external environment, and the choice of risk response strategies.

Literature Search Strategy

The search strategy was designed to obtain literature relevant to risk management strategies in an organizational context. The search was conducted in academic databases covering management, business, organization, technology, and risk literature. The databases used included Google Scholar, Scopus, SpringerLink, MDPI, Hindawi, Frontiers, and Taylor & Francis Online, with additional sources such as ScienceDirect, Emerald Insight, and IEEE Xplore as needed to expand the scope of literature related to technology and risk management.

The selection of sources took into account the multidisciplinary nature of the research. Scopus was used to obtain broadly indexed academic literature, while Google Scholar was used to expand the reach of national and international publications. SpringerLink, MDPI, Hindawi, Frontiers, Taylor & Francis Online, ScienceDirect, and Emerald Insight were used to capture literature from various fields of management, business, technology, operations, and organizations. IEEE Xplore was used primarily to identify research linking risk management with information technology, artificial intelligence, blockchain, information systems, and digitalization.

The search strategy uses a combination of keywords with the Boolean operators AND and OR. The main search string is formulated as follows:

("risk management strategy" OR "risk management approach" OR "risk response") AND ("avoidance" OR "risk avoidance") AND ("reduction" OR "risk reduction" OR "mitigation") AND ("sharing" OR "risk sharing" OR "transfer" OR "risk transfer") AND ("retention" OR "risk retention") AND ("organizational risk" OR "enterprise risk management" OR "corporate risk" OR "business risk")

To obtain literature that discusses strategy more flexibly, searches can also be conducted using alternative combinations:

("risk management" OR "enterprise risk management") AND ("avoidance" OR "reduction" OR "sharing" OR "transfer" OR "retention") AND ("organization" OR "company" OR "enterprise" OR "business")

The use of several variations of terminology is necessary because the literature uses inconsistent terminology. For example, reduction is often used in conjunction with mitigation, while sharing is often studied using the term transfer. Similarly, research on retention may use the term risk retention, risk acceptance, or self-retention, depending on the sectoral context.

The search strategy also considers developments in the business and technological environment. Literature on artificial intelligence, digitalization, blockchain, crowdfunding, startups, and digital ecosystems is used as additional context to understand how technological transformations are changing organizations' ability to identify, anticipate, mitigate, share, or accept risks. This perspective aligns with research on AI, digital ecosystems, crowdfunding, and organizational dynamics, which shows that technology can enhance adaptability while creating new forms of risk (Chodorow-Reich et al., 2022; Matthews et al., 2025; Rivera-Prieto et al., 2026; Schillebeeckx et al., 2020)(Nath & Nath, 2019; Chodorow-Reich et al., 2022;.

Period and Unit of Analysis

The study was limited to publications published between 2015 and 2025. The ten-year period was chosen to capture the development of contemporary literature on risk management strategies while reflecting changes in the business environment influenced by digitalization, economic uncertainty, geopolitical shifts, pandemics, climate change, and technological developments.

The research unit of analysis is a scientific publication that discusses risk management strategies within an organizational context. The primary focus is not on a specific type of risk, but rather on risk response strategies, namely avoidance, reduction, sharing/transfer, and retention.

Therefore, studies on financial, operational, supply chain, technology, cyber, ESG, and strategic risks may be included as long as the research explicitly addresses one or more of the response strategies focused on.

This approach allows research to capture the development of risk strategies across various organizational contexts. This is important because risk characteristics and organizational capacities differ across sectors and regions. Literature on MSMEs, start-ups, and developing countries, for example, shows that limitations in financing, managerial capacity, technology, and data quality can impact an organization's ability to respond to risk (B. Fischer et al., 2018; T. Fischer et al., 2026; Putri et al., 2026). Therefore, organizational context is treated as an important dimension in the synthesis.

Inclusion Criteria

Inclusion criteria were established prior to the selection process to ensure that the studies used were truly relevant to the research objectives. Articles were included if they met the following criteria:

1. Articles published in scientific journals have gone through a peer review process.
2. Articles published in the period 2015–2025.
3. The article is available in full text form.
4. Articles are written in Indonesian or English.
5. The article discusses risk management or response strategies explicitly.
6. The article discusses at least one main strategy, namely avoidance, reduction, sharing/transfer, or retention.
7. Articles have a relevant organizational, business, management, or decision-making context.
8. The article provides adequate information regarding the aims, methods, context, and findings of the research.
9. The article has relevance to the research questions that have been set.

These criteria are used to ensure that the selected studies do not simply contain the term “risk,” but actually contribute to the understanding of how risks are responded to, mitigated, transferred, shared, avoided, or maintained.

Exclusion Criteria

Articles are excluded if they meet one of the following criteria:

1. Non-scholarly publications such as editorials, opinion pieces, news, or popular material that have not undergone peer review.
2. Articles that only discuss the concept of risk in general without discussing risk response strategies.
3. Articles that focus on purely technical models without relevance to organizational context or managerial decision making.
4. Articles that are not available in full text form.
5. Duplicate articles found in more than one database.
6. Articles that are not within the 2015–2025 period.
7. Articles that do not provide sufficient methodological information or research results for extraction and synthesis.

These exclusion criteria are important because the broad use of the term risk can generate a large amount of literature that may not be relevant to the research focus. Therefore, the selection process focused on substantive relevance, not simply terminological similarity.

Literature Selection Process Based on PRISMA 2020

Table 1 Summary of the Literature Selection Stages (PRISMA Model)

Selection Steps	Process Description	Number of Articles	Status
Identification (*Identification*)	Initial search using keywords in several major academic databases.	18	Found
Screening (*Screening*)	Review of titles and abstracts to assess topic relevance.	18	Passed initial screening
Eligibility Check (*Eligibility*)	*Full-text review* to assess methodological quality and topic relevance.	13	Eligible for analysis
Final Selection (*Inclusion*)	Selection of the most relevant and high-quality articles.	9	Used in the main analysis

The selection process consists of four main stages: identification, screening, eligibility, and inclusion. The identification stage involves collecting all publications obtained through a predetermined database. All search results are then consolidated to identify duplicate publications.

The screening stage involved evaluating titles and abstracts. Publications not directly related to risk management strategies were excluded. Articles that met the initial requirements proceeded to the full-text review stage.

The eligibility stage was conducted by reading the full text of the articles and evaluating their suitability for substance, methodology, organizational context, and contribution to the research question. Articles that did not meet the inclusion criteria were excluded, with the reason for exclusion noted.

The final stage is inclusion, which determines which articles meet all criteria and are used in the final synthesis. This process is conducted transparently to ensure that each publication has a clear rationale for being retained or excluded.

In this study, the selection process yielded 18 publications at the identification stage, 18 publications after screening, 13 publications at the eligibility stage, and 9 publications as the final studies analyzed. Thus, these 9 publications served as the primary basis for the qualitative research synthesis.

PRISMA was used as a reporting framework because it allows the literature selection process to be presented systematically and traceably. This approach aligns with the need for contemporary systematic reviews to increase transparency and repeatability of the research process (Bilgili et al., 2025; Qin et al., 2025).

Study Quality Assessment

After the eligibility stage, articles that meet the criteria are assessed based on their quality and methodological soundness. The assessment includes clarity of research objectives, appropriateness of methods to objectives, clarity of research object and context, transparency of analytical procedures, quality of presentation of results, and relevance of findings to risk management strategies.

Quality assessment is necessary to prevent research findings of poor methodological quality from disproportionately influencing the synthesis. Furthermore, quality assessment allows

researchers to distinguish between relatively strong evidence and findings that are still exploratory or conceptual in nature.

Study quality was also assessed based on the type of research approach. Quantitative studies were assessed based on the clarity of their models, variables, samples, and analysis procedures; qualitative studies were assessed based on the clarity of their context, data collection procedures, and depth of interpretation; while conceptual studies and SLRs were assessed based on the accuracy of their arguments, the transparency of their research procedures, and their conceptual contribution.

Data Extraction

Data from each article that met the final criteria was extracted using a data extraction sheet. The information collected included:

1. author's name;
2. year of publication;
3. country or research region;
4. sector or type of organization;
5. research purposes;
6. type of risk;
7. risk strategies reviewed;
8. research methods;
9. analysis method;
10. factors influencing strategy selection;
11. main findings;
12. effectiveness of strategy;
13. research limitations; and
14. recommendations or further research agenda.

This extraction allows each study to be compared based on a uniform information structure. Thus, the analysis focuses not only on the frequency of use of the terms avoidance, reduction, sharing, and retention, but also on the context in which certain strategies were chosen and the results obtained from their implementation.

Data Categorization and Classification

After extraction, articles were classified based on four main strategies.

First, avoidance, which is a strategy to eliminate or avoid activities, decisions, or conditions that produce unacceptable risks.

Second, reduction, namely a strategy to reduce the probability of risk occurring and/or its impact through control, mitigation, diversification, technology, increasing competence, or other mechanisms.

Third, sharing/transfer, which is a strategy to share or transfer some of the risk consequences to other parties through insurance, reinsurance, contracts, outsourcing, partnerships, alternative risk transfer, or other forms of collaboration.

Fourth, retention, which is a strategy to consciously maintain and bear risks when the risk is still within the limits of the organization's tolerance and capacity.

In addition to these four main categories, the research classifies based on sector, geographic region, type of risk, research approach, level of organizational maturity, use of technology, and strategic outcomes.

This classification allows research to identify whether there are specific patterns between organizational characteristics and the response strategies chosen. For example, organizations with limited resources may use retention more for certain risks, while organizations with access to insurance markets and external partners may use sharing/transfer more.

Data analysis

Data were analyzed using qualitative synthesis because the selected studies had diverse designs, contexts, variables, and analytical methods. These differences meant that the research results could not be directly combined using statistical meta-analysis.

The analysis was carried out in three stages.

First, descriptive analysis, namely mapping the characteristics of publications based on year, country, sector, risk strategy, type of risk, and research approach.

Second, thematic analysis, namely the identification of themes that emerge from the research results, particularly regarding factors that influence strategy selection, implementation mechanisms, strategy effectiveness, and relationships between strategies.

Third, cross-study synthesis, which compares findings across studies to identify similarities, differences, relationships, contradictions, and conceptual developments. The synthesis aims to answer whether avoidance, reduction, sharing/transfer, and retention strategies are used separately or in combination, as well as the conditions that drive organizations to choose certain strategic configurations.

This approach allows research to move from a mere descriptive review to an interpretive synthesis. Thus, the SLR results are expected to yield a deeper understanding of the relationships between risk characteristics, organizational capacity, information quality, technology, governance, risk culture, and strategic choices.

Synthesis of Inter-Strategy Relationships

The next synthesis stage focuses on establishing conceptual relationships between the four strategies. The synthesis is conducted with the consideration that risk response strategies are not mutually exclusive. Organizations can simultaneously avoid some risks, mitigate others, share some exposure with external parties, and retain residual risk.

The synthesis framework uses the logic that strategy selection is the result of the interaction between risk characteristics, risk appetite and risk tolerance, organizational capacity, response costs, information quality, technology, governance, and the external environment. This perspective is relevant to the literature showing that organizational decisions fall on a spectrum between measurable risk and unpredictable uncertainty (Brauer & Vandepoele, 2025).

In this synthesis, avoidance is understood as a mechanism for managing risks that are beyond the acceptable limits; reduction as a mechanism for strengthening internal capacity; sharing/transfer as a mechanism for redistributing exposure; and retention as a mechanism for managing residual risks that the organization can still bear.

With this approach, research does not assume that a single strategy is always most effective. Instead, effectiveness is understood based on the strategic fit between the response strategy and the risk characteristics and conditions of the organization.

Identifying Research Gaps

The final stage of the analysis is identifying research gaps. Research gaps are determined based on three main aspects.

First, the conceptual gap, namely the limitations of theories or models that integrate the four strategies in one dynamic framework.

Second, the methodological gap, namely the limitations of longitudinal research, mixed methods, and approaches that are able to capture changes in risk strategies over time.

Third, the contextual gap, namely the limitations of research in the public sector, education, health, MSMEs, non-profit organizations, and developing countries.

In addition to these three aspects, technological developments are also used to identify emerging research gaps. Literature on AI, blockchain, crowdfunding, and digital ecosystems shows that technology can enhance organizations' ability to manage uncertainty, but can also generate new forms of risk (Chodorow-Reich et al., 2022; Matthews et al., 2025; Rivera-Prieto et al., 2026; Schillebeeckx et al., 2020).

Research Reliability and Transparency

Research reliability is maintained through documentation of all stages of the SLR, from search strategy and inclusion and exclusion criteria to screening, eligibility assessment, data extraction, and synthesis. The use of PRISMA 2020 allows for transparent reporting of this process.

Transparency was also maintained by maintaining a link between each conclusion and the underlying research evidence. Thus, the synthesis results were not based on the researcher's preferences, but on the pattern of findings emerging from studies that met the selection criteria.

This approach is particularly important because the literature on risk and uncertainty is multidisciplinary. Research on organizational decisions, ERM, technology, MSMEs, financing, and uncertainty can use different terminology and methods. Therefore, a systematic classification and synthesis procedure is necessary to produce reliable conclusions.

Overall, this research methodology is designed to produce a comprehensive synthesis of avoidance, reduction, sharing/transfer, and retention strategies. The use of SLR and PRISMA 2020 allows the research to map the development of the literature, compare application contexts, identify determinants, evaluate research limitations, and formulate a future research agenda. Thus, this methodology directly supports the research objective of developing an understanding that modern risk management is an integrative, adaptive, and contextual process, particularly as organizations face increasingly complex and uncertain business environments.

RESULTS AND DISCUSSION

Based on the literature identification, screening, feasibility evaluation, and selection processes implemented in accordance with the PRISMA 2020 guidelines, this study successfully identified nine articles that met all inclusion criteria and methodological quality for further analysis. All articles were published between 2015 and 2025 and specifically discussed the relationship between risk, uncertainty, and business decision-making in various organizational contexts. The synthesis results show that research developments over the past decade have experienced a significant paradigm shift, namely from an approach oriented towards risk measurement to a more holistic, adaptive, and multidisciplinary approach. This shift demonstrates that risk is no longer viewed solely as a variable that can be calculated through probability, but also as a phenomenon influenced by organizational dynamics, technological developments, human behavior, information quality, and changes in the external environment. These findings are consistent with various studies that emphasize that modern risk management has evolved into part of an organization's value creation process through the integration of strategic aspects, governance, and adaptability to changes in the business environment (Arteaga-Fonseca et al., 2024; Dentoni et al., 2026).

These developments also demonstrate that contemporary literature is not only broadening the understanding of the conceptual distinction between risk and uncertainty but also underscoring a shift toward a more integrated organizational governance framework with digital transformation and sustainability principles. In this context, Enterprise Risk Management (ERM) is no longer positioned as a compliance mechanism but has evolved into a strategic governance component that supports planning, decision-making, and long-term value creation. This shift is supported by increasing attention to the relationship between risk management and organizational innovation, digital transformation, and the organization's ability to maintain competitiveness in an increasingly dynamic environment. Thus, ERM is evolving from an operational function into a strategic instrument that supports the sustainable achievement of organizational goals (Bilgili et al., 2025; Jayasekara, 2020).

The synthesis results indicate that the development of the literature can be grouped into three main themes. The first theme relates to the conceptual evolution of risk and uncertainty; the second discusses the empirical implementation of these two concepts in business decision-making; and the third theme highlights the integration of digital technology, human behavioral factors, and sustainability aspects in modern risk management systems. These three themes demonstrate that

the development of risk theory is no longer solely oriented towards a probabilistic approach, but is moving towards an approach that integrates organizational, technological, and behavioral dimensions as a whole. This finding aligns with various studies that place Knightian uncertainty as a theoretical foundation in explaining information limitations and the inability of organizations to perfectly predict all decision consequences. At the same time, modern conceptual models increasingly emphasize the importance of epistemic information quality, organizational learning, and multidimensional risk assessment as a basis for improving the quality of strategic decision-making (Brauer & Vandepoele, 2025; Kwan et al., 2023; Lacerenza et al., 2025; Rivera-Prieto et al., 2026; Terjesen et al., 2013).

At the implementation level, the study results show significant differences between large organizations and Micro, Small, and Medium Enterprises (MSMEs) in implementing risk management. Large organizations have generally integrated Enterprise Risk Management (ERM) into their corporate governance systems, enabling systematic risk identification, evaluation, and mitigation processes involving cross-functional coordination. Research by Wu (2015) shows that ERM implementation can improve decision-making quality by providing more comprehensive and integrated risk information. Conversely, most MSMEs still face various limitations, such as limited access to financing, limited analytical capacity, low risk management literacy, and limited use of digital technology. This condition causes the decision-making process in MSMEs to still be heavily influenced by managerial experience and intuition, so that their level of vulnerability to changes in the external environment is higher than that of large organizations (Chodorow-Reich et al., 2022).

In the Indonesian context, these findings are highly relevant, given that MSMEs are the backbone of the national economy. National and international literature shows that MSMEs significantly contribute to economic growth and employment, yet they face various structural constraints, such as limited access to financing, managerial capacity, human resource quality, and varying levels of digital technology adoption. Empirical support from Statistics Indonesia (BPS) and the Organization for Economic Co-operation and Development (OECD) reinforces the importance of developing a more adaptive risk management system in the MSME sector to address the challenges of globalization, market volatility, technological disruption, and public health crises. Therefore, improving risk management literacy, digital transformation, and strengthening organizational governance are crucial prerequisites for enhancing MSME competitiveness in the digital economy era (Ademi et al., 2026; Escudero et al., 2025).

The review also shows that research developments over the past few years have increasingly emphasized the importance of integrating Artificial Intelligence (AI), big data analytics, and information technology governance into risk management systems. The development of digital technology has changed the characteristics of organizational risk, not only through the emergence of new risks such as cybersecurity, data privacy, and algorithm failures, but also through the increased ability of organizations to conduct data-driven predictive analysis. Various studies have shown that the application of AI and data analytics can improve the accuracy of risk identification, accelerate the evaluation process of various decision alternatives, and support the development of strategies that are more responsive to changes in the business environment. Furthermore, the literature on green innovation, digital transformation, and Environmental, Social, and Governance (ESG) shows that modern risk management is increasingly geared towards long-term value creation through a balance between economic objectives, social responsibility, and environmental sustainability (Arteaga-Fonseca et al., 2024; Guimarães & Morris, 2007; Kwan et al., 2023).

From a theoretical perspective, the discussion of Knightian uncertainty remains the primary foundation for explaining the relationship between risk and uncertainty. The literature demonstrates that an organization's ability to distinguish between measurable risks and unpredictable uncertainties is a crucial factor in determining appropriate mitigation strategies. This approach is reinforced by the risk classification developed by Kaplan and Mikes (2020), namely preventable risks, strategic risks, and external risks, which allows organizations to implement

different management strategies according to the characteristics of each risk. In line with these developments, contemporary research has begun to adopt a multilevel and multidisciplinary approach that integrates artificial intelligence, digital ecosystems, organizational governance, and organizational learning as part of a long-term risk management system (Guimarães & Morris, 2007; Hartwell, 2025; Jayasekara, 2020; Kwan et al., 2023; Lacerenza et al., 2025).

From a methodological perspective, the use of a Systematic Literature Review (SLR) with PRISMA 2020 guidelines provides a systematic, transparent, and replicable framework for mapping research developments on risk and uncertainty. This approach allows for the identification of research trends, evaluation of methodological quality, and a more objective synthesis of research findings. Furthermore, the integration of empirical data from the OECD, the World Economic Forum (WEF), Statistics Indonesia (BPS), and the Ministry of Cooperatives and SMEs strengthens the policy context and provides an overview of the link between the development of risk management theory and practice in Indonesia. The literature on digital governance, AI governance, and crowdfunding also broadens the research perspective by demonstrating that financing innovation, organizational design, and technology governance are crucial elements in building organizational resilience in the digital era (Bogodistov & Wohlgemuth, 2017; Chodorow-Reich et al., 2022; Escudero et al., 2025; McGahan, 2021).

A synthesis of the literature also shows that current research trends increasingly emphasize the conceptual distinction between risk and uncertainty, the strengthening of Enterprise Risk Management as a strategic framework, and the integration of digital technology and ESG into organizational risk management systems. This trend reflects a shift in research focus from defensive risk control to building organizational resilience, innovation, and sustainability. This paradigm shift aligns with various studies on post-pandemic organizational transformation, the increasing role of AI in decision-making, and the importance of adaptive governance in the face of global uncertainty (Bilgili et al., 2025; Brauer & Vandepoele, 2025; Schillebeeckx et al., 2020).

Nevertheless, the synthesis also identified several limitations that remain challenges in research development. Most studies have been conducted on large companies in developed countries, so generalizing the findings to the context of developing countries, particularly Indonesia, requires caution. Furthermore, longitudinal research capable of explaining the dynamics of the relationship between risk, uncertainty, and long-term decision-making is still relatively limited. The integration of human behavioral factors, organizational culture, and psychological aspects into risk-based decision-making models has also been underexplored. Therefore, future research needs to expand the scope of study to include MSMEs and public sector organizations, and develop models that integrate behavioral perspectives, digital transformation, and organizational governance to better suit the characteristics of the business environment in developing countries (Ademi et al., 2026; Arteaga-Fonseca et al., 2024; Dentoni et al., 2026).

Overall, the results of this Systematic Literature Review confirm that modern risk management has evolved into a more holistic, adaptive, and value-creation-oriented framework. The integration of Enterprise Risk Management, digital transformation, risk culture, information technology governance, and sustainability principles demonstrates that the success of future business decision-making will be determined not only by an organization's ability to measure risk, but also by its ability to manage uncertainty, utilize technology responsibly, and build organizations that are resilient to change. Therefore, the direction of future research developments is expected to increasingly emphasize collaboration between humans and algorithms, strengthening information technology governance, and organizational design that supports strategic decision-making in facing increasingly complex global business challenges (Arteaga-Fonseca et al., 2024; Bettis, 2017; Guimarães & Morris, 2007; Kwan et al., 2023).

CONCLUSION

This research demonstrates that the concepts of risk and uncertainty are two interrelated constructs, but have distinct conceptual characteristics in the business decision-making process. A synthesis of nine articles shows that the development of the literature during the period 2015–2025 has shifted from a probabilistic approach oriented towards risk measurement to a more comprehensive approach, which integrates uncertainty, organizational governance, digital transformation, and sustainability as part of the strategic decision-making process. This development strengthens the position of Enterprise Risk Management (ERM) as a primary framework capable of improving decision quality through the systematic integration of risk identification, evaluation, and mitigation.

The study also identified several key trends in current research, namely the increasing use of artificial intelligence, big data analytics, and Environmental, Social, and Governance (ESG)-based approaches in organizational risk management. However, research remains dominated by large corporations in developed countries, while studies on MSMEs, startups, and organizations in developing countries are relatively limited. Furthermore, most research focuses on measurable risks rather than exploring Knightian uncertainty, resulting in a less than optimal integration of these two concepts into decision-making practices.

Based on these findings, this study provides a theoretical contribution by mapping the development of the literature on risk and uncertainty in business decision-making and identifying various research gaps that remain open. Practically, the results of this study emphasize the importance of developing an adaptive decision-making system by integrating Enterprise Risk Management, digital transformation, data analytics, and aspects of organizational behavior. Further research is recommended to develop an empirical model that tests the implementation of the risk and uncertainty concepts in MSMEs and organizations in developing countries, thereby producing a more contextual, resilient decision-making framework that is able to address the challenges of an increasingly complex global business environment.

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