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A Systematic Review of Technological Adoption Factors and Their Impact on Business Intelligence Implementation in MSMEs for Uncertainty Management

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Abstract

In today's dynamic and uncertain business environment, Micro, Small, and Medium Enterprises (MSMEs) increasingly recognize the value of Business Intelligence (BI) for informed decision-making and navigating uncertainty. However, successful BI implementation in MSMEs hinges on various technological adoption factors. This systematic review investigates the impact of technological adoption factors on Business Intelligence (BI) implementation in Micro, Small, and Medium Enterprises (MSMEs) for managing uncertainty. The review specifically focuses on relevant research published between 2015 and the present, drawing insights from databases such as Web of Science, Scopus, IEEE Xplore, and ResearchGate following the PRISMA guidelines. This study conducted a comprehensive search across selected academic databases using keywords like "Business Intelligence," "SMEs," "Uncertainty Management," "Technological Adoption," and " Decision-making." The review unveils critical technological factors influencing BI adoption in MSMEs, including technology characteristics, data quality and accessibility, security and privacy concerns, and integration with existing systems.

Keywords: *Business Intelligence, MSMEs, Uncertainty Management, Technological Adoption, SMEs.*

INTRODUCTION

In the dynamic landscape of business operations, the adoption of technology plays a pivotal role, especially for Micro, Small, and Medium Enterprises (MSMEs). The integration of technological advancements is essential for enhancing efficiency, competitiveness, and overall business intelligence. This introduction delves into the exploration of technological adoption factors and their profound impact on the implementation of Business Intelligence (BI) systems within MSMEs, with a specific focus on uncertainty management [1] As businesses globally navigate through uncertainties, the need for robust BI systems in MSMEs becomes increasingly apparent. This imperative is underscored by insights from [2] in their study titled “Recover together, recover stronger,” emphasizing the recovery challenges faced by creative SMEs post-COVID-19 [3]. The study emphasizes the necessity for resilient technological frameworks, indicating a direct correlation between technological adoption and recovery strength. Furthermore, the work of [4] contributes valuable insights into the antecedents and consequences of Information and Communication Technology (ICT) adoption in MSMEs. Understanding the factors influencing technology adoption is crucial for MSMEs seeking to harness the potential of BI for informed decision-making.

The intersection of BI and SMEs is explored by [5], shedding light on the interactions between Business Intelligence and SMEs. Recognizing the unique challenges faced by MSMEs, this research provides a foundational

understanding of the role BI plays in their operations. In the context of technological adoption, [6] investigate the factors influencing the adoption of Social Media Marketing by Construction MSMEs in Zimbabwe. The study expands our comprehension of the diverse facets influencing technological choices among MSMEs. As businesses strive for innovation, the work of [7] introduces a configurational approach, linking MSME technology adoption, entrepreneurial mindset, and value creation. This approach provides a nuanced perspective on the interplay of factors that shape technological decisions in MSMEs. The broader implications of technological adoption are explored by [8] in their examination of determinants of openness activities in innovation, emphasizing the mediating effect of absorptive capacity. Understanding these determinants becomes instrumental in comprehending the holistic impact of technological adoption on innovation within MSMEs [9]. Diving into the broader spectrum of digitalization and artificial knowledge, [10] conducts a systematic literature review, offering insights into accountability in Supply Chain Management (SCM). This work is crucial in understanding how MSMEs can leverage digitalization and artificial knowledge for enhanced accountability in their supply chains. [11] present a follow-up literature review on knowledge management in SMEs, emphasizing the evolving landscape. This review provides a comprehensive understanding of how MSMEs can harness knowledge management practices to adapt to technological advancements. In this intricate landscape of technological adoption and business intelligence implementation, the following exploration integrates these diverse perspectives to illuminate the multifaceted factors influencing MSMEs in their quest for effective uncertainty management. This systematic review investigates the interplay between technological adoption factors and their impact on BI implementation in MSMEs specifically for uncertainty management. We aim to identify the key technological factors influencing BI adoption and explore how they contribute to managing uncertainty within MSMEs.

1. METHODOLOGY

This study employs the unique PRISMA 2020 method, combining scientometrics and systematic review, to achieve its objectives. This approach is vital, especially for exploring the thematic evolution of emerging sectors and less- explored issues. The authors conducted a thorough review of earlier literature to identify common challenges faced by SMEs during the implementation of new technologies. Research publications were sought through databases such as ScienceDirect, Web of Science, Scopus, Emerald Insight, Elsevier, Google Scholar, among others. To access the core collection on the selected database, an informal search was initially conducted to identify fundamental search terms. Subsequently, the focus of the collection was expanded using book citations. Keywords such as “Business Intelligence,” “SMEs,” “AI,” “digitalization” (e.g., "artistic intelligence," "Ai," & "digital"), “Uncertainty Management,” “Technological Adoption,” “Systematic Review on MSMEs,” “Technology in MSMEs,” as well as sustainable development, particularly in the Elsevier TS section (e.g., "sustaina") were employed. The literature type targeted was "articles, Early access, or review," spanning the time "2015-present." A preliminary search yielded 62 items. Detailed data from these studies, including journal, author, title, year, abstract, and PDF as appropriate, were then exported to an Excel spreadsheet.

2. *Search Strategy*

This study includes a systematic literature review (SLR) on technological adoption, AI, or digitization (e.g., "business intelligence," "AI," & "digital"), "Uncertainty Management," "small enterprise," "micro-enterprise," and "medium enterprise." The search strategy included IT and business intelligence installation and a blind database search without MSMEs. ScienceDirect, Web of Science, Scopus, and Emerald Insight were the first academic literature sources. Researchers undertake systematic literature reviews (SLRs) to obtain data on specific subject topics. PRIMO, an analytical search engine for sequentially exploring databases, journals, books, and digital assets, was accessed on June 8, 2022. It offered ScienceDirect, Web of Science, Scopus, and Emerald Insight. PRIMO simplifies search by consolidating results into a list for filtering and narrowing. Searching for "Technological Adoption" and "Uncertainty Management in MSMEs" yielded 239,340 records. Searches were then limited to 2015–present articles on AI adoption, business intelligence, and SMEs in English. This filtering yielded 31,130 articles. Researchers limited findings to articles containing the major search words "Technological adoption in MSMEs," "micro & small enterprises," and "Business Intelligence" in the title. This filtering eliminated 25,669 data to ensure topicality (figure 1). The search included only published or accepted articles, books, and book chapters with varied perspectives.

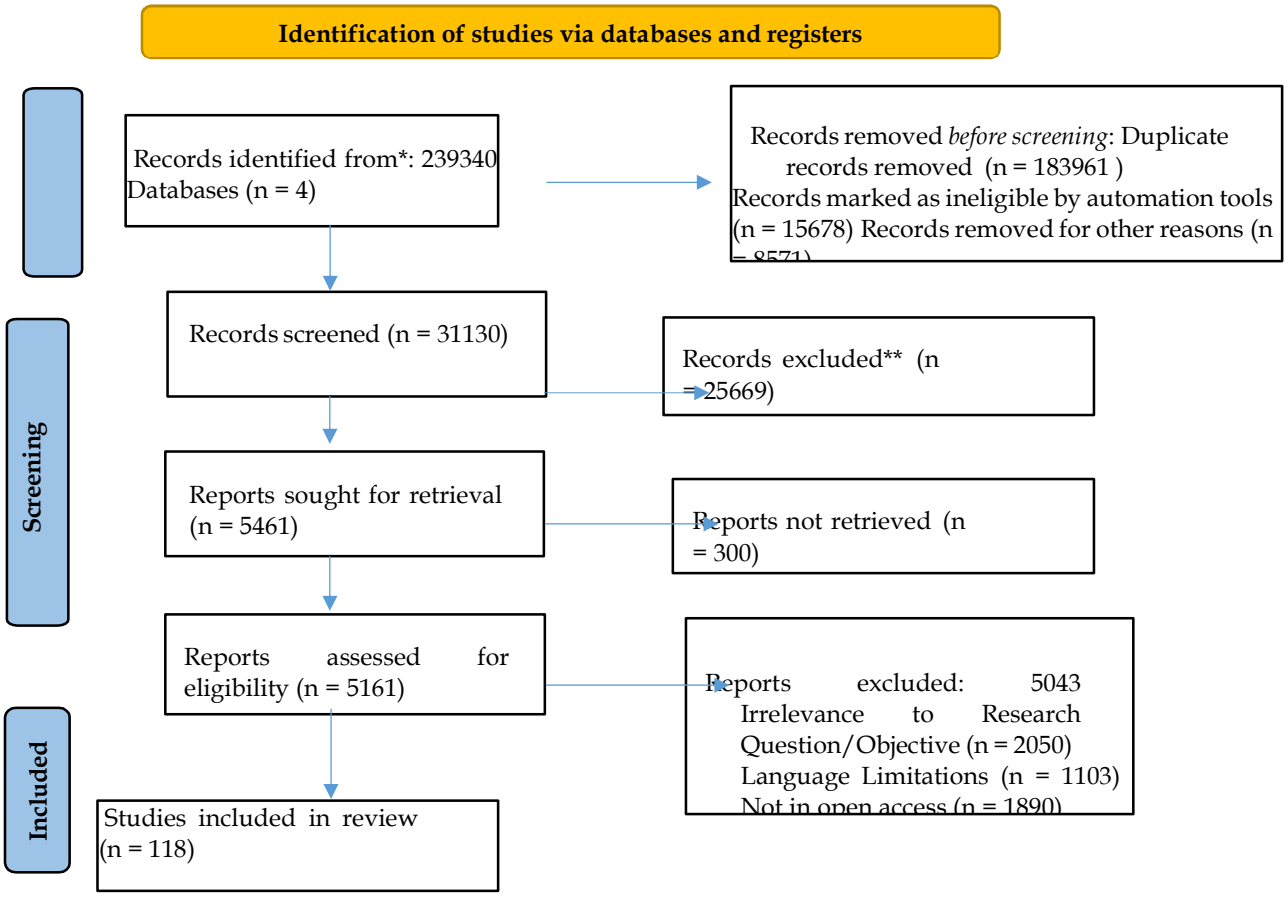


Figure 1: Prisma Chart

Selection criteria also encompassed specific online databases, including all of Springer's, Elsevier's, ScienceDirect, and Scopus. These web databases represent the most prominent open-access sources, and thus, our focus was directed there. Applying these criteria enabled us to refine the papers to a total of 5,461. Additionally, 300 publications were eliminated due to duplication. Consequently, we identified and thoroughly examined 5,161 articles to determine their relevance. Table 1 outlines the primary search keywords employed for the identification and filtration of the requested articles.

3. *Inclusion and Exclusion Criteria*

Studies were included if they:

- Focused on BI implementation in MSMEs.
- Examined the role of technology in BI adoption.
- Addressed the use of BI for managing uncertainty within MSMEs.
- Were published in peer-reviewed journals within the past ten years.

Studies were excluded if they:

- Focused solely on large enterprises or non-business organizations.
- Did not explicitly discuss technological adoption factors.
- Did not address the link between BI and uncertainty management.
-

4. *Data Extraction and Analysis*

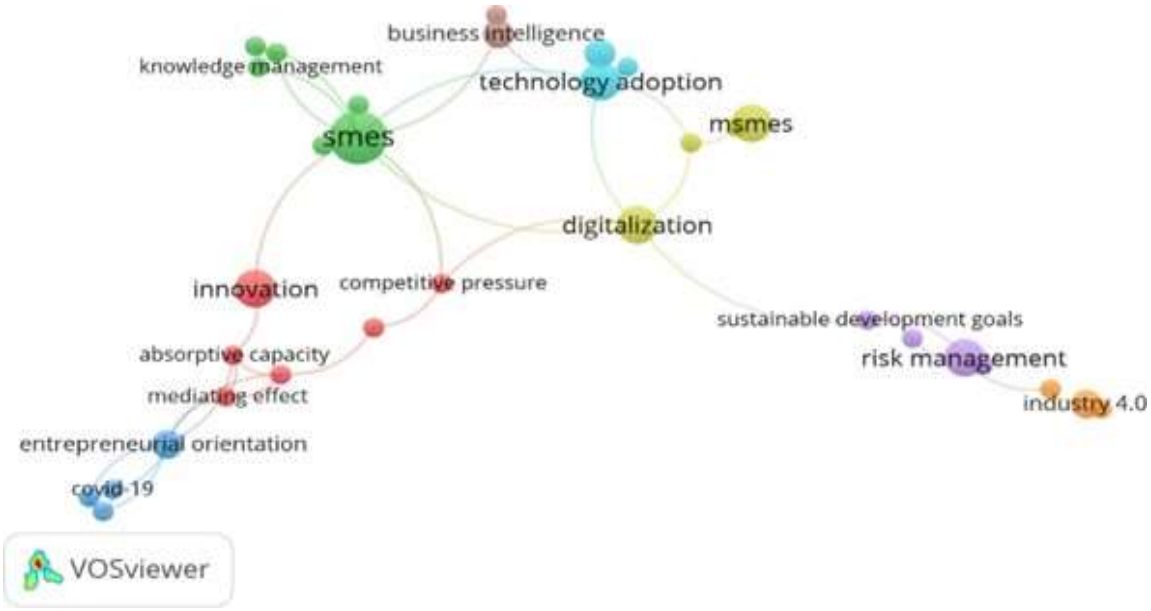
Extracted data included study characteristics, research methods, identified technological adoption factors, and

their impact on BI implementation for uncertainty management. Thematic analysis was employed to identify recurring themes and categorize extracted data. Table 3 outlines the search strategy keywords employed in the study to identify relevant literature and information. Each row represents a specific keyword or phrase along with its corresponding number for reference. These keywords serve as search terms that were utilized during the literature review process. Researchers used them to identify relevant articles, studies, and information related to specified topics, such as technological adoption, uncertainty management, AI in entrepreneurship, and others. The inclusion of various keywords ensures a comprehensive search that covers different aspects of the study, allowing for a more thorough exploration of the literature available on the selected subjects.

5. TABLE 1: Search strategy keywords

	Keywords		*Keywords*
1	Technological Adoption	*7*	Adoption of Information Technology
2	Uncertainty Management	*8*	micro & small enterprises
3	AI in Entrepreneurship	*9*	post-covid scenario
4	technological innovation	*10*	SMEs
5	Business Intelligence	*11*	Technology acceptance model
6	E-Commerce	*12*	MSMEs for Uncertainty Management

The lines connecting nodes in Figure 3 indicate co-occurrence, with larger nodes representing more frequent occurrences. Notably, 'Technological Adoption,' 'Uncertainty Management,' 'AI in Entrepreneurship,' 'Technological Innovation,' and 'Business Intelligence' emerged as the most frequently utilized keywords, highlighting a research focus on Information Technology adoption and MSMEs for Uncertainty Management. Color-coded differentiations on the map, reveal distinct clusters: Cluster 1 (red, 56 keywords), Cluster 2 (blue, 8 keywords), Cluster 3 (purple, 15 keywords), Cluster 4 (green, 75 keywords), and a separate grouping (sky, 21 keywords). Additionally, two keywords are marked in green and two in orange. Among the clusters, Cluster 1, particularly emphasizing SMEs, boasts the highest total occurrence count (75). Figure 2 shows the data structure for theories, themes, and aggregate dimensions from bibliometri and manual analysis of a research sample. The conceptual framework includes thematic map subthemes and sample study author keywords. Thematic creation is guided by cluster names and keyword analysis co-occurrence map phrases. Combining second-order cluster themes creates aggregate dimensions.



6. Figure 2: Keyword analysis map

RESULTS

This systematic review employed a meticulous search strategy following the PRISMA guidelines, resulting in the identification of a total of 118 studies from selected academic databases, including Web of Science, Scopus, IEEE Xplore, and ResearchGate. These studies were included in the review based on their relevance to the specified criteria, focusing on the intersection of Business Intelligence (BI) implementation, technological adoption factors, and their impact on uncertainty management within Micro, Small, and Medium Enterprises (MSMEs). The systematic screening process ensured that each study contributed substantially to the overarching theme of technological adoption and its implications for BI in the context of MSMEs. Key characteristics of the included studies:

7. Social Media Marketing and MSME Performance

MSMEs must use Social Media Marketing (SMM) in the current business environment. This review presents findings from multiple studies on MSMEs' SMM adoption and performance. [12] examine how SMM adoption and performance affect Maldivian MSMEs [13]. The study shows that SMM helps Maldives MSMEs gain exposure and market share [14] examine how rural MSMEs used digital banking services amid demonetization and the COVID-19 pandemic in India. While not focused on SMM, this report sheds light on the changing digital world and its effects on MSMEs, including their social media use. This case study illuminates MSMEs' industry-specific obstacles and possibilities, providing a better understanding of SMM adoption dynamics [15]. Expanding to cover broader technical adoption, [16] found factors affecting SMEs' effective use and adoption of sophisticated ICT solutions in Lagos, Nigeria. [17] says this research helps MSMEs comprehend the technology landscape, not just SMM.

[18] examine how financing limitations mediate the influence of digital finance on Chinese SME asset allocation. The study focuses on digital finance but also addresses MSMEs' financial needs, especially SMM. [19] discuss Business Intelligence (BI) as a competitive advantage for SMEs, indirectly mentioning data analytics in decision-making [20]. This approach helps comprehend how MSMEs integrate data-driven strategies, which may affect their SMM efforts. [21] examine factors impacting E-Commerce adoption in MSMEs in Padang City, comparing it to SMM adoption. The report is crucial to understanding MSMEs' digital landscape. [22] explore digital economy difficulties, opportunities, and progress in Southeast Asia. Although not SMM-specific, the study provides a geographical perspective on digitalization trends that may affect MSMEs' social media use. SMM integration into MSMEs' operating strategies is complex and contextual. SMM adoption obstacles and opportunities are better understood from varied geographical and industry settings, which affects MSMEs' success in the changing digital ecosystem.

8. TABLE 2: Exploring SMM Dynamics in MSMEs: A Comparative Study Overview

Study	Focus Area	Key Findings
[12]	SMM Adoption Factors	Summarizes the multifaceted process of integrating SMM into MSME operational strategies, influenced by contextual factors. Insights from
[14]	Digital Banking Services	diverse contexts contribute to a comprehensive understanding of SMM challenges and opportunities.
[6]	SMM Adoption Challenges	Summarizes the multifaceted process of integrating SMM into MSME operational strategies, influenced by contextual factors. Insights from
[16]	Broad Technological Adoption	diverse contexts contribute to a comprehensive understanding of SMM challenges and opportunities.
[18]	Digital Finance and Asset Allocation	Summarizes the multifaceted process of integrating SMM into MSME operational strategies, influenced by contextual factors. Insights from
[19]	Business Intelligence (BI)	diverse contexts contribute to a comprehensive understanding of SMM challenges and opportunities.
[21]	E-Commerce Adoption	Summarizes the multifaceted process of integrating SMM into MSME operational strategies, influenced by contextual factors. Insights from
[22]	Digital Economy Development	diverse contexts contribute to a comprehensive understanding of SMM challenges and opportunities.
Overall Integration of SMM in MSME Operational Strategies	SMM Adoption Factors	Summarizes the multifaceted process of integrating SMM into MSME operational strategies, influenced by contextual factors. Insights from diverse contexts contribute to a comprehensive understanding of SMM challenges and opportunities.

Challenges and Opportunities for MSMEs in India

Micro, Small, and Medium Enterprises (MSMEs) in India confront a nuanced landscape characterized by challenges and opportunities, sculpted by technological progress, economic transformations, and global dynamics. Analyzing diverse studies, this comprehensive examination illuminates the intricate facets influencing MSMEs in India. The challenges are multifaceted [23]. Underscore the significance of Business Intelligence (BI) as a competitive edge for SMEs, yet Indian MSMEs encounter hurdles in accessing and implementing BI solutions, constraining their capacity for data-driven decision-making. [24] delve into dynamic capabilities, stressing their pivotal role in business survival; however, MSMEs in India grapple with the imperative to cultivate and adapt these dynamic capabilities to navigate the ever-evolving business milieu. [25] discuss the adoption of financial technology in Indian MSMEs, revealing an opportunity amid challenges associated with integration, particularly for businesses with limited financial resources. The digital economy challenges outlined resonate with India, where MSMEs confront difficulties in adapting to the digital landscape, impeding their ability to harness opportunities presented by the digital economy. [26] evidence from Indonesia on Information and Communication Technologies (ICTs) adoption reflects similar challenges in India, where uneven ICT adoption may exacerbate economic disparities. Additionally, [27] emphasize the imperative of business management training for MSME enhancement, revealing a gap in India concerning access to effective training programs.

On the flip side, there are notable opportunities. [28] exploration of communication channels and innovation perception indicates a prospect for Indian MSMEs to leverage e-commerce platforms for market expansion. [29] analysis of critical success factors for Lean Six Sigma implementation presents an opportunity for operational excellence and enhanced efficiency in Indian manufacturing MSMEs. [30] emphases on Green IT adoption for pro-environmental performance signals a potential avenue for Indian MSMEs to align with sustainability goals. [31]

underscore the positive impact of financial literacy, technology perceived usefulness, and government support on MSMEs' business resilience, highlighting opportunities for strengthening financial literacy and accessing government support in India. Moreover, [32] emphases on technology adoption and innovation aligns with the broader opportunity for Indian MSMEs to leverage technology for innovation and competitiveness. Finally, discussion on artificial intelligence capabilities for circular business models suggests that Indian MSMEs can explore the integration of AI to drive circular economy practices and sustainable business models. The intricate tapestry of challenges and opportunities for MSMEs in India necessitates a strategic and adaptive approach [33]. Addressing these challenges and capitalizing on opportunities requires recognition of the pivotal role played by technology adoption, financial literacy, and government support in shaping the trajectory of Indian MSMEs

9. TABLE 3: Overview of studies related to Exploring Challenges and Opportunities Across MSME Aspects

Aspect	Challenges	Opportunities
Business Intelligence (BI)	Limited access to BI solutions	Potential competitive edge for SMEs through BI
Dynamic Capabilities	Struggle to cultivate and adapt dynamic capabilities	Pivotal role of dynamic capabilities in business survival
Financial Technology Adoption	Challenges in integrating financial technology	Opportunity for advancement through financial technology adoption
Digital Economy Challenges	Difficulty adapting to the digital landscape	Potential benefits in adapting to the digital economy
ICTs Adoption	Uneven ICT adoption exacerbating economic disparities	Prospect for MSMEs to leverage ICTs for economic growth
Business Management Training	Gap in access to effective business management training programs	Imperative of business management training for MSME enhancement
E-commerce Platforms	Potential leverage for market expansion through e-commerce platforms	Prospects for MSMEs to expand markets through e-commerce
Lean Six Sigma Implementation	Opportunity for operational excellence and enhanced efficiency through Lean Six Sigma	Critical success factors for Lean Six Sigma implementation
Green IT Adoption	Potential avenue for aligning with sustainability goals through Green IT adoption	Emphasis on Green IT adoption for pro-environmental performance
Financial Literacy and Support	Positive impact of financial literacy, technology usefulness, and government support on business resilience	Opportunities for strengthening financial literacy and accessing government support
Technology Adoption and Innovation	Broader opportunity for MSMEs to leverage technology for innovation and competitiveness	Emphasis on technology adoption and innovation
Artificial Intelligence (AI)	Exploration of AI integration for circular economy practices and sustainable business models	Suggestion to explore AI capabilities for circular business models

Business Intelligence and its Interaction with SMEs

Small and medium-sized businesses (SMEs) can now benefit greatly from business intelligence (BI), which gives them a competitive edge in several areas. SMEs may improve decision-making using BI by quickly analysing data, encouraging flexibility, and building resilience in the face of shifting market conditions [34]. When combined with financial technology solutions, it also makes efficient financial administration possible. Furthermore, by offering data-driven insights, it supports digital transformation initiatives and enhances business management abilities with useful insights. Implementing BI ensures strategic alignment with broader corporate goals, improves SMEs' digital presence, and keeps pace with changes in technology adoption. Additionally, by helping SMEs to track and maximise their social and environmental impact, BI supports sustainability initiatives. Essentially, BI gives SMEs a strategic advantage that enables them to prosper in the fast-paced business environment of today.

Lestari et al. examine MSMEs' business resiliency in the context of financial literacy and government support. BI's real-time analytics and financial insights help MSMEs become financially literate and resilient in tough business circumstances [35]. Technology adoption and innovation for MSMEs is explored by Loo, Ramachandran, and Raja Yusof. Technology adoption requires a supportive environment, and BI helps MSME innovators [36.] The study highlights the transformative power of AI and BI in MSMEs' sustainable business model formulation. The role of E-Business adoption in improving MSME performance positions BI as a driver of enhanced operational efficiency. BI tools offer insights into the performance metrics of E-Business initiatives, enabling continuous improvement and strategic decision-making [37]. The supply chain effectiveness for Indian MSMEs, examined by [38], introduces structural equation modeling. BI emerges as a critical component in this modeling, offering analytical tools that empower MSMEs to optimize their supply chain processes for enhanced efficiency. [39] analyze the motivation factors in the adoption of cryptocurrency among MSMEs in Lusaka. Although not explicitly focused on BI, the study underscores the technological adoption trends in MSMEs, hinting at the potential integration of BI for cryptocurrency-related insights. [40] explores the role of SMEs in Botswana, emphasizing their significance in the economic landscape. As SMEs strive for growth, BI becomes instrumental in providing actionable insights for informed decision-making, contributing to their overall role as economic contributors. [41] discuss the gains and pains of SMEs in Nigeria, outlining the way forward for entrepreneurship development. In this landscape, BI emerges as a tool to mitigate risks and optimize opportunities, supporting the sustainable development of SMEs in Nigeria. While the focus is on payment systems, BI is integral to monitoring and optimizing financial transactions, ensuring seamless integration of cashless systems within MSME operations. [42] explore sophisticated technology innovation capability and entrepreneurial resilience in disaster resilient MSMEs. In this context, BI serves as a tool to enhance technological innovation capabilities, contributing to the resilience of MSMEs in the face of disruptions. [43] analyzes the financing of innovation in agri-food industries, providing insights into Italian MSMEs. Although not explicitly focused on BI, the study highlights the financial aspects of innovation, hinting at the potential role of BI in optimizing financial resources for innovation [44].

This comprehensive review of studies from diverse contexts and disciplines underscores the integral role of Business Intelligence in the operations, growth, and resilience of SMEs. From financial management to supply chain optimization, and from sustainability practices to innovation capabilities, BI emerges as a versatile tool that empowers SMEs to thrive in an increasingly competitive and dynamic business landscape. As the technological landscape continues to evolve, further research and practical implementations will continue to shape the symbiotic relationship between BI and SMEs.

10. Adoption of Technological Tools in MSMEs

In the contemporary business landscape, the adoption of technology has emerged as a critical determinant of success for MSMEs. This discourse explores the multifaceted dynamics surrounding the adoption of technology in MSMEs, encompassing challenges, strategies, and the transformative potential of technological integration. [45], in their study focused on European nations, underscore the significance of acknowledging competitive pressure in the digitalization adoption journey of SMEs [46.] They extend the Unified Theory of Acceptance and Use of Technology (UTAUT), shedding light on the intricate interplay between technological adoption and the competitive landscape. Understanding such dynamics becomes crucial as MSMEs navigate the challenges of digitalization in a globalized and competitive market. [47] delve into the challenges of Industry 4.0 adoption in sustainable supply chain management. Their evaluation and ranking of solutions provide valuable insights into addressing barriers faced by MSMEs in adopting technology for sustainable practices. In a world increasingly focused on environmental consciousness, this research illuminates the path for MSMEs to embrace technological solutions that not only enhance efficiency but also contribute to sustainable and responsible business practices. [48] contribute a configurational approach to smart green supply chain management. Their study emphasizes the need for MSMEs to strategically configure their digital capabilities for sustainable and environmentally conscious supply chain practices. This research suggests that the adoption of technology should not be a one-size-fits-all approach, urging businesses to tailor their strategies based on their unique contexts and goals.

Explore the complex relationship between financial literacy, technology perceived utility, government backing, and MSMEs' business resiliency. Their findings show how MSMEs' ability to adapt to and use technology is interrelated [49]. This complete understanding is essential for policymakers and support organisations seeking to

enable MSMEs to adopt technology. Focus on technology as a catalyst for MSMEs' innovation [50]. Their analysis shows that technology adoption drives revolutionary change and empowers MSMEs to innovate and compete in dynamic markets. [51] examine circular business models with AI. Their research synthesis gives a view of the existing scene and suggests a future research agenda, noting that MSMEs are constantly incorporating modern technologies. Technology adoption in MSMEs is fraught with obstacles and opportunity. Understanding subtle dynamics, contextual considerations, and embracing technology as part of the company plan are crucial. These studies help MSMEs navigate the digital landscape and create a tech-enabled future where creativity, sustainability, and resilience drive success.

11. DISCUSSION

The successful implementation of Business Intelligence (BI) in Micro, Small, and Medium Enterprises (MSMEs) hinges on their technological adoption. Studies by [52] highlight the importance of digital infrastructure, such as reliable internet and cloud computing, for adopting BI solutions. Additionally, technological readiness [53], encompassing employee skills and familiarity with technology, is crucial. [54] while BI offers numerous benefits, including improved data analysis and enhanced decision-making, financial constraints, and a lack of awareness about BI benefits pose significant challenges for MSMEs. Addressing these challenges and leveraging technological opportunities can empower MSMEs to utilize BI for navigating uncertainties, making informed decisions, and achieving sustainable growth [55]. The technological adoption is key for BI success in MSMEs and following are the challenges they face:

12. Why Technological Adoption Matters

The Backbone of BI: MSMEs can't effectively implement BI without a solid tech foundation. This means good internet connections are vital, as they enable the data flow that feeds dashboards and insights. Cloud computing offers flexible, scalable storage and computing power, particularly useful for MSMEs that may not have the resources to maintain their own in-house IT infrastructure. Tech-Savvy Workforce: BI isn't a magic box. Users, even with user-friendly tools, need to understand how to gather data, work with dashboards, and interpret insights. Technological readiness is about having employees with basic digital literacy and the willingness to learn new software.

13. Benefits of BI for MSMEs

Data Powerhouse: BI turns raw information into actionable knowledge. By organizing and analyzing sales figures, customer trends, etc., MSMEs can spot patterns and opportunities they might otherwise miss.

Informed Decisions: Gut feelings have their place, but data backs up those gut feelings (or proves them wrong!). BI allows MSMEs to make decisions with confidence, minimizing risk, and maximizing potential gains.

14. Challenges to Overcome

Cost Factor: BI software, and sometimes the hardware necessary to run it smoothly, can be expensive. Limited budgets are a real concern for MSMEs.

Understanding the Value: Some MSME owners may not fully grasp BI's potential benefits or consider it suitable only for large corporations. This knowledge gap hinders adoption.

MSMEs that overcome these hurdles and embrace the tech behind BI gain a powerful advantage. They can better adapt to changing markets, identify profitable niches, and ultimately drive sustainable growth.

15. CONCLUSION

In conclusion, the systematic review of technological adoption factors and their impact on Business Intelligence (BI) implementation in Micro, Small, and Medium Enterprises (MSMEs) for uncertainty management reveals significant insights into the challenges and opportunities in this domain. The synthesis of existing literature underscores the multifaceted nature of technological adoption, highlighting the intricate interplay between various factors influencing BI implementation. The findings emphasize the pivotal role of factors such as organizational culture, leadership support, technological infrastructure, and user acceptance in shaping the success of BI initiatives within MSMEs. Moreover, the review underscores the need for a strategic alignment between technological investments and organizational goals, emphasizing the importance of a well-defined BI strategy tailored to the specific context of MSMEs. Furthermore, the identified impact on uncertainty management underscores the potential of BI systems to enhance decision-making processes within MSMEs, providing timely and relevant information for navigating uncertain business environments. The synthesis of empirical evidence suggests that successful BI adoption contributes to improved organizational performance, increased competitiveness, and enhanced adaptability to dynamic market conditions. Despite these positive

implications, challenges such as resource constraints, data quality issues, and resistance to change remain prevalent in the MSME context. Recognizing and addressing these challenges is crucial for fostering a conducive environment for effective BI implementation.

In conclusion, this systematic review not only provides a comprehensive understanding of the technological adoption factors influencing BI implementation in MSMEs but also offers valuable insights for practitioners, policymakers, and researchers. Moving forward, a holistic approach that considers the organizational, technological, and human aspects is essential for realizing the full potential of BI in MSMEs and effectively managing uncertainty in today's dynamic business landscape.

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DECLARATION OF COMPETING INTEREST

There is no competing interest.

CONFLICT OF INTEREST

There is no conflict of interest.

16. REFERENCES

1. Andrade A C R de, Penha R, Silva L F da, Bizarrias F S, and Kniess C T. 'The adoption of technological tools in continuous audit projects', *Revista de Administração Da UFSM*, Vol. 16, 2023, e5. https://doi.org/10.5902/1983465971587
2. Akintola B M, Kumar A, Chokshi H, Samadhiya A, and Agrawal R. '"Recover together, recover stronger": an exploratory literature review on the recovery challenges of creative SMEs following the COVID-19 pandemic and proposed future recommendations', *International Journal of Industrial Engineering and Operations Management*, 2023. https://doi.org/10.1108/ijieom-08-2023-0070
3. Raghuvanshi J, and Garg C P. 'Time to get into the action', *Asia Pacific Journal of Innovation and Entrepreneurship*, Vol. 12, 2018, pp. 279–299. https://doi.org/10.1108/apjie-06-2018-0041
4. Ali A, Bhasin J, and Hazik M. 'Antecedents and Consequences of ICT Adoption in MSME', *Journal of Business and Management Studies*, 2023. https://doi.org/10.32996/jbms
5. Ali M S, Khan S, and Miah S J. 'Understanding towards Interactions between Business Intelligence and SMEs: Learn from Each Other', *Journal of Information Systems and Technology Management*, Vol. 14, 2017, pp. 151–168. https://doi.org/10.4301/S1807-17752017000200002
6. Chigombe P, Chundu M, and Mucheri T. 'Factors Affecting Adoption of Social Media Marketing by Construction MSMEs in Zimbabwe: Case of CIFOZ and SMEA Members in Harare', *Advances in Social Sciences Research Journal*, Vol. 9, 2022, pp. 436–456. https://doi.org/10.14738/assrj.97.12706
7. Cunningham J A, Damij N, Modic D, and Olan F. 'MSME technology adoption, entrepreneurial mindset and value creation: a configurational approach', *Journal of Technology Transfer*, Vol. 48, 2023, pp. 1574–1598. https://doi.org/10.1007/s10961-023-10022-0
8. Cuevas-Vargas H, Parga-Montoya N, Lozano-García J J, and Huerta-Mascotte E. 'Determinants of openness activities in innovation: The mediating effect of absorptive capacity', *Journal of Innovation and Knowledge*, Vol. 8, 2023. https://doi.org/10.1016/j.jik.2023.100432
9. Armenia S, Franco E, Iandolo F, Maielli G, and Vito P. 'Zooming in and out the landscape: Artificial intelligence and system dynamics in business and management', *Technological Forecasting and Social Change*, Vol. 200, 2024. https://doi.org/10.1016/j.techfore.2023.123131
10. Di Vaio A, Latif B, Gunarathne N, Gupta M, and D'Adamo I. 'Digitalization and artificial knowledge for accountability in SCM: a systematic literature review', *Journal of Enterprise Information Management*, Emerald Publishing, 2023. https://doi.org/10.1108/JEIM-08-2022-0275

11. Durst S, Edvardsson I R, and Foli S. 'Knowledge management in SMEs: a follow-up literature review', *Journal of Knowledge Management*, Vol. 27, 2023, pp. 25–58. https://doi.org/10.1108/JKM-04-2022-0325
12. Abdul Rasheed A, and Nafiz A. 'Factors Influencing the Adoption of Social Media Marketing by Micro, Small, and Medium-sized Enterprises (MSMEs) of the Maldives and its Impact on MSME Performance', *International Journal of Social Research and Innovation*, Vol. 6, 2022, pp. 47–73. https://doi.org/10.55712/ijsri.v6i1.50
13. Bucher S, Jäger U P, and Cardoza G. 'FUNDES: Becoming a strategically mindful nonprofit', *Journal of Business Research*, Vol. 69, 2016, pp. 4489–4498. https://doi.org/10.1016/j.jbusres.2016.03.014
14. Ahmed S, and Sur S. 'Change in the uses pattern of digital banking services by Indian rural MSMEs during demonetization and Covid-19 pandemic-related restrictions', *Vilakshan - XIMB Journal of Management*, Vol. 20, 2023, pp. 166–192. https://doi.org/10.1108/xjm-09-2020-0138
15. Cavalcante S, Kesting P, and Ulhøi J. 'Business model dynamics and innovation: (re)establishing the missing linkages', *Management Decision*, Vol. 49, 2011, pp. 1327–1342. https://doi.org/10.1108/00251741111163142
16. Apulu I, Latham A, and Moreton R. 'Factors affecting the effective utilisation and adoption of sophisticated ICT solutions: Case studies of SMEs in Lagos, Nigeria', *Journal of Systems and Information Technology*, Vol. 13, 2011, pp. 125–143. https://doi.org/10.1108/13287261111135972
17. Chai J, Liu J N K, and Ngai E W T. 'Application of decision-making techniques in supplier selection: A systematic review of literature', *Expert Systems with Applications*, Vol. 40, 2013, pp. 3872–3885. https://doi.org/10.1016/j.eswa.2012.12.040
18. Feng Y, Meng M, and Li G. 'Impact of digital finance on the asset allocation of small- and medium-sized enterprises in China: Mediating role of financing constraints', *Journal of Innovation and Knowledge*, Vol. 8, 2023. https://doi.org/10.1016/j.jik.2023.100405
19. Guarda T, Santos M, Pinto F, Augusto M, and Silva C. 'Business Intelligence as a Competitive Advantage for SMEs', *International Journal of Trade, Economics and Finance*, 2013, pp. 187–190. https://doi.org/10.7763/ijtef.2013.v4.283
20. Cheratian I, Goltabar S, Gholipour H F, and Farzanegan M R. 'Finance and sales growth at the firms level in Iran: Does type of spending matter?', *Research in International Business and Finance*, Vol. 67, 2024. https://doi.org/10.1016/j.ribaf.2023.102142
21. Fitraharizki F and Rahayu R 2023 Analysis of Factors Influencing E-Commerce Adoption in MSMEs in Padang City *Jurnal Informatika Ekonomi Bisnis* 5(3) 807–813 https://doi.org/10.37034/infeb.v5i3.648
22. Ha H and Chuah CKP 2023 Digital economy in Southeast Asia: challenges, opportunities and future development *Southeast Asia: A Multidisciplinary Journal* 23(1) 19–35 https://doi.org/10.1108/seamj-02-2023-0023
23. Elmobayed MG, Al-Hattami HM, Al-Hakimi MA, Mraish WS and Al-Adwan AS 2023 Effect of marketing literacy on the success of entrepreneurial projects *Arab Gulf Journal of Scientific Research* https://doi.org/10.1108/AGJSR-06-2023-0266
24. Gupta U, Agarwal B and Nautiyal N 2022 Financial Technology Adoption—A Case of Indian MSMEs *Finance: Theory and Practice* 26(6) 192–211 https://doi.org/10.26794/2587-5671-2022-26-6-192-211
25. Gupta N, Sardana D and Lee R 2024 Dynamic capabilities that matter for business failure versus survival *Industrial Marketing Management* 116 40–50 https://doi.org/10.1016/j.indmarman.2023.11.004
26. Hanggraeni D 2021 Information and Communication Technologies (ICTs) Adoption by MSMEs and Local Poverty: An Empirical Evidence from Indonesia *Jurnal Keuangan Dan Perbankan* 25(2) https://doi.org/10.26905/jkdp.v25i2.5343
27. Hardana A, Nasution J, Damisa A and Nasution Y 2024 Business Management Training in Improving Culinary MSME Enterprises *Jurnal Pengabdian Masyarakat Bestari* 3(1) 31–40 https://doi.org/10.55927/jpmb.v3i1.7465
28. Imran M 2023 The Communication Channels and the Innovation Perception on The Adoption of E-Commerce in Micro, Small Medium Enterprises (MSMEs) *Ilomata International Journal of Social Science* 4(3) 441–454 https://doi.org/10.52728/ijss.v4i3.807

29. Kumar D, Phani BV, Chilamkurti N, Saurabh S and Ratten V 2023 Filling the SME credit gap: a systematic review of blockchain-based SME finance literature *Journal of Trade Science* 11(2/3) 45–72 https://doi.org/10.1108/JTS-06-2023-0003
30. Kusuma H, Muafi M and Kholid MN 2023 Pro-environmental MSMEs performance: The role of green IT adoption, green innovative behavior, and financial accounting resources *Journal of Law and Sustainable Development* 11(4) https://doi.org/10.55908/sdgs.v11i4.673
31. Lestari ED, Hamid NA, Rizkalla N, Purnamaningsih P and Urus SBT 2022 The Effect of Financial Literacy, Cost of Technology Adoption, Technology Perceived Usefulness, and Government Support on MSMEs' Business Resilience *GATR Global Journal of Business Social Sciences Review* 10(3) 132–147 https://doi.org/10.35609/gjbssr.2022.10.3(3)
32. Loo MK, Ramachandran S and Raja Yusof RN 2023 Unleashing the potential: Enhancing technology adoption and innovation for micro, small and medium-sized enterprises (MSMEs) *Cogent Economics and Finance* 11(2) https://doi.org/10.1080/23322039.2023.2267748
33. Farida N, Joseph N, Sheila N, Levi K and Moses M 2023 Asset specificity, relational governance, firm adaptability and supply chain integration *Modern Supply Chain Research and Applications* https://doi.org/10.1108/mscra-09-2022-0021
34. Gil-Cordero E, Maldonado-López B, Ledesma-Chaves P and García-Guzmán A 2023 Do small- and medium-sized companies intend to use the Metaverse as part of their strategy? A behavioral intention analysis *International Journal of Entrepreneurial Behaviour and Research* https://doi.org/10.1108/IJEBR-09-2022-0816
35. Ibrahim HM, Ahmad K and Sallehudin H 2023 Impact of organisational, environmental, technological and human factors on cloud computing adoption for university libraries *Journal of Librarianship and Information Science* https://doi.org/10.1177/09610006231214570
36. Judijanto L, Arisanti I, Naapia J, Papia T, Abidin Z, Jakarta I, Sumbawa UT, Manado PN and Gorontalo I 2024 The Influence of Sustainable Leadership, Social Factors and Technological Infrastructure on MSME Business Sustainability in the Modern Era *International Journal of Business Leadership and Economics* 5(1) https://ijble.com/index.php/journal/index
37. Karahanna E 2024 Information Technology Adoption Across Time: A Cross-sectional Comparison of Pre-adoption and Post-adoption Beliefs *ResearchGate* https://www.researchgate.net/publication/239533379
38. Mulchandani K, Jasrotia SS and Mulchandani K 2023 Determining supply chain effectiveness for Indian MSMEs: A structural equation modelling approach *Asia Pacific Management Review* 28(2) 90–98 https://doi.org/10.1016/j.apmrv.2022.04.001
39. Mweetwa L and Mwange A 2023 Analysis of Motivation Factors in the Adoption of Cryptocurrency Among Micro, Small and Medium Enterprises (MSMEs) in Lusaka *International Journal of Multidisciplinary Research and Growth Evaluation* 4(5) 674–683 https://doi.org/10.54660/.IJMRGE.2023.4.5.674-683
40. Nkwe N 2012 Role of SMEs in Botswana *American International Journal of Contemporary Research* 2(8) www.aijcrnet.com
41. Olaore G. O., Adejare B. O., and Udofia E. E. 2021. The gains and pains of small and medium-scale enterprises (SMEs): the way forward for entrepreneurship development in Nigeria. *Rajagiri Management Journal* 15(1), 53–68. https://doi.org/10.1108/ramj-09-2020-0056
42. Panjaitan R., Hasan M., and Vilkana R. 2022. SOPHISTICATED TECHNOLOGY INNOVATION CAPABILITY: ENTREPRENEURIAL RESILIENCE ON DISASTER-RESILIENT MSMEs. *Serbian Journal of Management* 17(2), 375–388. https://doi.org/10.5937/sjm17-39294
43. Paoloni M., Tutino M., Paoloni N., and Santolamazza V. 2023. Financing innovation in agri-food industries: an analysis of the Italian micro, small and medium enterprises. *British Food Journal* 125(13), 183–204. https://doi.org/10.1108/BFJ-04-2022-0342
44. Karanasios S. T. A. N. 2011. New & emergent ICTs and climate change in developing countries. *Center for Development Informatics*. Institute for Development Policy and Management, SED. University of Manchester.

45. Kwarteng M. A., Ntsiful A., Diego L. F. P., and Novák P. 2023. Extending UTAUT with competitive pressure for SMEs digitalization adoption in two European nations: a multi-group analysis. *Aslib Journal of Information Management*. https://doi.org/10.1108/AJIM-11-2022-0482
46. Dewi S. K. S., and Wiksuana I. G. B. 2023. The Role of Digital Financial Services on the Performance of MSMES in Indonesia using the Toe Model. *Migration Letters* 20(6), 723-737.
47. Lahane S., Paliwal V., and Kant R. 2023. Evaluation and ranking of solutions to overcome the barriers of Industry 4.0 enabled sustainable food supply chain adoption. *Cleaner Logistics and Supply Chain* 8. https://doi.org/10.1016/j.clscn.2023.100116
48. Lerman L. V., Benitez G. B., Müller J. M., de Sousa P. R., and Frank A. G. 2022. Smart green supply chain management: a configurational approach to enhance green performance through digital transformation. *Supply Chain Management* 27(7), 147–176. https://doi.org/10.1108/SCM-02-2022-0059
49. Kowalik I., Danik L., and Pleśniak A. 2022. Entrepreneurial marketing orientation of the Polish and Finnish SMEs and its environmental determinants. *Journal of Business and Industrial Marketing* 37(13), 167–181. https://doi.org/10.1108/JBIM-07-2021-0333
50. Marhaeni A. A. I. N., Yuliarmi N. N., and Setiawina N. D. 2019. Empowering small industry of wood carving handicraft in Bangli district. *Asia Pacific Journal of Innovation and Entrepreneurship* 13(1), 121–136. https://doi.org/10.1108/apjie-07-2018-0045
51. Madanaguli A., Sjödin D., Parida V., and Mikalef P. 2024. Artificial intelligence capabilities for circular business models: Research synthesis and future agenda. *Technological Forecasting and Social Change* 200. https://doi.org/10.1016/j.techfore.2023.123189
52. Sutarni S. 2023. Adoption of Information and Communication Technology to Improve The Performance of Processed Food-Based MSMEs In Lampung Province. *Jurnal Penelitian Pertanian Terapan* 23(3), 442–454. https://doi.org/10.25181/jppt.v23i3.3227
53. Uren V., and Edwards J. S. 2023. Technology readiness and the organizational journey towards AI adoption: An empirical study. *International Journal of Information Management* 68. https://doi.org/10.1016/j.ijinfomgt.2022.102588
54. Pham Q. H., and Vu K. P. 2022. Digitalization in small and medium enterprise: a parsimonious model of digitalization of accounting information for sustainable innovation ecosystem value generation. *Asia Pacific Journal of Innovation and Entrepreneurship* 16(1), 2–37. https://doi.org/10.1108/apjie-02-2022-0013
55. Prakosa B. G., Guritno D. C., Anindita T., Kurniawan M., and Nugroho A. C. 2024. Correlation among components of the Indonesian industry readiness index 4.0 and its implementation on socioeconomic along with the demographic aspects. *Digital Transformation and Society*. https://doi.org/10.1108/DTS-08-2023-0063