E-Commerce Risk Perception and Management: A Bibliometric Review (1995–2023) Highlighting Theoretical Insights and Future Directions

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Abstract
The use of e-commerce is growing daily all over the world. Risk perception and e-commerce management are enhanced by technological advancements. Review analysis examines how risk management and perception have evolved in e-commerce. The bibliometric analysis of the study used Scopus metadata from 1995 to 2023. The meta-data retrieval procedure takes into account the inclusion and exclusion procedures. This study investigated a literature progress status, identified the leading contributor to the production of literature. In addition, review investigation can observe cluster analysis based on keyword occurrences using VosViewer. An annual review of research output from 2004 shows a significant rise, with substantial peaks in 2010 and 2011, suggesting rising concerns and complexity regarding e-commerce threats. The overall trend, driven by evolving digital transaction challenges, demonstrates a consistent academic interest in the subject, notwithstanding changes. The study includes geographical research productivity, regional perspectives, key sources, and many aspects of e-commerce risk management. With emerging economies like Brazil and Indonesia gaining traction, a geographical analysis finds China as the largest donor, followed by the United States, Taiwan, the United Kingdom, and India. Well-known conferences and publications are valuable resources. The paper identifies seven topic clusters, respective of supply-chain risk, consumer trust, behavioural intentions, service quality, new trends, privacy concerns, and technological adoption. Dealing with these gaps will assist in defining e-commerce risks and guiding policies aimed at increasing consumer trust and digital transaction security. These results highlight research gaps, supported theories, and scholarly research problems.

Keywords: Bibliometric Review, Cluster Analysis, E-Commerce, Future Directions, Risk Perception and Management, Theoretical Insights.

Introduction

Today, an increasing number of people reside in both rural and urban areas, and they are using e-commerce more than ever. It will pound all over the world. Every e-commerce user looks at risk and risk management. By reducing risk and fostering user trust, technological advancements are being met. The COVID-19 guidelines are boosting the sped-up online buying. These changes must be known to create sensible plans for reducing expected hazards and building consumer confidence in e-commerce systems (1). Current trends emphasize how risks, including financial instability, information security, and privacy concerns, influence customer behavior and e-commerce adoption. As e-commerce platforms expand, so does the complexity of risk management, which includes dealing with sensitive personal data, guaranteeing transaction security, and preserving customer confidence (2). The COVID-19 epidemic has brought these problems to people's attention more, sped up the trend of shopping online, and shown new flaws in e-commerce systems (3, 4). Being aware of these trends is important if you want to find good ways to lower the risks people think they face and increase their trust in e-commerce systems. It also illustrates to governments and companies the shifting landscape of digital trade and how they might mitigate increasing worries (5). Despite advancements in the field, the existing research on

risk perception and management in e- commerce remains inadequate. There is a lack of comprehensive, long-term research on the development of these methods and their effects on consumer behavior. Research often lacks a global perspective, focussing instead on particular places. There is a lack of thorough research on annual growth trends and regional disparities in e-commerce risk management. Moreover, there is little understanding of the major influences that inform the literature (6). Current studies often isolate certain characteristics without taking a larger perspective. The Scholar needs to examine important terminology and ideas, such as perceived risk and technological acceptability, to identify gaps and guide future research. Despite considerable research, there is still a lack of knowledge of longitudinal changes and regional spreading. E-commerce (7, 8). The Present Study look on to the questions. Like the annual growth trends, geographical contributions, and the top sources contributing of research on risk perception and risk management in e-commerce. Similarly, the key terms and concepts identified in the literature reflect the current state and gaps in e-commerce risk management research. By addressing these gaps, the study will provide a more nuanced view of the area, giving organizations practical insights and future research paths to strengthen digital transaction security and customer confidence. The Scholar will achieve this by offering a more comprehensive understanding of the industry (2). The present study investigated primary objective is Analyse the annual growth and trends in research related, the geographical distribution of research contributions. Identify the most prominent countries, institutions and the primary sources. Similarly, the secondary objective is identified key terms and concepts align with the current research objectives and future directions in e-commerce risk management. Additionally, the goal is to suggest research questions, identify gaps, and provide theoretical recommendations based on the keywords. The study aims to offer a comprehensive overview of the field and suggest prospective areas for future research and progress. This will be accomplished by bringing these objectives into focus (9). Scoping and Web of Science publications on sustainable logistics for e-commerce are increasing between 2000 and 2021.

This study conducts a bibliometric review analysis of the methods used to address the economic, social, and environmental aspects of logistics operations in e-commerce settings through technological advancements (1). A number of user attributes, including risk tolerance, are used to assess the connection between the literature on customer knowledge management and e-commerce. Internet knowledge and preference and how they affect consumers' intentions to buy and their perception of online risk. 276 consumers with prior online experience participated in a survey that served as the basis for the empirical study. Factor analysis, model fitting, and multidimensional analysis are used to support the hypothesis analysis. The results of this study show that how customers perceive the risk of using various CKM tools is a significant factor in explaining some of their online behaviour (7). A new analysis was conducted for 10,242 qualified records in order to allow for a comparison of the research areas of cybersecurity and electronic commerce by keyword node. There are sixty-nine clusters that comprise the main themes of cybersecurity. The Silhouette means shows a relatively high homogeneity which is associated with the large sizes of the clusters. Therefore, the keyword nodes associated with the most relevant citers for each cluster highlight the impact of their work on the related topic of research. By comparing cybersecurity with electronic commerce. The outcome-based discussion expressed that, Customers who believe that online shopping is dangerous and who worry about the security of their personal information and the resilience of the retailer's infrastructure. The cybersecurity awareness to the necessity of preventing fraud in the online setting. Because of the link between cybersecurity and the adoption of electronic commerce, cybersecurity awareness and education are necessary (6). The bibliometric study was conducted between 1977 and 2024 on e-commerce contacts. E-commerce businesses facilitate online trading for both buyers and sellers, according to the concept. Key word occurrence extraction and bibliometric analysis were conducted in this study using R programming. Pricing, trust, online security, and distribution channels were among the powerful keywords identified by thematic analysis in this study. Concerns about the consumer experience and the

protection of their personal data are reflected in it. Data protection and cybersecurity have benefits in e-commerce and logistics, but they may eventually be supplanted by more recent technologies like block chain (8).

Methodology

Using a system that will gather and assess relevant data from the Scopus database, one may do a bibliometric review on online banking, electronic commerce, and risk management. The following steps define the approach to be used for this review (6, 10).

Data Collection

The research question for this study is to examine the current state of knowledge and trends in online banking, electronic commerce, and risk management (8, 11). The data collection process for the Scopus metadata analysis involved several methodical steps to ensure the relevance and quality of the data concerning risk perception and perceived risk management in e-commerce practices.
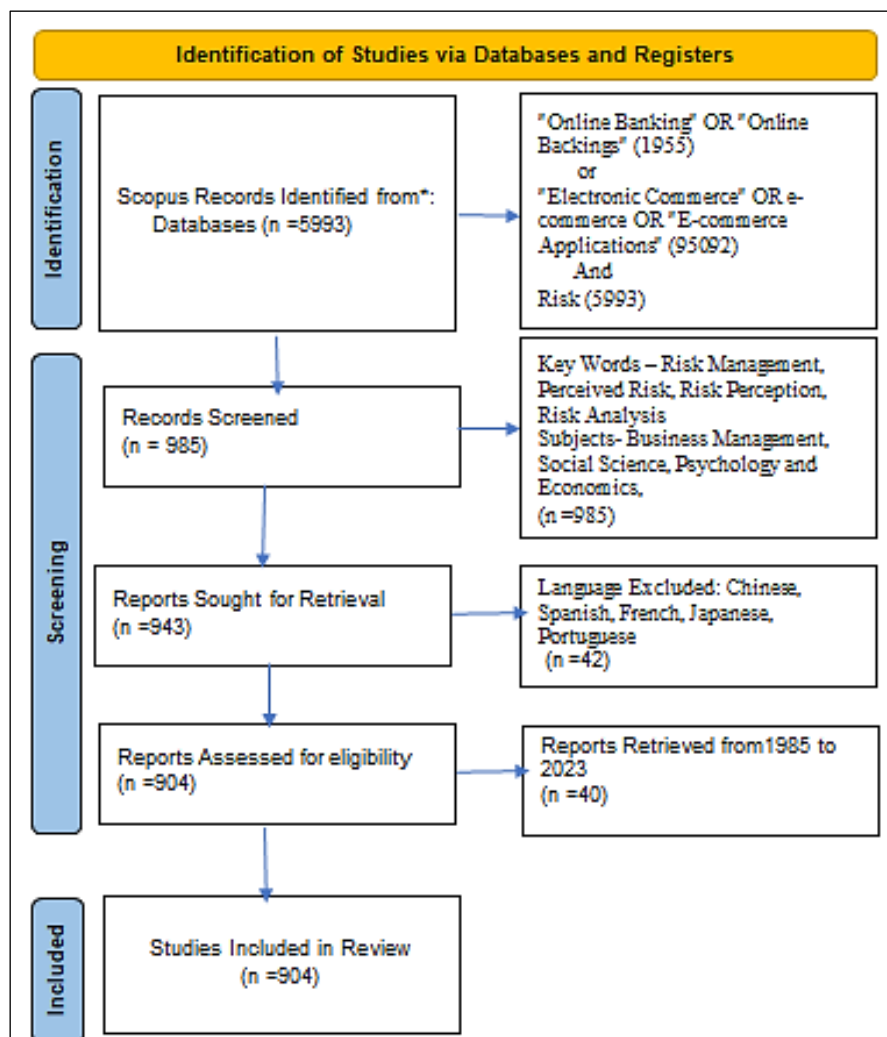

Figure 1: SLR Flowchart Illustrating the Search Process (12)

The process began with an initial search in the Scopus database, covering the time frame from 1995 to 2023 in Figure 1 (8). The Scholar used keywords related to "risk perception," "perceived risk management," and "e-commerce," which yielded a total of 904 (12). Next, the inclusion criteria were applied. This included selecting only articles published in English and focusing on document types such as articles, conference papers, and reviews. The Scholar limited the subject areas to business, management, economics, computer science, and social sciences. To maintain relevance, The Scholar included only articles explicitly discussing risk perception or risk management in an e-commerce context (13, 14). Following this, The Scholar used exclusion criteria

to filter out irrelevant topics, such as articles addressing risk perception outside the e-commerce domain (e.g., healthcare or environmental studies). The Scholar removed duplicate records, particularly those published across multiple journals or conferences, as well as non-peer-reviewed content such as editorials and opinion pieces (15). The 904 articles that met the criteria for detailed analysis underwent rigorous screening and selection. The final step, data extraction, involved subjecting the selected articles to bibliometric analysis using tools like VOSviewer (16). This helped identify key themes, trends, and clusters within the literature. Overall, this structured approach ensured that the resulting dataset was comprehensive and reflective of the developments in risk perception and management within e-commerce over the specified period (14, 17).

Results

The researcher examines established objectives derived from published documents' yearly growth trends, nations' geographical contributions to literature, and the leading documents in the field. The Scholars analyze the top ten nations, cluster keywords related to e-commerce using VOSviewer, and assess risk using Scopus metadata (18).

Annual Growth Trend

From 1995 to 2023, Scopus-indexed literature documented (904) the scholarly evolution of research on risk perception and perceived risk management within e-commerce practices, as reflected in Figure 2. The data shows an initial period of minimal academic activity in the late 1990s, with only a few publications each year. However, from 2004 onwards, there is a noticeable increase in research output, indicating a growing academic interest in understanding and managing risks within the e-commerce domain (19). The peak periods between 2010 and 2011, with publication counts reaching as high as 95 in 2011, suggest heightened attention to these issues, likely driven by the rapid expansion of e-commerce and the accompanying risks perceived by both consumers and providers. Post-2011, the fluctuations in publication numbers may reflect shifts in research focus or the emergence of new risk management challenges and strategies within e-commerce (2, 17).
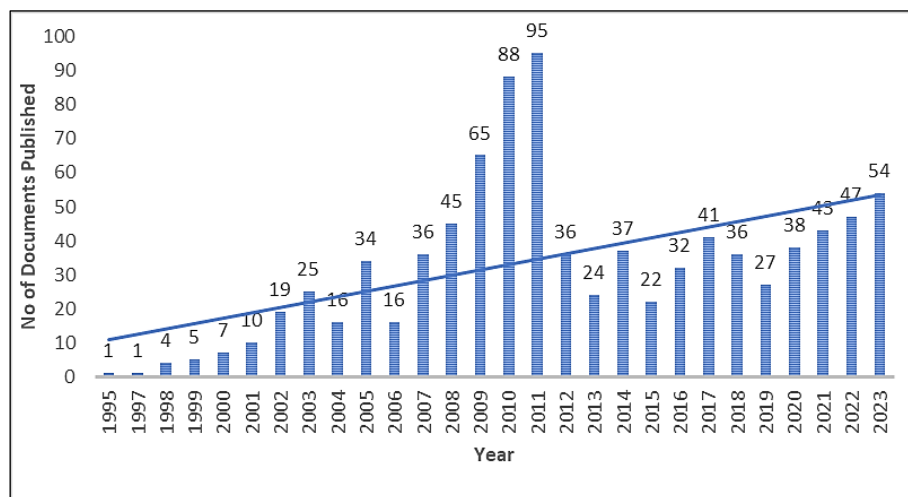

Figure 2: Annual Growth Rate of Literature Documents Publication (12)

Despite the fluctuations, the trendline suggests a steady overall increase in annual publications, indicating growing research interest and output over time. The most recent years, 2022 and 2023, continue this upward trend, with 47 and 54 publications reflecting sustained or increasing research activity. This trend indicates a long-term growth in academic or scientific publications, possibly driven by growing interest in the field or more active research communities contributing to the body of knowledge (5, 8).

Geographical Documents Publications

The geographical distribution of 904 publications on risk perception and risk management in e-commerce, based on Scopus data from 1995 to 2023, shows considerable variation across nations. In Figure 3, navy blue denotes the nation with the highest document publications, while light navy

blue denotes the nation with the lowest document publications. The lowest document is indicated by light gray. China leads with 358 publications, reflecting its significant role in global e-commerce. The United States follows with 154 publications, highlighting its focus on technological innovation and cybersecurity. Other notable contributors include Taiwan, the UK, and India. Asia, including

China, Taiwan, and India, is central to this research, while Europe also plays a key role with contributions from the UK, Spain, and Germany (13, 17). Emerging markets like Brazil and Indonesia are increasingly involved, though regions such as Africa and Eastern Europe remain under-represented.
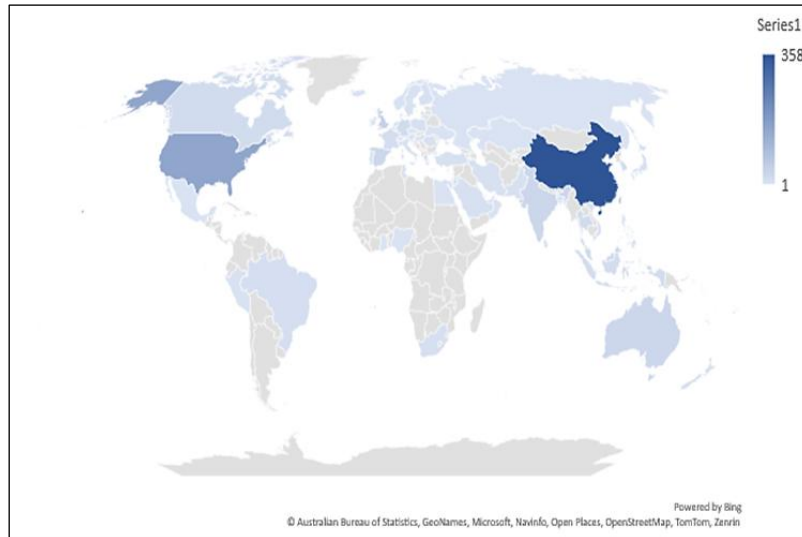

Figure 3: Geographical Documents Publications (13)

The United States follows with 154 publications, highlighting its focus on technological innovation and cybersecurity. Other notable contributors include Taiwan, the UK, and India (13). Asia, including China, Taiwan, and India, is central to this research, while Europe also plays a key role with contributions from the UK, Spain, and Germany. Emerging markets like Brazil and Indonesia are increasingly involved, though

regions such as Africa and Eastern Europe remain under-represented (18).

Top Documents Published Source Pages

A study of the top ten published source pages on risk perception and perceived risk management in e-commerce, based on Scopus metadata from 1995 to 2023, Table 1 reveals that highest research documents published country (1).

Table 1: Top Ten Documents Published source pages

Sl. No	Source Title	No. Articles
1	Proceedings of The International Conference on Electronic Business	52
2	2011 2nd International Conference on Artificial Intelligence Management Science and Electronic Commerce Aimsec 2011 Proceedings	34
3	Proceedings of The International Conference on E-Business and E-Government Icee 2010	34
4	2011 International Conference on E-Business and E-Government Icee2011 Proceedings	27
5	Computers and Security	20
6	Electronic Commerce Research	17
7	Electronic Commerce Research and Applications	17
8	International Journal of Information Management	15
9	Lecture Notes in Business Information Processing	14
10	Sustainability Switzerland	14

The table 1 lists the top 10 sources contributing the most articles on e-commerce-related topics. The proceedings of the International Conference on Electronic Business led with 52 articles, indicating its prominence in electronic business research. Following are the 2011 2nd International Conference on Artificial Intelligence Management Science and Electronic Commerce Proceedings of the International Conference on E-Business and E-Government, both with 34 articles each, reflecting significant contributions to e-commerce and e-governance. Other notable sources include Computers and Security, which has 20 articles emphasizing the importance of cybersecurity in e-commerce, and Electronic Commerce Research and Electronic Commerce Research and Applications, which each have 17 articles. The International Journal of Information Management and Sustainability (Switzerland) also features prominently, contributing to the fields of e-commerce management and sustainability, with 15 and 14 articles, respectively. Table 1represent a diverse range of research source pages and the broader domain of e-commerce (20).

Author keyword Clustering

The VOSviewer analysis of Scopus metadata from 1995 to 2023 categorizes the research on risk perception and perceived risk management in e-commerce activities into seven clusters in Figure 4. Each cluster represents a thematic grouping of terms that highlights the key areas of focus within the research body (Table 2) (18).

Supply Chain and Risk Management (Cluster 1): encompasses topics such as adverse selection, credit risk, e-business, supply chain risk, and risk management. Risk assessment and supply chain management highlight the challenges associated with information asymmetry, financial risk, and logistics in e-commerce (5). In this Cluster highlight the multifaceted risks inherent in e-commerce supply chains, including financial uncertainties and information disparities. Effective risk management strategies are crucial to mitigate these challenges, ensuring smooth operations and fostering trust among stakeholders.
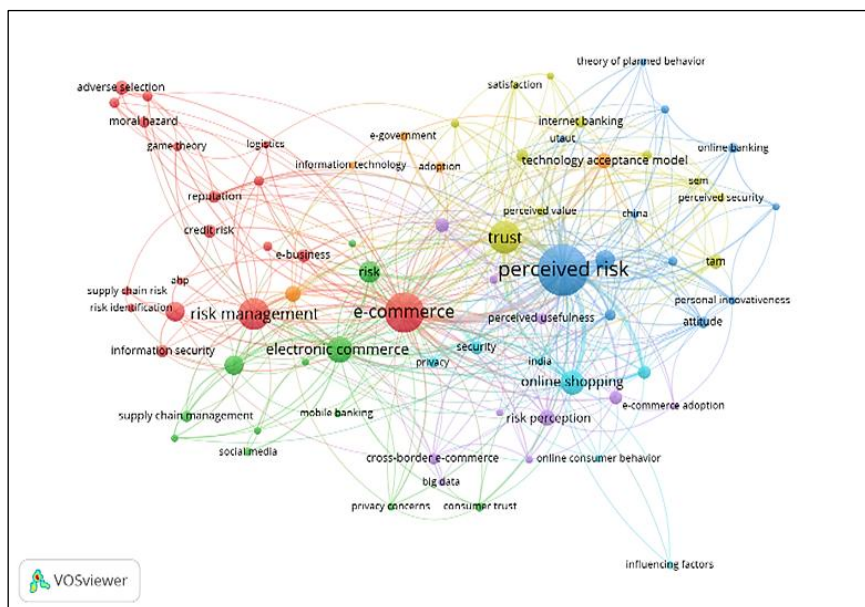

Figure 4: Author Keyword Clustering (12)

Consumer Trust and Information Systems (Cluster 2): This cluster is characterized by important concepts, including customer trust, electronic commerce, risk management, and social media. This study examines the interactions between customer trust, privacy concerns, and risk management associated with information systems

in e-commerce environments. Keywords such as "consumer trust," "privacy concerns," and "risk analysis" underscore the importance of trust in the adoption of information systems by consumers. Addressing privacy issues and implementing robust risk control measures are essential to enhance consumer confidence in e-commerce platforms.

Behavioral Intentions and Technological Acceptance (Cluster 3): Include attitude, behavioral intention, perceived risk, and technology acceptance. The study examines consumer behavior, focusing on the influence of perceived risks and benefits on the acceptance of technology, online banking, and purchasing intentions. This cluster Understanding how perceived risks affect consumers' willingness to adopt new technologies is vital. Strategies to reduce perceived risks can lead to higher acceptance rates of e-commerce technologies.

Consumer Loyalty and Service Excellence (Cluster 4): This cluster primarily focuses on concepts such as customer loyalty, perceived security, service excellence, and trust. It highlights the importance of perceived security and service quality in online banking and e-commerce to enhance consumer satisfaction and loyalty. This cluster emphasizes the role of high-quality service and trust-building in fostering consumer loyalty. Effective risk management contributes to service excellence, thereby enhancing customer satisfaction and loyalty.

Risk Perception and Emerging Trends (Cluster 5): This cluster encompasses concepts such as big data, COVID-19, e-commerce adoption, and risk perception, highlighting the evolving trends in e-commerce, particularly concerning the epidemic and its impact on customer behavior and risk perception. This cluster reflects how emerging trends and global events influence consumer behavior and risk perceptions. Staying attuned to these trends is essential for proactive risk management in e-commerce.

Table 2: Author Keywords Clustering

Cluster No	Cluster Name	Keyword
1	E-Commerce Risk and Supply Chain Management	Adverse Selection, Credit Risk, E-business, e-commerce, Electronic Market, Financial risk, game theory, Information asymmetry, Information Security, logistics, moral hard, reputation, risk assessment, risk management, risk identification, supply chain, supply chain risk.
2	Consumer trust and information systems	Consumer trust, electronic commerce, experience, information system, management, mobile banking, privacy concerns, risk, risk analysis, risk control, social media,
3	Behavioral intentions and technological acceptance	Attitude, behavioral intention, china, consumer behavior, online banking, perceived benefit, perceived risk, personal innovations, purchase intention, technology acceptance, theory of planned behavior, utaut.
4	Consumer loyalty and service excellence	Customer loyalty, customer satisfaction, internet baking, perceived security, perceived values, satisfaction, SEM, service quality, Structure equation modeling, tam, trust.
5	Risk perception and emerging trends	Big data, consumer behavior, COVID-19, cross-border e-commerce, e-commerce adoption, online trust, perceived usefulness, repurchase intention, and risk perception.
6	Privacy and Security Concerns	In India, influencing factors include online consumer behavior, purchase intention, online shopping, privacy, and security.
7	E-governance and technology adoption	Adoption, e-governance, information technology, internet, technology acceptance mode.

Privacy and Security Concerns (Cluster 6): Privacy, security, online purchasing intentions, and the factors that influence them are all topics of interest. This paper focuses on the elements that influence online consumer behavior, particularly highlighting privacy and security issues. Addressing these concerns is fundamental to building trust and encouraging online purchasing behaviors.

E-governance and Technology Adoption (Cluster 7): This cluster contains keywords including adoption, e-governance, information

technology, and methods for technological acceptance. The discussion revolves around the broader acceptance of e-governance and information technology and their impact on e-commerce practices. This cluster understanding the factors that influence the adoption of e-governance technologies can inform strategies to manage risks associated with digital governance platforms.

The categories encompass various topics, from supply chain risks to consumer behavior and emerging trends, illustrating the diverse nature of research in e-commerce risk management. Each cluster addresses a unique aspect of this field. The clustering highlights the complexity and evolving nature of e-commerce and the interconnections among various risk awareness and management elements. Table 2 clusters reflect the multi-faceted nature of research in e-commerce risk management, with each cluster addressing different aspects ranging from supply chain risks to consumer behavior and emerging trends. The clustering underscores the complexity and evolving nature of e-commerce, highlighting how various elements of risk perception and management are interconnected (1, 2, 8). By analysing seven clusters, researchers and practitioners can develop targeted strategies to address specific risks, enhance consumer trust, and adapt to emerging trends, thereby improving overall risk management practices in the digital marketplace.

Discussion

The study of risk perception and risk management in e-commerce from 1995 to 2023 reveals significant trends. Initially, research was sparse, with only a few publications in the late 1990s. However, a notable increase began around 2004, peaking in 2010 and 2011, likely due to the rapid growth of e-commerce and heightened awareness of associated risks. Despite some fluctuations, the trend indicates a sustained interest in the field, reflecting ongoing challenges and advancements in technology (12). In the year 2012 on words, e-commerce risk mitigation is strengthened. The risk mitigation practices overcoming the Technology risk and smooth and trust made. It is reducing the research document publication from 2011 to 2012. The emerging new technology-based risk perception and management research made on e-

commerce users' perspective. This outcome has instable of document publications from 2012 to 2019. In 2019, COVID guidelines attracted new users and new strategies in e-commerce platforms. In this aspect, slightly, improving the research on these concepts from 2019 to 2023. Geographical analysis reveals that China leads with 358 publications, highlighting its prominent role in e-commerce research, especially in supply chain management and risk perception. The United States follows with 154 publications emphasizing innovation and cybersecurity. Significant contributions also come from Taiwan, the UK, and India. While Asia (particularly China and Taiwan) and Europe (including the UK, Spain, and Germany) are prominent, emerging markets like Brazil and Indonesia are growing. However, regions like Africa and Eastern Europe are less represented. Key sources include influential conference proceedings and journals, such as "Proceedings of the International Conference on Electronic Business (21). Risk perceptions in e-commerce indeed exhibit in Figure 3 notable differences between developed and developing markets, influenced by varying economic, cultural, and infrastructural factors. In developed markets, such as the United States and the United Kingdom, consumers often prioritize concerns related to data privacy, cybersecurity, and identity theft. These apprehensions stem from the high incidence of cyberattacks and the extensive use of digital payment systems in these regions. Consequently, businesses in developed countries invest heavily in advanced security measures and transparent data protection policies to build consumer trust. Conversely, in developing markets like India and Brazil, while cybersecurity remains a concern, additional factors significantly influence risk perception. Issues such as product authenticity, payment fraud, and delivery reliability are more pronounced due to less mature regulatory frameworks and logistical challenges. For instance, the prevalence of counterfeit goods and unreliable delivery services can deter consumers from engaging in e-commerce transactions. Moreover, lower levels of digital literacy and limited access to secure payment options further exacerbate perceived risks. Incorporating these regional comparisons enhances the paper's contribution by highlighting the necessity for tailored risk management strategies. Understanding that

consumers in different markets have distinct concerns allows businesses and policymakers to develop targeted interventions. For example, in developed markets, emphasizing robust data protection measures and transparent privacy policies can alleviate consumer fears. In contrast, in developing markets, efforts might focus on improving product verification processes, enhancing payment security, and strengthening logistics to ensure reliable delivery. This cluster analysis offers important insights into how e-commerce risk management is changing. The clustering of key terms such as supply chain risks, consumer trust, privacy concerns, and technology adoption reveals distinct yet interconnected themes central to e-commerce research. The findings highlight the complex relationship between behavioral intentions, service quality, and emerging trends. Consumer trust is crucial in shaping attitudes towards online shopping, shaped by perceptions of risk and privacy concerns. The Theory of Planned Behaviour (TPB) and Unified Theory of Acceptance and Use of Technology (UTAUT) emerge as essential frameworks for understanding how consumers' behavioral intentions correlate with technology acceptance and e-commerce adoption (14, 22, 23). Moreover, the analysis identifies that information asymmetry and adverse selection remain central concerns, especially in supply chain management. The interplay between information security and moral hazards emphasizes the need for robust risk assessment and management strategies in e-commerce. The cluster analysis uncovers distinct consumer segments based on their innovation adoption, perceived usefulness, and trust in online platforms. These findings suggest that e-commerce providers must develop tailored risk mitigation and trust-building mechanisms to effectively target different consumer groups.

Furthermore, the impact of social media usage on consumer trust highlighted the importance of transparent communication and privacy protection in cultivating long-term customer loyalty. As cross-border e-commerce continues to grow, addressing logistical challenges and differing regulatory standards will be vital for maintaining consumer confidence in global transactions (14, 22). The cluster analysis offers a thorough understanding of the interconnectedness between risk, trust, and technology adoption,

emphasizing the necessity for further integration of information systems and consumer behavior research to comprehend the future of e-commerce.

Implications

The importance of bridging theoretical insights with industry practices, particularly in the realm of risk mitigation. The following strategies through which enterprises can leverage bibliometric insights for effective risk management (8).

Practical Implication by Industry

Identifying Emerging Risk Factors: Bibliometric analyses enable organizations to detect emerging themes and trends in risk management by systematically reviewing scholarly publications. For instance, a bibliometric study on supply chain risk management highlighted key clusters such as 'Risk management in construction project management' and 'Enterprise risk management in the construction sector,' providing insights into prevalent and emerging risk factors within these domains. Enterprises can utilize such analyses to proactively identify and address potential risks pertinent to their industry.

Enhancing Decision-Making Processes: Bibliometric tools like VOSviewer facilitate the visualization of complex interrelationships among risk factors. By mapping these relationships, organizations can prioritize risks and allocate resources more effectively. For example, a bibliometric analysis in the Islamic banking sector provided a structural mapping of knowledge distribution, assisting in understanding the interactions and collaborations among various risk factors. Such insights can inform strategic decision-making and policy formulation.

Benchmarking and Best Practices: Enterprises can identify leading experts and seminal works in the field of risk management. This knowledge allows organizations to benchmark their practices against industry standards and adopt best practices. For instance, understanding the authorship patterns and most productive authors in risk management research can guide enterprises in seeking collaborations or consulting authoritative sources.

Monitoring Technological Advancements: Bibliometric studies can reveal technological innovations and their implications for risk management. By staying informed about advancements such as blockchain technology and big data analytics, organizations can assess their

potential impact on existing risk management frameworks and adapt accordingly. A bibliometric analysis on sustainability and risk management highlighted the integration of blockchain technology in minimizing risks, underscoring the importance of monitoring technological trends.

Scholarly Implication

The bibliometric review provides an overview of the academic research on the treatment suggestions derived from the cluster analysis. In a similar vein, suggested research questions for academic research. specifically, defined research gap for academic study.

Recommended Theory for Investigations

The Scholar investigates the keywords of past published research papers and applies them to further theory investigations (17).

Agency Theory: Relevant for understanding adverse selection and moral hazard issues, where information asymmetry impacts the decisions of supply chain partners.

Expectation-Confirmation Theory (ECT): This theory is useful for exploring repurchase intentions by studying the role of customer satisfaction and how expectations are met in e-commerce.

Game Theory: It is useful for analyzing strategic decision-making in e-commerce, particularly how companies manage risk in competitive and cooperative supply chain environments.

Information Asymmetry Theory: Explains the impact of uneven information distribution between buyers and sellers, which leads to adverse selection and inefficiencies in e-commerce.

Innovation Diffusion Theory (IDT/DOI): IDT explores how new technologies are adopted, considering factors like relative advantage, compatibility, and trialability. It applies to the spread of e-commerce and e-governance technologies.

Prospect Theory: Addresses how individuals perceive and assess risk, and it can be applied to study risk perception and decision-making in cross-border e-commerce.

Resource Dependency Theory: This can be used to study how supply chain partners manage resources and dependencies, particularly in mitigating risks like logistics and credit risk.

Risk Management Theory Focuses on identifying, assessing, and mitigating risks within e-commerce supply chains.

Risk Perception Theory: Explains how perceived risks, such as privacy and security concerns, shape consumers' purchase intentions and technology adoption in e-commerce.

Social Exchange Theory: This theory investigates how consumers weigh the risks and benefits of engaging in e-commerce transactions, focusing on perceived risks and trust factors.

Technology Acceptance Model (TAM): TAM explains how perceived ease of use and perceived usefulness influence consumers' acceptance of e-commerce platforms and technology. It's particularly valuable when investigating perceived security, privacy risks, and e-governance technology adoption.

Theory of Planned Behavior (TPB): Useful for investigating how individual attitudes, subjective norms, and perceived behavioral control influence behavioral intentions in e-commerce and online banking contexts. TPB can also explain how privacy and security concerns affect consumer intentions to purchase online.

Trust-Based Consumer Decision-Making Model: Central to understanding how trust influences consumer behavior in e-commerce, particularly regarding online transactions and mobile banking.

Unified Theory of Acceptance and Use of Technology (UTAUT): UTAUT extends TAM by integrating social influence, performance expectancy, effort expectancy, and facilitating conditions. It's useful for studying cross-border e-commerce and technology adoption in private and public sectors, including e-governance.

Protection Motivation Theory: This theory explores how consumers are motivated to protect their privacy and security when engaging in e-commerce transactions.

Service Quality Model: This model evaluates the gap between customer expectations and actual service delivered, which is useful in understanding service quality in e-commerce platforms.

Task-Technology Fit Theory: Explores how well technology fits the task at hand, especially in aligning e-commerce technologies with business processes.

Resource-Based View: This theory emphasizes the role of internal resources, such as IT

infrastructure, in gaining a competitive advantage. It applies to both e-commerce and e-governance. These theories are more suitable for the e-commerce and customer satisfaction analysis related to E-Commerce Risk Perception and Management (15).

Recommended Research Questions for Scholarly Study

The scholar investigating the major keywords usages future research direction-based study questioners relevant to E-Commerce Risk Perception and Management (17). How does information asymmetry influence adverse selection, credit risk, and inefficiencies in e-commerce transactions? What role does reputation management play in mitigating financial risk and enhancing consumer trust in electronic markets? How can game theory and risk management theories be applied to improve risk mitigation strategies within competitive and cooperative e-commerce supply chain ecosystems? How do logistics and information security interact to reduce moral hazard in supply chain management for e-businesses? What are the most effective risk assessment and identification methods for managing risks in e-commerce operations, particularly in the supply chain? How do information systems management practices influence consumer trust and risk perception on e-commerce platforms? What role do privacy concerns and perceived risk play in shaping consumer trust and behavioral intentions toward mobile banking and e-commerce platforms? How do social media interactions and transparency influence consumer trust and risk assessment in e-commerce transactions? What risk control mechanisms most effectively foster consumer trust and reduce perceived risk in the electronic commerce domain? How do trust and perceived ease of use affect the successful implementation of e-governance technologies, and what implications does this have for public sector efficiency? How does service quality (measured by the SERVQUAL model) impact customer satisfaction, trust, and loyalty in Internet banking and e-commerce platforms? How can cluster analysis segment consumers based on risk perception, trust, and service satisfaction, providing insights into targeted marketing and strategy development? How do attitudes, subjective norms, and perceived behavioral control influence consumers'

behavioral intentions and technology adoption in e-commerce, as explained by TPB and UTAUT? How does perceived risk affect technology acceptance in online banking and e-commerce environments, particularly during and after the COVID-19 pandemic? How does personal innovation moderate the relationship between perceived benefits (e.g., convenience) and purchase intention in e-commerce? How do perceived value, trust, and security affect consumer decision-making in online transactions? How do trust and perceived usefulness influence consumers repurchase intentions on e-commerce platforms, especially cross-border e-commerce? How can big data analytics reveal emerging trends in e-commerce, such as consumer behavior changes during the COVID-19 pandemic? How does risk perception influence consumer behavior in cross-border e-commerce transactions, particularly with differing regulatory standards and delivery uncertainties? How do privacy and security concerns shape purchase intentions in different consumer segments, and how can businesses enhance privacy policies to improve trust? What are the key factors driving technology adoption in e-governance platforms, and how do TAM and UTAUT explain the adoption patterns across different regions and demographics? How does service excellence contribute to customer satisfaction and retention in e-commerce platforms, and what role does perceive security play in this process? How does consumer trust in e-commerce platforms vary based on the platform's perceived security measures and privacy protections? How does social media influence trust in e-commerce transactions, particularly concerning privacy concerns and risk mitigation? As TAM and UTAUT explain, how do perceived ease of use and security concerns affect technology acceptance in e-commerce and online banking?

Investigation of Research Gap

Despite the rapid growth of e-commerce, significant challenges in risk management, customer trust, and technological adoption remain inadequately addressed. Current research primarily focuses on isolated elements of these concerns, often separating frameworks like agency theory, information asymmetry, and the TAM. However, there is a lack of comprehensive studies integrating these theories to understand the

interaction of various risk factors in e-commerce (15, 24). While existing research has examined the impact of privacy concerns and perceived risk on customer behavior, the link between these factors and trust in e-commerce platforms requires further exploration. The potential of reputation management to mitigate financial risks and enhance trust remains under-researched, as does the influence of social media interactions on consumer trust and risk perception (17). Another underexplored area is the application of game and risk management theories to improve strategies in e-commerce supply chains, especially regarding logistics and information security (21). There is a critical gap in understanding how these factors reduce moral hazards and identifying effective risk assessment methods tailored to e-commerce operations. Additionally, while the TPB and the UTAUT offer valuable insights into consumer intentions, more empirical testing is needed in practical contexts, such as cross-border e-commerce and post-COVID-19 consumer behavior. Research on how perceived risk influences technology adoption in these settings is limited (15, 24, 25). Finally, models like SERVQUAL shed light on customer satisfaction and loyalty. Still, there is a shortage of studies examining the relationship between perceived service quality and consumer trust in e-commerce platforms (26, 27). As e-commerce evolves, understanding the complex relationships between perceived risk, consumer trust, and technology adoption is crucial for developing strategies that enhance user experience and support sustainable growth. Addressing these research gaps will provide valuable insights for policymakers and practitioners navigating the digital marketplace (14). The importance of incorporating product and service-specific variables to enhance the comprehensiveness of our study. Integrating risk perception, trust, and behavioural intentions variables can provide deeper insights into different product categories influence consumer behavior and risk perceptions in e-commerce. These factors influencing consumer trust in purchasing electronics online may differ from those affecting trust in online grocery shopping.

Conclusion

This study provides a comprehensive review of the evolution in research on risk perception and risk management in e-commerce from 1995 to 2023. The analysis reveals a significant upward trend in publications, especially after 2004, with peaks around 2010 and 2011, reflecting the growing concerns and complexities in e-commerce risks. China emerges as the leading contributor, followed by the United States, Taiwan, the UK, and India, with emerging markets like Brazil and Indonesia gaining prominence. Key sources of influence include major conference proceedings and journals, underscoring the importance of these platforms in advancing research. A cluster analysis reveals that risk in e-commerce and supply chain management involves financial and operational risks. Effective risk management strategies must address these interrelated factors to enhance efficiency and trust in the electronic market. The clustering of key terms highlights diverse thematic areas, including supply chain risks, consumer trust, and emerging trends like big data and privacy concerns. These findings underscore the need for further exploration of integrated risk management frameworks and a more global perspective to address evolving challenges and enhance consumer trust in digital transactions. The rapid growth of e-commerce presents ongoing challenges in risk management, consumer trust, and technology adoption, which remain inadequately addressed in existing literature. A holistic approach integrating theories such as agency theory, information asymmetry, and technology acceptance model is essential for understanding the interplay of risk factors in e-commerce environments. Furthermore, the influence of privacy concerns, social media interactions, and service quality on consumer behaviour warrants deeper exploration. Addressing these gaps will provide valuable insights for practitioners, and scholarly investigation guiding the development of effective strategies that enhance user experience and promote sustainable growth in the digital marketplace. Present day, emerging technology integrated in ecommerce, the incorporation of AI, IoT and FinTech (Digital payment) technologies has significantly transformed e-commerce operations, enhancing personalization, customer service, and fraud detection. AI-driven recommendation systems and chatbots have improved user engagement and trust by providing tailored experiences. Emerging digital payment

technologies have revolutionized transaction methods but present technical challenges related to privacy, security, and fraud prevention. Security breaches and lack of robust fraud protection mechanisms can diminish consumer confidence in digital payments.

Abbreviations

ECT: Expectation-Confirmation Theory, IAT: Information Asymmetry Theory, IDT/DOI: Innovation Diffusion Theory, RDT: Resource Dependency Theory, RMT: Risk Management Theory, RPT: Risk Perception Theory, SET: Social Exchange Theory, TET: Technology Acceptance Model: TPB: Theory of Planned Behaviour, UTAUT: Unified Theory of Acceptance and Use of Technology.

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Conflict of Interest

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References

1. Zhou F, Liu Y. Blockchain-enabled cross-border e-commerce supply chain management: A bibliometric systematic review. Sustainability. 2022;14(23):1-23.
2. Thangavel P, Chandra B. Two Decades of M-Commerce Consumer Research: A Bibliometric Analysis Using R Biblioshiny. Sustainability (Switzerland). Multidisciplinary Digital Publishing Institute (MDPI). 2023; 15(15):1-32.
3. Ioannidis JP, Tezel A, Jagsi R. Overall and COVID-19-specific citation impact of highly visible COVID-19 media experts: Bibliometric analysis. BMJ Open. 2021; 11(10):1-7.
4. Al-maaitah TA, Majali TE, Alsoud M, Almaaitah DA. The impact of COVID-19 on the electronic commerce users behavior. Journal of Contemporary Issues in Business and Government. 2021; 27(1):784-793.
5. He P, Wang TY, Shang Q, Zhang J, Xu H. Knowledge mapping of e-commerce supply chain management: a bibliometric analysis. Electronic Commerce Research. 2022; 24(3):1889-925.
6. Vuţă DR, Nichifor E, Ţierean OM, Zamfirache A, Chiţu IB, Foris T, Brătucu G. Extending the frontiers of electronic commerce knowledge through cybersecurity. Electronics. 2022;11(14):1-14.
7. Lopez-Nicolas C, Molina-Castillo FJ. Customer Knowledge Management and E-commerce: The role of customer perceived risk. International Journal of Information Management. 2008;28(2):102-13.
8. Bach NH, Hoang CC. Exploring the evolution of distribution in e-commerce: a bibliometric analysis. Journal of distribution science. 2025;23(1):79-93.
9. Shashi, Centobelli P, Cerchione R, Merigo JM. Mapping knowledge management research: a bibliometric overview. Technological and Economic Development of Economy. 2021; 28(1):239–67.
10. Jahng J, Jain H, Ramamurthy K. Effects of interaction richness on consumer attitudes and behavioral intentions in e-commerce: Some experimental results. European Journal of Information Systems. 2007;16(3):254–69.
11. Ndonga D. E-Commerce in Africa: Challenges and Solutions. African Journal of Legal Studies. 2012;5(3):243–68.
12. Bedaduri R, Mamilla R. Exploring trends and dynamics in women's entrepreneurship research: A bibliometric analysis of survey questionnaires and emerging themes. Multidiscip Rev. 2024;7(11):1-10. https://doi.org/10.31893/multirev.2024266
13. Altarturi HHM, Nor ARM, Jaafar NI, Anuar NB. A bibliometric and content analysis of technological advancement applications in agricultural e-commerce. Electronic Commerce Research. 2023; 25(1):805–48.
14. Villa E, Ruiz L, Valencia A, Picón E. Electronic commerce: factors involved in its adoption from a bibliometric analysis. Journal of Theoretical and Applied Electronic Commerce Research. 2018;13(1):39–70.
15. Zahra AA, Nurmandi A, Tenorio CB, Rahayu R, Benectitos SH, Mina FLP. Bibliometric analysis of trends in theory-related policy publications. Emerging Science Journal. 2021;5(1):96–110.
16. Chen Y, Cheng L, Lian R, Song Z, Tian J. COVID-19 Vaccine Research Focuses on Safety, Efficacy, Immunoinformatic, and Vaccine Production and Delivery: A Bibliometric Analysis Based on VOSviewer. Biosci Trends. 2021;15(2):64–73.
17. Ramamurthy B, Kumar Pradhan S. Microfinance and Women: Bibliometric Review with Current Status, and Future Research Directions. Review of Economics and Finance. 2023; 21(1):1911-28. https://orcid.org/0000-0003-1420-113X
18. Suclupe-Navarro P, Limaymanta CH, Ramírez NH, Guillén H. Scientific Production on Library Anxiety: A Bibliometric and Scientometric Analysis from Scopus. Revista Espanola de Documentación Cientifica. 2021;44(2):1–13.
19. Nomalisa NE, Widowati R. A bibliometric analysis using the VOS Viewer: Green marketing, repurchase intention, and correlations. Multidisciplinary Reviews. Malque Publishing. 2024; 7(6):1-12.

20. Kakouris A, Georgiadis P. Analysing entrepreneurship education: a bibliometric survey pattern. Journal of Global Entrepreneurship Research. 2016; 6(1):1-18.

21. Ramos E, Dien S, Gonzales A, Chavez M, Hazen B. Supply chain cost research: a bibliometric mapping perspective. Benchmarking: An International Journal. 2021;28(3):1083-100.

22. Junaid-ur-Rehman S. Evaluating the Effectiveness of Reasoned-action Theories (TRA, TPB, IBM) for Explaining Low E-commerce Adoption in a Developing Country: A Structural Equation Modelling (SEM) approach AI trends in digital humanities research. Trends in Computer Science and Information Technology. 2022;7(2):35–46.

23. Santosa AD, Taufik N, Prabowo FHE, Rahmawati M. Continuance intention of baby boomer and X generation as new users of digital payment during COVID-19 pandemic using UTAUT2. Journal of Financial Services Marketing. 2021;26(4):259–73.

24. Lee MC. Factors influencing the adoption of Internet banking: An integration of TAM and TPB with perceived risk and perceived benefit. Electron Commer Res Appl. 2009;8(3):130–41.

25. Martinez BM, McAndrews LE. Do you take? The effect of mobile payment solutions on use intention: an application of UTAUT2. Journal of Marketing Analytics. 2023;11(3):458–69.

26. Sharma V, Jangir K, Gupta M, Rupeika-Apoga R. Does service quality matter in FinTech payment services? An integrated SERVQUAL and TAM approach. International Journal of Information Management Data Insights. 2024;4(2):1-16.

27. Vong J, Fang J, Insu S. Delivering financial services through mobile phone technology: a pilot study on impact of mobile money service on micro-entrepreneurs in rural Cambodia. Int. J. Information Systems and Change Management. 2012; *6*(2): 177-186.