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Unlocking Omnichannel Success for Small and Medium-sized Enterprises: A Systematic Review of Technologies, Barriers, and Enablers

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Abstract:

Purpose: To identify the appropriate technologies to support the implementation of omnichannel strategies in small and medium-sized enterprises (SMEs) and explore the enablers and barriers underlying the success of omnichannel adoption.

Design/methodology/approach: This research employed a systematic literature review (SLR) approach based on articles published in the last ten years which were acquired from Scopus database. Literature was screened using specified inclusion and exclusion criteria, thereafter coded and analyzed to meet the research objectives.

Findings: The study demonstrates that omnichannel help SMEs enhance market reach and customer satisfaction by integrating digital and physical channels. E-commerce platforms and social media are the most accessible technologies, whereas advanced tools like big data pose challenges due to costs and complexity. SMEs face barriers such as limited budgets, low levels of digital literacy, and inadequate infrastructure. Enhancing digital literacy, fostering collaboration with stakeholders, and leveraging scalable technologies like cloud-based CRM systems and social media platforms play a crucial role in overcoming these barriers. These enablers provide cost-effective solutions, empower SMEs to utilize digital tools effectively, and facilitate resource sharing and operational synergy, aligning well with their limited resources.

Research limitations/implications: The findings were drawn from secondary data from SME literatures of omnichannel which are limited, thereby constraining their generalizability.

Practical implications: Prioritizing affordable, scalable, cost-effective technologies that align with their resources, phased implementation starting with simpler tools, workforce training, and a focus on customer engagement are suggested practical solutions to improve efficiency and customer experience.

Social implications: By adopting omnichannel strategies, SMEs can enhance customer experiences and contribute to broader economic growth by bridging digital divides and increasing their competitiveness in global markets.

Originality/value: This research addresses a gap by focusing on SMEs rather than large enterprises, providing practical insights into suitable technologies and scalable strategies for resource-constrained businesses.

Keywords: barriers, enablers, omnichannel, Small and Medium-sized Enterprises (SMEs), systematic review, technologies

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1. Introduction

Omnichannel has become a global business trend in recent years, primarily due to rising customer expectations for a consistent experience across various sales channels, both digital and physical. Omnichannel integrates multiple sales channels, allowing consumers to seamlessly switch between them, creating a more holistic and unified experience (Verhoef, Kannan & Inman, 2015). As digitalization has increasingly become an essential need across various sectors, including the SME sector, omnichannel has been widely adopted as a key strategy. It enables businesses to unify their marketing and distribution channels, ensuring a smoother and more consistent customer experience. SMEs play a crucial role in the global economy, particularly in developing countries. In Indonesia, SMEs contribute more than 60% of the national GDP and employ over 97% of the workforce (Ministry of Cooperatives and SMEs, 2021). Despite their significant contribution, SMEs often lag in adopting new technologies, including those supporting omnichannel strategies, due to limitations in capital, technological infrastructure, and technical expertise (Afolayan, Plant, White, Jones & Beynon-Davies, 2015; Awa, Awara & Lebari, 2015; Narayan & Hungund, 2022). This results in a competitive imbalance between SMEs and larger enterprises, which are better equipped to leverage technology for channel integration.

The implementation of omnichannel enables SMEs to optimize their interactions with consumers, thereby increasing customer satisfaction and expanding market reach (Fujimura & Ishino, 2020; Szymczyk, 2020). This trend aligned with the current evolution of consumer behavior, where customers increasingly rely on both online and offline channels during the purchasing process (Kim, Lee & Ryu, 2018). Szymczyk (2020) identified that the use of technologies such as e-commerce and mobile technologies has been key in helping SMEs adapt to rapidly changing consumer behavior. However, despite the significant potential of omnichannel, SMEs face substantial challenges in adopting these technologies. The main challenges include limited resources, constrained capital, and a lack of workforce skills in operating omnichannel-supporting technologies (Ciasullo, Montera, Mercuri & Mugova, 2022; Mrutzek-Hartmann, Kotzab, Yumurtacı-Hüseyinoğlu & Kühling, 2022). Ciasullo et al. (2022) noted that a lack of awareness of digital technology and barriers to technology adoption have hindered SMEs from fully leveraging omnichannel strategies. Meanwhile, research by Fujimura and Ishino (2020) indicates that integrating B2B and B2C systems can optimize omnichannel use for SMEs in the health food sector, though adjustments are required to achieve efficiency. This underscores the importance of identifying the most suitable technologies and addressing these challenges to support the sustainability of SMEs.

SMEs face challenges in adopting technology, particularly due to limitations in scalability and resources compared to larger companies (Fujimura & Ishino, 2020). Omnichannel strategies offer many benefits, such as better operational efficiency and stronger customer relationships, but putting them into practice requires significant investment in technology and employee training, which can be difficult for SMEs to afford. Additional challenges, such as a lack of awareness of the benefits of technology and limited capital, also act as significant barriers for SMEs in fully leveraging omnichannel strategies (Ciasullo et al., 2022; Szymczyk, 2020). Mrutzek-Hartmann et al. (2022) further emphasize that the lack of skilled labor is a key barrier to omnichannel strategy implementation for SMEs in Germany and Turkey, highlighting the need for adjusted strategies that fit SME capacities. Adopting omnichannel technology requires not only investing in new tools but also making important changes to the business model and the mindset of SMEs leaders (Berman & Thelen, 2018). The success of this approach largely

depends on how well SMEs can choose the right technology that fits their needs and resources without overwhelming their limited operations (Hossain, Azam & Quaddus, 2021).

Previous systematic reviews on omnichannel strategies have often focused on large companies or specific industries, such as retail and manufacturing (Verhoef et al., 2015). However, these studies have not fully addressed the specific challenges faced by SMEs, including limited capital, infrastructure, and technical skills. Additionally, most prior reviews do not provide in-depth discussions of technologies that are suitable and affordable for SMEs. This research aims to fill that gap by focusing on omnichannel strategies tailored to SMEs and highlighting technological solutions that align with their capacities and needs.

This research focuses on identifying the most appropriate technologies to support omnichannel strategy implementation in SMEs and exploring the enablers and barriers that influence the success of omnichannel technology adoption. The key research questions are:

RQ1. What are the most appropriate technologies for supporting omnichannel strategy implementation in SMEs?

RQ2. What are the hindering and facilitating factors in adopting omnichannel-supporting technologies?

The paper begins with the background and problem statement, followed by a literature review that outlines previous studies on omnichannel adoption in SMEs and the associated challenges. The methodology section explains the systematic literature review approach used, while the results section presents findings related to supporting technologies, the challenges faced, and proposed solutions. The discussion contextualizes these findings within the existing literature. Finally, the paper concludes with recommendations and suggestions for further research.

2. Literature Review

2.1. Omnichannel

Omnichannel is an approach that integrates various distribution and communication channels in business to create a consistent experience for consumers, regardless of the platform or their mode of interaction with the company. According to Kim et al. (2018), omnichannel allows companies to connect multiple channels, such as e-commerce, physical stores, and social media, allowing customers to conduct transactions seamlessly from any location. In the context of SMEs, implementing omnichannel requires adaptations to resource limitations and scalability constraints, given the significant differences compared to larger companies (Chopra, 2018; Fujimura & Ishino, 2020; Verhoef et al., 2015). Verhoef et al. (2015) emphasize that the omnichannel concept is more than just connecting sales channels but also ensuring a consistent customer experience across all touchpoints.

The transformation toward omnichannel requires several stages to be implemented effectively, particularly for SMEs that have resource limitations. According to Ciasullo et al. (2022), there are three main stages in the transformation towards omnichannel: digitization of sales channels, system and data integration, and consumer experience integration. At the initial stage, SMEs begin by digitizing their sales channels, such as by creating an online store and integrating it with social media channels. Technologies like e-commerce platforms and social media are critical at this stage to enhance consumer visibility and accessibility. At the system and data integration stage, SMEs need to integrate data from various sales channels to gain deeper insights into consumer behavior and business operations. The use of integrated ERP and CRM systems enables real-time sales activity tracking and better customer relationship management (Mrutzek-Hartmann et al., 2022). The final stage involves creating a consistent and integrated customer experience across all interaction points, both online and offline. POS technology and mobile applications can be used to ensure that customers enjoy a uniform experience, whether in physical stores or through online transactions (Szymczyk, 2020).

2.2. Technologies, Enablers, and Barriers to Omnichannel in Smes

Technology is a key element in the successful implementation of an omnichannel strategy. Tools such as e-commerce platforms, point-of-sale (POS) systems, customer relationship management (CRM) software, enterprise resource planning (ERP) systems, and social media platforms are examples that can support the integration of distribution and communication channels (Mrutzek-Hartmann et al., 2022; Szymczyk, 2020).

E-commerce and mobile platforms have become essential tools for SMEs to reach a broader audience, especially in the rapidly evolving digital environment (Amornkitvikai, Tham, Harvie & Buachoom, 2022; Szymczyk, 2020). Moreover, integrated POS systems offer significant benefits by enabling real-time sales monitoring and facilitating faster strategic decision-making for SME owners (Cao & Li, 2018). Cloud-based technologies are also widely employed to enhance inventory management and accelerate customer service by improving stock transparency (Maheshwari, Kamble, Pundir, Belhadi, Ndubisi & Tiwari, 2021).

The adoption of omnichannel technology is not solely reliant on the availability of tools but also on enablers that support the process. Collaboration with international partners, the development of a synergistic digital ecosystem, and increased customer digital literacy are key enablers that drive SME adoption of omnichannel technologies (Ciasullo et al., 2022). AI-powered data analytics and inventory transparency, supported by cloud computing, have proven to enhance operational efficiency and customer experiences peed (Maheshwari et al., 2021). Additionally, customer preferences for personalized shopping experiences play a vital role in encouraging the integration of omnichannel technologies (Nguyen, 2020).

However, SMEs face significant barriers in adopting omnichannel strategies. One of the most critical challenges is the lack of capital and skilled human resources (Mrutzek-Hartmann et al., 2022). Complexities in channel integration, limited digital infrastructure, and difficulties in managing multichannel logistics also present considerable obstacles (Eriksson, Norrman & Kembro, 2019; Szymczyk, 2020). Moreover, low customer digital literacy and distrust in digital payment systems further hinder the adoption of customer-facing technologies (Bell, Gallino & Moreno, 2015; Szymczyk, 2020). Table 1 presents the primary component of technologies, enablers, and barriers, organized into five categories. These categories provide a clear approach for analyzing the key factors influencing the adoption of omnichannel strategies in SMEs.

Category	Definition	References
Infrastructure and integration	Technologies that facilitate cross-channel integration.	Cao and Li (2018); Szymczyk (2020)
Customer experience and interaction	Technologies that enhance customer interaction through personalization and real-time responses.	Nguyen (2020); Niranjanamurthy, Kavyashree, Jagannath and Chahar (2013)
Data management and decision-making	Technologies that support data analysis and insight-driven decision-making.	Kim et al. (2018); Maheshwari et al. (2021)
Logistics and supply chain	Technologies that optimize inventory and distribution management.	Fujimura and Ishino (2020); Hübner, Amorim, Fransoo, Honhon, Kuhn, de-Albeniz et al. (2021)
Payment and security systems	Technologies that facilitate secure digital transactions	Bell et al. (2015); Maheshwari et al. (2021)

Table 1. Categorization of technologies, enablers, and barriers in omnichannel

3. Research Methodology

This study uses a systematic literature review (SLR) approach aimed at identifying, evaluating, and interpreting research related to the adoption of omnichannel technology in SMEs. SLR was chosen because it facilitates a systematic and transparent analysis of the literature, ensuring that all relevant studies are identified and critically assessed (Tranfield, Denyer & Smart, 2003). The SLR is a methodological approach designed to conduct structured, transparent, and replicable reviews of the literature (Kitchenham, Brereton, Budgen, Turner, Bailey & Linkman, 2009). This method differs from traditional literature reviews because it involves a more rigorous process for selecting literature based on explicit inclusion and exclusion criteria. Furthermore, SLR enables researchers to comprehensively map findings and identify gaps in the existing research. In this study, the SLR is conducted using the PRISMA method (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to guide the literature screening and analysis process. The PRISMA diagram, which illustrates the literature selection process applied in this study, is presented in Figure 1.

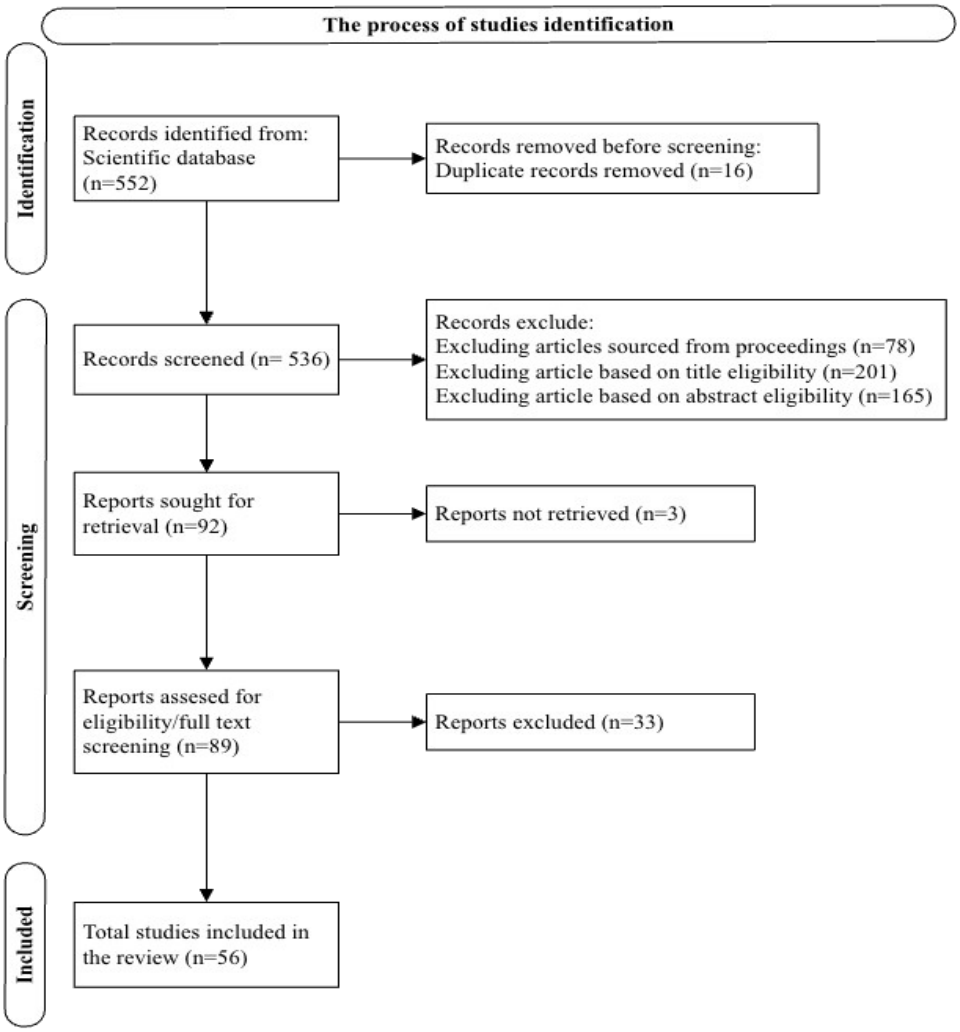

Figure 1. PRISMA flow diagram of SLR in this study

Figure 1 illustrates the PRISMA flow diagram used in this study to document the systematic literature review (SLR) process. The diagram outlines the various stages of the literature selection process, including identification, screening, eligibility, and inclusion. Each stage is represented with detailed counts of records reviewed, excluded, and retained, ensuring transparency and replicability of the review process.

3.1. Literature Selection Criteria

The literature selection in this study focuses on articles sourced from the Scopus database, using inclusion and exclusion criteria to ensure the relevance and quality of articles related to the research topic. These criteria can be seen in Table 2.

Inclusion criteria	Exclusion criteria
Articles published within the last 10 years (2013-2023)	Articles published older than 10 years
Research focused on omnichannel adoption and its supporting technology	Articles published irrelevant to the topic
Journal articles presenting empirical data or case studies on the impact of omnichannel technology	Journal articles focusing/based on theories
Written in English	Articles written in languages other than English

Table 2. Inclusion and exclusion criteria

These criteria were selected to ensure that the selected literature is relevant to the research topic, reflects current developments, and provides reliable data. Articles limited to conference proceedings or written in languages other than English were excluded.

3.2. Data Collection and Analysis Process

The data collection process was conducted using the Scopus database, one of the largest and most reliable sources of academic literature. Keywords used to search for articles included various combinations of terms relevant to this research. The keyword searches used in Scopus are as follows:

1. (TITLE-ABS-KEY ("omnichannel" OR "omni-channel" OR "omni channel") AND TITLE-ABS-KEY ("adoption" OR "adopt*"))
2. (TITLE-ABS-KEY ("omnichannel" OR "omni-channel" OR "omni channel") AND TITLE-ABS-KEY ("technology" OR "technolog*"))
3. (TITLE-ABS-KEY ("omnichannel" OR "omni-channel" OR "omni channel") AND TITLE-ABS-KEY ("MSME" OR "SME" OR "small and medium enterprises"))
4. (TITLE-ABS-KEY ("digital tool" OR "digital technology") AND TITLE-ABS-KEY ("MSME" OR "SME" OR "small and medium enterprises"))

The search process involved examining article titles, abstracts, and keywords. Once articles were identified, initial screening was done by evaluating the abstracts to ensure they met the inclusion criteria. Articles that satisfied these criteria were subsequently coded and fully reviewed.

3.3. Data Analysis Method

Data analysis was conducted using content analysis, in which each article was examined to identify the adopted omnichannel technologies and the challenges faced by SMEs in implementing these technologies. Each article was analyzed in depth, focusing on key findings such as the types of technology adopted, its impact on business operations, and the challenges encountered. The data extracted from each article were categorized into three main themes:

- Types of technology: includes technologies adopted such as CRM, ERP, POS, e-commerce platforms, and others.
- Key barriers and enablers in omnichannel technology adoption

After classifying the articles, the data were analyzed descriptively to present findings related to omnichannel technology adoption in SMEs, challenges in technology adoption, and applicable solutions. In addition to descriptive analysis, this study employed cross-analysis to compare omnichannel adoption between large companies and SMEs. This comparative analysis aimed to identify key differences in how large companies and SMEs navigate digital transformation through omnichannel strategies, providing deeper insights into the SME context. The findings highlight factors that must be considered for successful technology adoption in this sector. The results of these analyses are discussed in detail in the results and discussion section.

4. Results

This study identifies various technologies that support the implementation of omnichannel strategies, focusing primarily on SMEs. However, it also incorporates insights from large enterprises (LEs) to draw relevant comparisons where applicable. While the research is centered on SMEs, certain technologies and practices successfully implemented by LEs provide valuable lessons that could be adapted to the SME context. The study also examines the challenges associated with adopting omnichannel technologies, highlighting differences and similarities between LEs and SMEs. Despite these challenges, the study identifies key enabling factors that facilitate the adoption of omnichannel technologies, emphasizing the unique conditions and capacities of SMEs while reflecting on the broader insights gained from LEs.

4.1. Profile Analysis

Figure 2 illustrates the number of publications by SMEs and LEs from 2014 to 2024. Initially, the growth of publications was minimal, with both SMEs and LEs contributing sporadically until 2017, indicating limited research activity during this period. A significant increase began in 2018, particularly driven by LEs, reflecting growing engagement in research. The trend continued upward, with a sharp rise during the 2020-2022 period, where LEs dominated the contributions, possibly influenced by increasing investments in innovation and technological advancements. The number of publications peaked in 2022, highlighting the active role of LEs in driving research.

Figure 3 illustrates the number of publications by the country of origin of the first author's institution, distinguishing between SMEs and LEs. The United Kingdom and the United States dominate the field, with 9 and 8 publications, respectively, primarily driven by LEs. Italy and India also show notable contributions, shared between SMEs and LEs. Other countries, such as Portugal, Sweden, France, and South Korea, contribute a moderate number of publications, mainly from LEs. In contrast, countries like Bangladesh, China, Filipina, Finland, ireland, Japan, Saudi Arabia, and Slovakia contribute only one publication each, with SMEs accounting for most of these outputs. These findings highlights that research on omnichannel technology adoption remains concentrated in developed countries, particularly in the United States and Europe, while developing countries contribute less to the academic literature in this area.

Figure 4 illustrates the number of publications by SMEs and LEs across different academic journals. The International Journal of Retail & Distribution Management stands out as the most frequently used journal, with 7 publications, dominated entirely by LEs. Sustainability follows with 5 publications, where both SMEs and LEs contribute, indicating a more balanced participation. Other journals, such as the Journal of Business Research and International Journal of Operations & Production Management, each account for 4 publications, with a significant contribution from LEs. A diverse range of journals, including the Journal of Interactive Marketing and Journal of Theoretical and Applied Electronic Commerce Research, have moderate levels of contribution (2–3 publications), often involving both SMEs and LEs. The remaining journals, such as the Journal of Logistics Management and IEEE Transactions on Engineering Management, feature only 1 publication each, showing limited but diverse representation, with LEs generally taking the lead. These results suggest that LEs dominate the academic landscape, while SMEs exhibit limited.

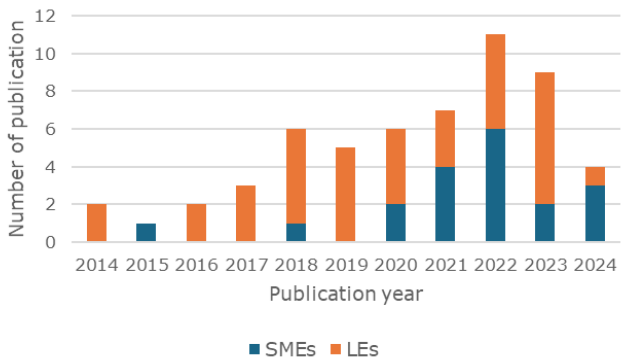

Figure 2. Number of publications

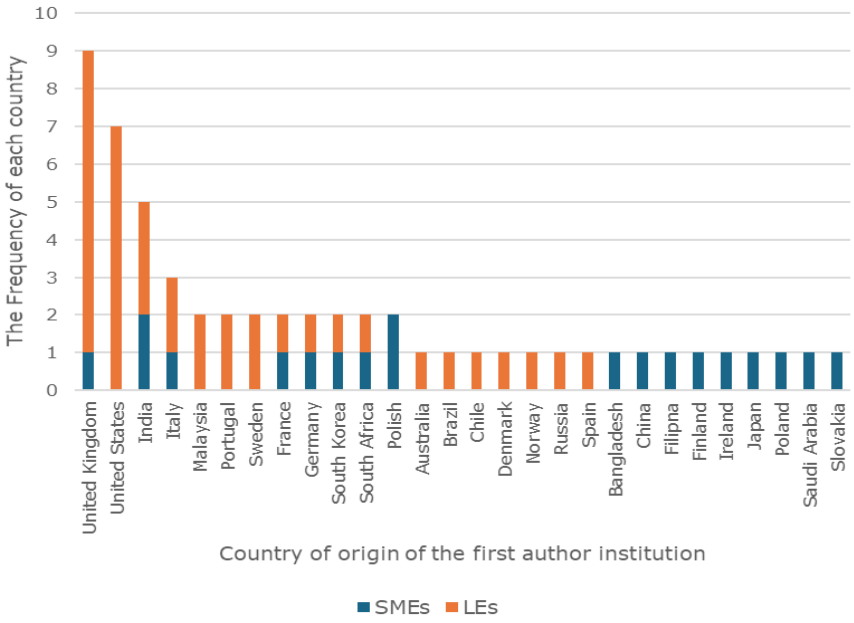

Figure 3. Distribution of articles collected by country of the first author's institution

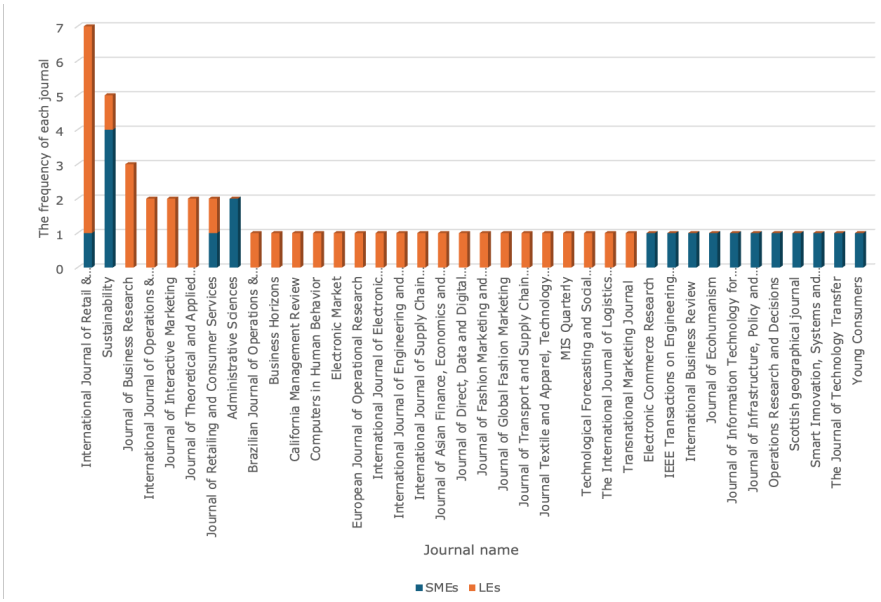

Figure 4. Distribution of articles collected by journal

Figure 5 presents the comparative distribution of publications related to omnichannel technology adoption between small and medium-sized enterprises (SMEs) and large enterprises (LEs). Of all the publications, 62% focus on LEs, while 38% focus on SMEs. This indicates that research on omnichannel technology adoption is more concentrated on LEs than on SMEs. The dominance of research on LEs may be attributed to their greater resources for adopting advanced technologies. However, the substantial proportion of publications focusing on SMEs (38%) indicates that omnichannel technology adoption within SMEs has also garnered significant research attention. This reflects the critical role SMEs play in the global economy.

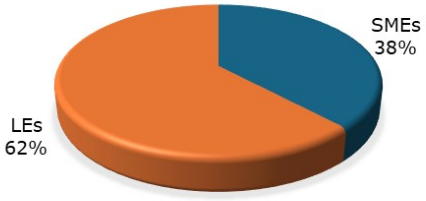

Figure 5. Comparative distribution of omnichannel technology adoption studies

4.2. Technologies Supporting Omnichannel in SMEs

This study used content analysis to identify and categorize technologies supporting omnichannel strategies in both SMEs and LEs. Technology-related terms were grouped based on their functions and roles, then consolidated into broader categories. The findings reveal that omnichannel-supporting technologies integrate sales channels and facilitate customer interactions. These technologies are grouped into five categories as shown in Table 1. The results reveal that omnichannel supporting technologies include multiple systems that collaborate to integrate sales channels and facilitate consumer interactions.

Table 3 further demonstrates that SMEs tend to adopt simpler and more affordable technologies, such as e-commerce platforms and social media, due to their ease of use and relatively low initial investment. These technologies enable SMEs to expand their market reach, enhance customer engagement, and provide a more personalized customer experience without requiring substantial technical resources (Cueto, Frisnedi, Collera, Batac & Agaton, 2022; Leu & Masri, 2021). In contrast, LEs leverage more advanced technologies, such as big data analytics, IoT, and ERP systems. These technologies support cross-channel data integration and enable in-depth analysis for better strategic decision-making (Bag, Dhamija, Singh, Rahman & Sreedharan, 2023; Hübner et al., 2021). LEs also often utilize technologies like augmented reality (AR) and location-based applications to enhance the customer experience across both physical and digital touchpoints (Schrage, Meißner, Schuette & Kenning, 2022). This difference reflects the greater financial and operational capacity of LEs compared to SMEs, which often rely on more basic and scalable technologies (Saghiri & Mirzabeiki, 2021).

Category	Technology	Function	Reference	
			Applied LEs	Applied SMEs
Infrastructure and integration	E-commerce platform	Digital sales platforms for consumer reach	Hübner et al. (2021); Kumar and Uma (2019) (N = 2)	Cueto et al. (2022); Fujimura and Ishino (2020); Kádárová, Lachvajderová and Sukopová (2023); Obokoh, Arogundade, Sthembiso and Akinola (2024); Szymczyk (2020); Tripathi and Singh (2024) (N = 6)
	Omnichannel platform	Unified platforms for cross-channel management	Luo, Zhang, Zeng and Qu (2020); Savastano, Bellini, D'Ascenzo and De-Marco (2019) (N = 2)	Kim et al. (2018); Leu and Masri (2021) (N = 2)
	Hybrid sales systems	Hybrid sales systems for mixed retail and wholesale operations	Hu and Zhou (2023) (N = 1)	N/A

Category	Technology	Function	Reference	
			Applied LEs	Applied SMEs
	ERP	Enterprise resource planning for operational efficiency	Adivar, Hüseyinoğlu and Christopher (2019); Kembro and Norrman (2019); Mishra (2021); Solem, Fredriksen and Sørebø (2023) (N = 4)	N/A
	Integrated information management system	Integrated systems for managing business data across channels	Chaudhary, Singh and Sharma (2022); Ermes and Niemann (2023); Lehrer and Trenz (2022) (N = 3)	N/A
Customer experience and interaction	Mobile apps	Mobile tools for customer engagement and sales	Adivar et al. (2019); Ciasullo et al. (2022); Herrero-Crespo, Viejo-Fernández, Collado-Agudo and Sanzo-Pérez (2022); Jocevski (2020); Kumar and Uma (2019); Parise, Guinan and Kafka (2016); Song and Jo (2023); von-Briel (2018) (N = 7)	N/A
	Online mall/online store	Online sales channels	Solem et al. (2023) (N = 1)	Kim et al. (2018) (N = 1)
	In-store apps/location-based retail apps	Location-based apps for personalized in-store experience	Cook (2014); Jocevski (2020); Piotrowicz and Cuthbertson (2014); Savastano et al. (2019); Schrage et al. (2022); Song and Jo (2023) (N = 6)	N/A
	Virtual trial rooms	Virtual shopping tools for customer experience	Kumar and Uma (2019) (N = 1)	N/A
	Augmented reality	Tools to enhance customer interaction with virtual environments	Lee and Leonas (2018); Miell, Gill and Vazquez (2018); Parise et al. (2016); von-Briel (2018) (N = 4)	N/A
	Kiosk	Tools for facilitating in-store transactions	Lee and Leonas (2018) (N = 1)	N/A
	Wearable technology	Wearable devices for improving customer experience	Verhoef, Stephen, Kannan, Luo, Andrews, Bart et al. (2017) (N = 1)	N/A
	Mobile technology	Mobile-based tools for customer engagement and data collection	Hoehle, Aloysius, Chan and Venkatesh (2018); Piotrowicz and Cuthbertson (2014); Verhoef et al. (2017) (N = 3)	N/A
	Fit and sizing technology	Virtual fitting tools for personalized shopping experience	Miell et al. (2018) (N = 1)	N/A
	Tools CRM	Customer data management and interaction tracking	Gerea and Herskovic (2022); Song and Jo (2023) (N = 2)	Van-der-Loo, Chen, Edwards, Holden, Karamperidis, Kollingbaum et al. (2015) (N = 1)

Category	Technology	Function	Reference	
			Applied LEs	Applied SMEs
Customer experience and interaction	Social media	Marketing and customer interaction through digital platforms	Fraccastoro, Gabrielsson and Pullins (2021); Kaur, Keong, Singh, Sandhu, Senathirajah and Haque (2023) (N = 2)	Cueto et al. (2022); Leu and Masri (2021); Obokoh et al. (2024); Omrani, Rejeb, Maalaoui, Dabić and Kraus (2022); Ziółkowska (2021) (N = 5)
	Traditional communication tools	Communication tools for customer and business interaction	Fraccastoro et al. (2021) (N = 1)	N/A
	Chatbot	Automated customer service tools	Kumar and Uma (2019) (N = 1)	N/A
	Digital platforms	Digital tools for marketing and consumer engagement	Lee (2020) (N = 1)	N/A
	MIM (mobile instant messaging)	Instant messaging tools for customer communication	Cook (2014); Vazquez, Dennis and Zhang (2017) (N = 2)	N/A
Data management and decision-making	Big data	Data analysis and insights for operational efficiency	Gerea and Herskovic (2022); Grewal, Roggeveen and Nordfält (2016); Hübner et al. (2021); Jocevski (2020); Saghiri and Mirzabeiki (2021) (N = 5)	Kádárová et al. (2023); van-der-Loo et al. (2015); Obokoh et al. (2024); Omrani et al. (2022); Saghiri and Mirzabeiki (2021); Ziółkowska (2021) (N = 6)
	Blockchain	Secure transactions and data management	Kaur et al. (2023) (N = 1)	N/A
	Smart tags	Inventory tracking through digital tags	Saghiri, Aktas, and Mohammadipour (2023) (N = 1)	N/A
	Advanced stock monitoring	Tools to ensure real-time inventory management	Saghiri et al. (2023); Song and Jo (2023) (N = 2)	N/A
	Real-time inventory systems	Systems to manage inventory levels in real-time	Lehrer and Trenz (2022); Saghiri, Wilding, Mena and Bourlakis (2017) (N = 2)	N/A
	Artificial intelligence	Artificial intelligence for data-driven insights and automation	Hübner et al. (2021); Nam and Kannan (2020) (N = 2)	Cakir, Iftikhar, Bielozorov, Pourzolfaghar and Helfert (2021) (N = 1)
Logistics and supply chain	Cloud computing	Distributed data management for real-time operations	Bhuiyan, Faraji, Rashid, Bhuyan, Hossain and Ghose (2024); Cueto et al. (2022); Kádárová et al. (2023); van-der-Loo et al. (2015); Omrani et al. (2022) (N = 5)	N/A
	Internet of Things (IoT)	Device connectivity for tracking and monitoring	Hübner et al., (2021); Lee and Leonas (2018); Saghiri and Mirzabeiki (2021); Verhoef et al. (2017) (N = 4)	Bhuiyan et al. (2024); Cakir et al.(2021); Kádárová et al. (2023); Omrani et al. (2022) (N = 4)

Category	Technology	Function	Reference	
			Applied LEs	Applied SMEs
Logistics and supply chain	Digital distribution tools	Tools to enhance product delivery and logistics	N/A	Van-der-Loo et al. (2015) (N = 1)
	Barcode	Product identification and logistics tracking	Saghiri et al. (2023) (N = 1)	N/A
	Online order processing systems	Technology to automate and streamline the placement, payment, fulfillment, and tracking of customer orders in real time.	Song and Jo (2023) (N = 1)	N/A
	Digital logistics platform 4PL (Ship-from-Store)	Tools for integrating and managing the entire logistics chain with a fourth-party logistics (4PL)	de-Souza-Schweitzer, Arante, Agostino, Braghirolli, Mafia and Frazzon (2024) (N = 1)	N/A
	RFID	Tools for tracking inventory and improving supply chain visibility	Cao and Li (2018); Ermes and Niemann (2023); Hübner et al. (2021); Saghiri and Mirzabeiki (2021) (N = 4)	N/A
	Warehouse management system	Tools to manage warehouse logistics and operations	Adivar et al. (2019) (N = 1)	N/A
Payment and security systems	Billing systems	Tools for automating payment processes	Lehrer and Trenz (2022) (N = 1)	N/A
	E-wallet	Digital payment tools	N/A	Leu and Masri (2021) (N = 1)
	Privacy management	Tools for ensuring data privacy and security	Nam and Kannan (2020) (N = 1)	N/A

Table 3. Omnichannel technology classification

Big data is widely used for analyzing customer behavior, predicting demand, and enabling faster, data-driven decisions (Bag et al., 2023; Bhuiyan et al., 2024). SMEs can leverage big data on a smaller scale to improve decision-making processes (Gerea & Herskovic, 2022; Hübner Wollenburg & Holzapfel, 2016). E-commerce platforms connect online and offline channels, allowing businesses to reach more customers. SMEs achieve better efficiency by integrating these platforms with CRM tools and logistics systems (Leu & Masri, 2021; Savastano & Anagnoste, 2020). Mobile and in-store apps further enhance customer experience through personalized engagement and location-based promotions, encouraging faster purchase decisions (Parise et al., 2016; Schrage et al., 2022).

IoT and RFID enhance logistics by enabling real-time inventory tracking, improving supply chain visibility, and reducing costs (Kádárová et al., 2023; Saghiri & Mirzabeiki, 2021). Cloud-hosted CRM systems help SMEs manage customer relationships at a lower cost, providing personalized services without expensive (Cueto et al., 2022; Hübner et al., 2016). Omnichannel platforms ensure a seamless experience across sales channels, improving customer satisfaction and retention (Lehrer & Trenz, 2022). Social media is a key tool for marketing and engagement, enabling businesses to interact with customers and respond to feedback in real-time (Fraccastoro et al., 2021; Leu & Masri, 2021) Finally, SMEs must prioritize data security to safeguard customer information, requiring investments in technology upgrades (van-der-Loo et al., 2015; Verhoef et al., 2017).

4.3. Barriers to adopting omnichannel technologies

As the need to provide a unified shopping experience across various channels grows, adopting an omnichannel strategy has become essential for many companies, including SMEs. However, implementing an omnichannel strategy faces numerous challenges and barriers that hinder its full execution. Based on literature analysis, several key categories of obstacles influence the effectiveness of omnichannel adoption, both in technical and non-technical aspects. The present study has identified 36 barriers from the collected articles, based on the categories specified in Table 1. Table 4 presents the barriers identified from the existing literature.

Category	Barrier	Reference	
		LEs	SMEs
Infrastructure and integration	Challenges in integrating multiple channels.	Vazquez et al. (2017) (N = 1)	N/A
	Inefficient coordination between digital and physical channels.	Adivar et al. (2019); Jocevski (2020); Lee (2020); Savastano et al. (2019) (N = 4)	N/A
	Connectivity issues for technology integration	Verhoef et al. (2017) (N = 1)	N/A
	Insufficient digital infrastructure	Lehrer and Trenz (2022) (N = 1)	Bag et al. (2023); Ciasullo et al. (2022); Leu and Masri (2021); Obokoh et al. (2024); Szymczyk (2020) (N = 5)
	Limited ability to integrate technology into workflows.	Fraccastoro et al. (2021); Herrero-Crespo et al. (2022); Hübner et al. (2021); Piotrowicz & Cuthbertson (2014); Solem et al. (2023) (N = 5)	Cakir et al. (2021); Kim et al. (2018) (N = 2)
	Lack of education about the benefits of digital technology	N/A	Ciasullo et al. (2022) (N = 1)
	Limited ability to utilize digital technology effectively	Fraccastoro et al. (2021); Hu and Zhou (2023); Hübner et al. (2021); Luo et al. (2020) (N = 4)	Ciasullo et al. (2022) (N = 1)
	Low readiness for digital adoption	N/A	Tripathi and Singh (2024) (N = 1)
	Limited investment in technology	Chaudhary et al. (2022); Lehrer and Trenz (2022); Song and Jo (2023) (N = 3)	Bhuiyan et al. (2024); Fujimura and Ishino (2020); Mrutzek-Hartmann et al. (2022) (N = 3)
	High costs for implementing digital solutions	Cao and Li (2018) (N = 1)	Kádárová et al. (2023); van-der-Loo et al. (2015) (N = 2)
	Lack of skilled workforce	Chaudhary et al. (2022) (N = 1)	Fujimura & Ishino (2020; Omrani et al. (2022) (N = 2)
	Insufficient digital skills among staff	Ermes and Niemann (2023); Song and Jo (2023) (N = 2)	Mrutzek-Hartmann et al. (2022); Omrani et al. (2022); Saura, Palacios-Marqués and Ribeiro-Soriano (2023); van-der-Loo et al. (2015) (N = 4)
	Reliance on specific platforms	N/A	Kim et al. (2018) (N = 1)

Category	Barrier	Reference	
		LEs	SMEs
	Technical barriers in implementation	Song and Jo (2023) (N = 1)	N/A
Customer experience and interaction	Inconsistent experience across channels	Cook (2014) (N = 1)	N/A
	Disconnected customer touchpoints across channels.	Gerea and Herskovic (2022); Saghiri et al. (2017); Saghiri and Mirzabeiki (2021) (N = 3)	N/A
	Different needs for online vs. offline	Grewal et al. (2016) (N = 1)	N/A
	Cultural differences in customer journey	Nam and Kannan (2020) (N = 1)	N/A
	Lack of cross-channel personalization	Kumar and Uma (2019) (N = 1)	N/A
	Integrated customer experience issues	Kaur et al. (2023) (N = 1)	N/A
	Sizing and fitting issues in online shopping	Miell et al. (2018) (N = 1)	N/A
	Low social interaction on digital platforms	Vazquez et al. (2017) (N = 1)	N/A
	Disruptions in the checkout process	Hoehle et al. (2018) (N = 1)	N/A
	Physical distance limits customer access, impacting their shopping experience	N/A	Saura et al. (2023) (N = 1)
	Need for real-time content	Parise et al. (2016) (N = 1)	N/A
Data management and decision-making	Challenges in utilizing big data for decision-making.	Gerea and Herskovic (2022) (N = 1)	N/A
	Low technology adoption rates	N/A	Bag et al. (2023); Szymczyk (2020) (N = 2)
	Limited technology usage in specific areas	Fraccastoro et al. (2021) (N = 1)	N/A
Logistics and supply chain	Demand variability	de-Souza-Schweitzer et al. (2024); Saghiri et al. (2023) (N = 2)	N/A
	Limited shelf-life visibility	Saghiri et al. (2023) (N = 1)	N/A
	Inventory tracking challenges	Kaur et al. (2023) (N = 1)	N/A
	Complicated logistics for managing multichannel operations.	de-Souza-Schweitzer et al. (2024); Ermes and Niemann (2023); Kaur et al. (2023) (N = 3)	N/A
	Fulfillment complexity	Hübner et al. (2021); Kembro and Norrman (2019) (N = 2)	N/A
	Return management complexities	Ermes and Niemann (2023) (N = 1)	N/A
Payment and security systems	Low consumer trust in data privacy	Hoehle et al. (2018); Song and Jo (2023) (N = 2)	N/A

Table 4. Barriers to omnichannel adoption

The barriers to implementing omnichannel strategies can be categorized into five main areas. In infrastructure and integration, companies often face difficulties in connecting digital and physical channels, exacerbated by limited technology investment, inadequate digital infrastructure, and high implementation costs (Bag et al., 2023; Jocevski, 2020; Lehrer & Trenz, 2022). In customer experience and interaction, creating a consistent experience across channels remains a significant challenge, driven by channel fragmentation, differing customer needs between online and offline environments, and insufficient personalization and social interaction (Gerea & Herskovic, 2022; Hoehle et al., 2018; Saghiri & Mirzabeiki, 2021). For data management and decision-making, low levels of technology adoption and limited utilization of big data hinder companies ability to analyze customer behavior in real time (Gerea & Herskovic, 2022; Szymczyk, 2020). In logistics and supply chain, demand variability, low inventory visibility, and the complexity of multichannel fulfillment disrupt operational efficiency (de-Souza-Schweitzer et al., 2024; Saghiri et al., 2023). Finally, in payment and security systems, a lack of consumer trust in digital data privacy limits customer acceptance of online transactions, requiring companies to enhance their security measures (Hoehle et al., 2018; Song & Jo, 2023). These barriers highlight the need for strategic investments in technology and system integration to ensure the successful implementation of omnichannel strategies.

The primary barriers faced by SMEs in adopting omnichannel technologies include budget constraints, low levels of digital literacy, and inadequate technological infrastructure (Ciasullo et al., 2022; Mrutzek-Hartmann et al., 2022). Moreover, SMEs often lack skilled personnel to manage these technologies, making it challenging for them to integrate physical and digital channels effectively (Lehrer & Trenz, 2022). The high cost of advanced technologies such as IoT and big data analytics also represents a significant hurdle for SMEs, as these technologies require substantial upfront investments and supporting technical resources (Bag et al., 2023; Saghiri & Mirzabeiki, 2021). Meanwhile, LEs face different challenges, such as the complexity of integrating large-scale systems and data, as well as managing multichannel logistics (Hübner et al., 2021; Saghiri & Mirzabeiki, 2021). Another barrier for SMEs is low consumer trust in digital payment systems, which slows the adoption of digital technology on the customer side (Hoehle et al., 2018). These insights indicate that SMEs' challenges are more related to resource constraints, while LEs primarily encounter technical and operational complexities on a larger scale.

4.4. Enablers in Adopting Omnichannel Technologies

Table 5 provides detailed enablers that facilitate the implementation of omnichannel strategies across businesses, categorized into five main areas: infrastructure and integration, customer experience and interaction, data management and decision-making, logistics and supply chain, and payment and security systems. Each category includes key factors and examples of practical measures from the literature that contribute to overcoming omnichannel challenges. These enablers highlight the critical components necessary to enhance omnichannel operations and ensure success across both LEs and SMEs.

Category	Enabler	Reference	
		LEs	SMEs
Infrastructure and integration	Investment in digital infrastructure to support omnichannel systems	Lehrer and Trenz (2022); Luo et al. (2020) (N = 2)	Bag et al. (2023); Barbosa and Casais (2022); Cakir et al. (2021); Omrani et al. (2022) (N = 4)
	Integration of data and technology systems to enable seamless operations	Hübner et al. (2021); Saghiri and Mirzabeiki (2021) (N = 2)	N/A
	Strengthening IT systems to enhance operational and technical efficiency	Nam and Kannan (2020) (N = 1)	N/A
	Enhancing physical store experiences as part of the omnichannel journey	Savastano et al. (2019) (N = 1)	N/A

Category	Enabler	Reference	
		LEs	SMEs
	Integration of sales channels for seamless operations	Jocevski (2020) (N = 1)	N/A
	Technology to assist employees in managing omnichannel operations	Cook (2014) (N=1)	N/A
Customer experience and interaction Customer experience and interaction	Strengthening brand value through consistent omnichannel strategies	N/A	Ciasullo et al. (2022) (N = 1)
	Leveraging customer-created content to boost engagement and trust	N/A	Saura et al. (2023) (N = 1)
	Delivering consistent and high-quality customer experiences across channels	Chaudhary et al. (2022); Ermes and Niemann (2023); Herrero-Crespo et al. (2022); Hu and Zhou (2023); Song and Jo (2023) (N = 5)	N/A
	Leveraging social factors to drive customer engagement and loyalty	Schrage et al. (2022); Song and Jo (2023); Vazquez et al. (2017) (N = 3)	N/A
	Improving customer perception of the brand through unified channels	Kaur et al. (2023) (N = 1)	N/A
	Providing tailored customer experiences based on individual preferences	Gerea and Herskovic (2022) (N = 1)	N/A
	Offering instant support to customers to enhance satisfaction and loyalty	Kumar and Uma (2019) (N = 1)	N/A
	Targeting customers with personalized marketing based on their geographic location	Luo et al. (2020) (N = 1)	N/A
	Synchronizing marketing efforts across online and offline channels	Lee (2020) (N = 1)	N/A
	Providing advanced tools to improve customer shopping experience, such as AR or VR	Lee and Leonas (2018); Parise et al. (2016); (N = 2)	N/A
	Understanding evolving customer preferences	N/A	Szymczyk (2020) (N = 1)
	Adapting to digital transformation in customer engagement	N/A	Nam and Kannan (2020) (N = 1)
	Ensuring uniformity of products across all channels.	Cook (2014) (N = 1)	N/A
Data management and decision-making	Building technical competencies to leverage digital tools effectively	N/A	Omrani et al., 2022) (N = 1)
	Ensuring organizational dedication to adopting and using digital technologies	N/A	Leu and Masri (2021) (N = 1)

Category	Enabler	Reference	
		LEs	SMEs
Data management and decision-making	Utilizing key performance indicators (KPIs) to monitor and optimize omnichannel performance	N/A	Adivar et al. (2019) (N = 1)
	Increasing awareness of digital tools and their potential benefits	N/A	Saura et al. (2023) (N = 1)
	Encouraging the adoption of new technologies to improve business operations	N/A	Cueto et al. (2022) (N = 1)
	Facilitating the exchange of knowledge to support informed decisions.	Mishra (2021) (N=1)	N/A
	Workforce development	Mishra (2021) (N = 1)	Bhuiyan et al. (2024); Cueto et al. (2022); Leu and Masri (2021); Mrutzek-Hartmann et al. (2022); Obokoh et al. (2024); Omrani et al. (2022); Saura et al. (2023); Szymczyk (2020); Tripathi and Singh (2024); Ziólkowska (2021) (N = 10)
Logistics and supply chain	Enhancing the efficiency of supply chains to support seamless omnichannel operations.	Kembro and Norrman (2019) (N = 1)	Fujimura and Ishino (2020) (N = 1)
	Increasing adaptability in logistics to respond to demand changes across channels.	Saghiri et al. (2023) (N = 1)	N/A
	Improving the ability to track and manage inventory across multiple locations in real-time.	Kembro & Norrman (2019); Saghiri et al. (2017) (N = 3)	N/A
	Driving business innovation through technology adoption	N/A	Omrani et al. (2022) (N = 1)
	Supply chain collaboration for omnichannel success	N/A	Ciasullo et al. (2022) (N = 1)
	Coordinating with stakeholders to enhance omnichannel operations	Mishra (2021) (N = 1)	Mishra (2021); van-der-Loo et al. (2015) (N = 1)
	Enhancing organizational agility to meet changing supply chain demands	N/A	Leu and Masri (2021); Mrutzek-Hartmann et al. (2022) (N = 2)
	Strengthening internal teamwork to improve supply chain coordination.	Solem et al. (2023) (N=1)	N/A
Payment and security systems	Support from regulations to enable secure digital transactions	N/A	Tripathi and Singh (2024) (N = 1)

Table 5. Enablers to omnichannel adoption

The identified enablers play a pivotal role in overcoming challenges and ensuring the successful implementation of omnichannel strategies. In infrastructure and integration, investments in digital infrastructure and the integration of technology systems are fundamental for seamless operations. Strengthening IT systems and aligning sales channels

enhance operational efficiency, enabling businesses to deliver consistent experiences (Lehrer & Trenz, 2022; Luo et al., 2020). Meanwhile, customer experience and interaction focus on creating meaningful engagement through consistent branding, personalized marketing, and advanced tools such as AR/VR. Leveraging user-generated content and ensuring high-quality, unified customer experiences across channels are vital for building trust and loyalty (Lee & Leonas, 2018; Saura et al., 2023).

In the area of data management and decision-making, developing technical competencies and utilizing digital tools such as KPIs help businesses monitor and optimize omnichannel performance. Digital awareness and workforce development also empower companies to leverage data insights effectively, supporting informed decision-making (Omrani et al., 2022; Saura et al., 2023). For logistics and supply chain, the focus lies on enhancing efficiency through real-time inventory tracking, adaptability to demand changes, and fostering collaboration with stakeholders. Improved internal teamwork and flexibility further strengthen supply chain coordination, ensuring smooth operations (Kembro & Norrman, 2019; Solem et al., 2023). Lastly, in payment and security systems, regulatory support for secure digital transactions builds consumer trust, which is essential for seamless payment processes and overall success in omnichannel initiatives (Tripathi & Singh, 2024). By addressing these enablers, businesses can enhance their operational readiness, improve customer satisfaction, and adapt effectively to the evolving demands of the digital landscape.

Key enablers for successful omnichannel adoption in SMEs involve leveraging scalable and cost-effective technologies, such as cloud-based CRM systems, social media, and e-commerce platforms (Cueto et al., 2022; Hübner et al., 2021). These technologies not only enhance operational efficiency but also enable SMEs to provide more personalized customer experiences. Digital literacy training for employees is crucial, helping to improve internal capabilities to manage these technologies more effectively (Bhuiyan et al., 2024; Saura et al., 2023). Additionally, collaboration with stakeholders, such as technology partners and logistics providers, offers supplementary support to address resource limitations (Leu & Masri, 2021). On the other hand, LEs benefit from significant investments in digital infrastructure and the adoption of cutting-edge technologies like IoT and big data analytics, which allow them to personalize customer experiences and optimize supply chain management (Bag et al., 2023; Saghiri et al., 2023). Operational adjustments aligned with market needs and continuous investments in technological innovation are key enablers for LEs to maximize their omnichannel strategies.

5. Discussion

The study highlights several technologies essential for implementing omnichannel strategies in SMEs. E-commerce platforms and social media emerge as the most accessible and impactful tools for SMEs, enabling them to connect digital and physical channels effectively. These tools enhance customer engagement, brand visibility, and customer satisfaction while requiring lower financial investment and technical expertise compared to advanced technologies. For instance, social media facilitates real-time communication and personalized marketing, allowing SMEs to interact with customers and respond to their needs dynamically (Cueto et al., 2022; Leu & Masri, 2021).

Technologies like cloud-based CRM systems play a critical role in improving customer relationship management at a lower cost by enabling SMEs to deliver personalized services without extensive resource requirements (Hübner et al., 2016; Song & Jo, 2023). Additionally, mobile apps and location-based retail tools further enhance customer experience by delivering tailored, location-specific promotions, encouraging faster purchase decisions (Schrage et al., 2022).

While advanced technologies such as big data analytics and IoT offer immense potential for real-time inventory tracking and predictive analytics, their adoption remains limited among SMEs due to the high costs and complexity of implementation (Bag et al., 2023; Saghiri & Mirzabeiki, 2021). However, SMEs can leverage simplified versions of these tools to improve decision-making processes at a smaller scale (Bhuiyan et al., 2024). Overall, a balanced integration of scalable, user-friendly technologies like e-commerce platforms and cloud-based solutions with gradual adoption of advanced tools like IoT and big data can enable SMEs to successfully implement omnichannel strategies while remaining resource-conscious.

The adoption of omnichannel technologies is influenced by various barriers and enablers. Key challenges include limited budgets, low levels of digital literacy, and inadequate infrastructure (Bag et al., 2023; Jocevski, 2020). SMEs often struggle to integrate digital and physical channels due to insufficient investments in technology and a lack of skilled personnel to manage these systems (Lehrer & Trenz, 2022). For instance, advanced technologies like IoT and big data require significant financial and technical resources, which are often beyond the reach of SMEs (Saghiri & Mirzabeiki, 2021).

Furthermore, fragmented customer experiences and inconsistent touchpoints across online and offline channels pose significant challenges. SMEs may lack the capability to personalize customer journeys or address varying needs across channels, limiting their ability to foster loyalty and satisfaction (Gerea & Herskovic, 2022). In logistics and supply chain, issues such as demand variability, low inventory visibility, and fulfillment complexity disrupt operational efficiency (de-Souza-Schweitzer et al., 2024). Finally, low consumer trust in digital payment systems and concerns over data security further hinder omnichannel adoption (Hoehle et al., 2018).

Several enablers were identified to address these challenges. Investments in digital infrastructure and the integration of technology systems are foundational for seamless operations (Lehrer & Trenz, 2022; Luo et al., 2020). For SMEs, leveraging scalable technologies like cloud-based CRM systems provides cost-effective solutions to improve customer engagement and operational efficiency. Additionally, social media and mobile apps offer accessible tools to boost customer interaction and promote personalized experiences (Saura et al., 2023).

Workforce development and digital literacy training are critical enablers, empowering SMEs to utilize digital tools effectively and improve decision-making processes (Bhuiyan et al., 2024; Saura et al., 2023). In logistics and supply chain, real-time inventory tracking and supply chain collaboration enhance operational efficiency, while regulatory support for secure digital payments fosters consumer trust and encourages adoption (Tripathi & Singh, 2024). By adopting a strategic approach that prioritizes cost-effective, scalable solutions and workforce development, SMEs can overcome resource constraints and enhance their readiness to implement omnichannel strategies successfully.

6. Conclusion

This study set out to identify the appropriate technologies to support the implementation of omnichannel strategies in SMEs and explore the enablers and barriers that influence the success of omnichannel adoption. The findings highlight that omnichannel strategies can significantly enhance SMEs market reach and customer satisfaction by integrating digital and physical channels. Technologies such as e-commerce platforms and social media emerge as the most accessible and impactful tools for SMEs due to their affordability, scalability, and ease of use. However, more advanced tools, including big data analytics, IoT, and real-time inventory systems, are less accessible to SMEs due to high costs, technical complexity, and resource constraints. Cloud-based CRM systems and location-based apps offer SMEs an opportunity to deliver personalized customer experiences while minimizing implementation barriers. Key barriers hindering omnichannel adoption include limited budgets, low digital literacy, inadequate digital infrastructure, and a lack of skilled workforce. To overcome these challenges, the study emphasizes several enablers, such as workforce training, stakeholder collaboration, and leveraging cost-effective, scalable technologies like cloud-based solutions and mobile tools. Enhancing digital literacy and fostering internal and external collaboration are particularly crucial for ensuring SMEs' ability to adopt and utilize omnichannel technologies effectively.

This study has some limitations. It relies on secondary data, focusing mostly on existing literature about SMEs, which limits the findings' generalizability, especially across industries and regions. Additionally, the study synthesizes prior research but does not include real-world data or account for rapid changes in technology adoption. Finally, it does not address the specific needs of different sectors, such as retail versus service-oriented SMEs. Future research could explore real-world cases or conduct surveys to validate these findings in practice. Comparing SMEs across industries or countries could uncover unique challenges and opportunities. Studies should also examine emerging technologies like AI and blockchain, as well as the long-term impacts of omnichannel strategies on SMEs' competitiveness and sustainability.

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References

Adivar, B., Hüseyinoğlu, I.Ö.Y., & Christopher, M. (2019). A quantitative performance management framework for assessing omnichannel retail supply chains. *Journal of Retailing and Consumer Services,* 48, 257-269. https://doi.org/10.1016/j.jretconser.2019.02.024

Afolayan, A., Plant, E., White, G.R.T., Jones, P., & Beynon-Davies, P. (2015). Information technology usage in SMEs in a developing economy. *Strategic Change,* 24(5), 483-498. https://doi.org/10.1002/jsc.2023

Amornkitvikai, Y., Tham, S.Y., Harvie, C., & Buachoom, W.W. (2022). Barriers and factors affecting the e-commerce sustainability of Thai Micro-, Small- and Medium-Sized Enterprises (MSMEs). *Sustainability,* 14(14), 8476. https://doi.org/10.3390/su14148476

Awa, H.O., Awara, N.F., & Lebari, E.D. (2015). Critical factors inhibiting Electronic Commerce (EC) adoption in Nigeria: A study of operators of SMEs. *Journal of Science & Technology Policy Management,* 6(2), 143-164. https://doi.org/10.1108/JSTPM-07-2014-0033

Bag, S., Dhamija, P., Singh, R.K., Rahman, M.S., & Sreedharan, V.R. (2023). Big data analytics and artificial intelligence technologies based collaborative platform empowering absorptive capacity in health care supply chain: An empirical study. *Journal of Business Research,* 154, 113315. https://doi.org/10.1016/j.jbusres.2022.113315

Barbosa, J., & Casais, B. (2022). The transformative and evolutionary approach of omnichannel in retail companies: insights from multi-case studies in Portugal. *International Journal of Retail and Distribution Management,* 50(7), 799-815. https://doi.org/10.1108/IJRDM-12-2020-0498

Bell, D., Gallino, S., & Moreno, A. (2015). Showrooms and information provision in omni-channel retail. *Production and Operations Management,* 24(3), 360-362. https://doi.org/10.1111/poms.12258_2

Berman, B., & Thelen, S. (2018). Planning and implementing an effective omnichannel marketing program. *International Journal of Retail and Distribution Management,* 46(7), 598-614. https://doi.org/10.1108/IJRDM-08-2016-0131

Bhuiyan, M.R.I., Faraji, M.R., Rashid, M., Bhuyan, M.K., Hossain, R., & Ghose, P. (2024). Digital Transformation in SMEs Emerging Technological Tools and Technologies for Enhancing the SME's Strategies and Outcomes. *Journal of Ecohumanism,* 3(4), 211-224. https://doi.org/10.62754/joe.v3i4.3594

Cakir, G., Iftikhar, R., Bielozorov, A., Pourzolfaghar, Z., & Helfert, M. (2021). Omnichannel retailing: Digital transformation of a medium-sized retailer. *Journal of Information Technology Teaching Cases,* 11(2), 122-126. https://doi.org/10.1177/2043886920959803

Cao, L., & Li, L. (2018). Determinants of retailers' cross-channel integration: an innovation diffusion perspective on omni-channel retailing. *Journal of Interactive Marketing,* 44(1), 1-16. https://doi.org/10.1016/j.intmar.2018.04.003

Chaudhary, P., Singh, A., & Sharma, S. (2022). Understanding the antecedents of omni-channel shopping by customers with reference to fashion category: the Indian millennials' perspective. *Young Consumers,* 23(2), 304-320. https://doi.org/10.1108/YC-05-2021-1327

Chopra, S. (2018). The Evolution of Omni-Channel Retailing and its Impact on Supply Chains. *Transportation Research Procedia,* 30, 4-13. https://doi.org/10.1016/j.trpro.2018.09.002

Ciasullo, M.V., Montera, R., Mercuri, F., & Mugova, S. (2022). When Digitalization Meets Omnichannel in International Markets: A Case Study from the Agri-Food Industry. *Administrative Sciences,* 12(2), 68. https://doi.org/10.3390/admsci12020068

Cook, G. (2014). Customer experience in the omni-channel world and the challenges and opportunities this presents. *Journal of Direct, Data and Digital Marketing Practice,* 15(4), 262-266. https://doi.org/10.1057/dddmp.2014.16

Cueto, L.J., Frisnedi, A.F.D., Collera, R.B., Batac, K.I.T., & Agaton, C.B. (2022). Digital innovations in MSMEs during economic disruptions: experiences and challenges of young entrepreneurs. *Administrative Sciences,* 12(1), 8. https://doi.org/10.3390/admsci12010008

de-Souza-Schweitzer, N.L.S., Arante, M.T., Agostino, Í.R.S., Braghirolli, L.F., Mafia, M.M.P., & Frazzon, E.M. (2024). Ship-from-store omnichannel using a 4pl digital platform. *Brazilian Journal of Operations & Production Management,* 21(2), 1856. https://doi.org/10.14488/BJOPM.1856.2024

Eriksson, E., Norrman, A., & Kembro, J. (2019). Contextual adaptation of omni-channel grocery retailers' online fulfilment centres. *International Journal of Retail and Distribution Management,* 47(12), 1232-1250. https://doi.org/10.1108/IJRDM-08-2018-0182

Ermes, T., & Niemann, W. (2023). Managing omni-channel reverse logistics risk during supply chain disruption recovery in the South African fashion industry. *Journal of Transport and Supply Chain Management,* 17, 932. https://doi.org/10.4102/jtscm.v17i0.932

Fraccastoro, S., Gabrielsson, M., & Pullins, E.B. (2021). The integrated use of social media, digital, and traditional communication tools in the B2B sales process of international SMEs. *International Business Revien,* 30(4), 101776. https://doi.org/10.1016/j.ibusrev.2020.101776

Fujimura, T., & Ishino, Y. (2020). Omni-Channel Challenges Facing Small- and Medium-Sized Enterprises: Balancing Between B2B and B2C. In: Jezic, G., Chen-Burger, J., Kusek, M., Sperka, R., Howlett, R., & Jain, L. (Eds.), *Agents and Multi-Agent Systems: Technologies and Applications 2020. Smart Innovation, Systems and Technologies* (186, 343-353). Springer, Singapore. https://doi.org/10.1007/978-981-15-5764-4_32

Gerea, C., & Herskovic, V. (2022). Transitioning from Multichannel to Omnichannel Customer Experience in Service-Based Companies: Challenges and Coping Strategies. *Journal of Theoretical and Applied Electronic Commerce Research,* 17(2), 394-413. https://doi.org/10.3390/jtaer17020021

Grewal, D., Roggeveen, A.L., & Nordfält, J. (2016). Roles of retailer tactics and customer-specific factors in shopper marketing: Substantive, methodological, and conceptual issues. *Journal of Business Research,* 69(3), 1009-1013. https://doi.org/10.1016/j.jbusres.2015.08.012

Herrero-Crespo, A., Viejo-Fernández, N., Collado-Agudo, J., & Sanzo-Pérez, M.J. (2022). Webrooming or showrooming, that is the question: explaining omnichannel behavioural intention through the technology acceptance model and exploratory behaviour. *Journal of Fashion Marketing and Management: An International Journal,* 26(3), 401-419. https://doi.org/10.1108/JFMM-05-2020-0091

Hoehle, H., Aloysius, J.A., Chan, F., & Venkatesh, V. (2018). Customers' tolerance for validation in omnichannel retail stores: Enabling logistics and supply chain analytics. *International Journal of Logistics Management,* 29(2), 704-722. https://doi.org/10.1108/IJLM-08-2017-0219

Hossain, M.I., Azam, M.S., & Quaddus, M. (2021). Small firm entry to e-marketplace for market expansion and internationalization: A theoretical perspective. *Journal of International Entrepreneurship,* 19(4), 560-590. https://doi.org/10.1007/s10843-021-00297-5

Hu, F., & Zhou, Z. (2023). Information services and omnichannel retailing strategy choices of e-commerce platforms with supplier competition. *Electronic Commerce Research,* 23(4), 2647-2689. https://doi.org/10.1007/s10660-022-09557-5

Hübner, A., Amorim, P., Fransoo, J., Honhon, D., Kuhn, H., de-Albeniz, V.M. et al. (2021). Digitalization and omnichannel retailing: Innovative OR approaches for retail operations. *European Journal of Operational Research,* 294(3), 817-819. https://doi.org/10.1016/j.ejor.2021.04.049

Hübner, A., Wollenburg, J., & Holzapfel, A. (2016). Retail logistics in the transition from multi-channel to omni-channel. *International Journal of Physical Distribution & Logistics Management,* 46(6/7), 562-5583. https://doi.org/10.1108/IJPDLM-08-2015-0179

Jocevski, M. (2020). Blurring the Lines between Physical and Digital Spaces: Business Model Innovation in Retailing. *California Management Review,* 63(1), 99-117. https://doi.org/10.1177/0008125620953639

Kádárová, J., Lachvajderová, L., & Sukopová, D. (2023). Impact of digitalization on SME performance of the EU27: Panel data analysis. *Sustainability,* 15(13), 9973. https://doi.org/10.3390/su15139973

Kaur, K., Keong, C.S., Singh, J., Sandhu, S.K., Senathirajah, A.R.B.S., & Haque, R. (2023). Examining Factors Influencing Fashion Apparel Purchases in Omni-Channel Retailing: A Post-Covid-19 Study. *Transnational Marketing Journal,* 11(1), 44-58.

Kembro, J., & Norrman, A. (2019). Exploring trends, implications and challenges for logistics information systems in omni-channels: Swedish retailers' perception. *International Journal of Retail and Distribution Management,* 47(4), 384-411. https://doi.org/10.1108/IJRDM-07-2017-0141

Ministry of Cooperatives and SMEs (2021). Perkembangan Data Usaha Mikro, Kecil, Menengah, dan Usaha Besar. Available at: https://satudata.umkm.go.id/arsip/2

Kim, H., Lee, D., & Ryu, M.H. (2018). An optimal strategic business model for small businesses using online platforms. *Sustainability (Switzerland),* 10(3), 579. https://doi.org/10.3390/su10030579

Kitchenham, B., Brereton, O.P., Budgen, D., Turner, M., Bailey, J., & Linkman, S. (2009). Systematic literature reviews in software engineering-a systematic literature review. *Information and Software Technology,* 51(1), 7-15. https://doi.org/10.1016/j.infsof.2008.09.009

Kumar, G., & Uma, V.R. (2019). An optimized technique to Foster Omnichannel retail experience leveraging key technology dimensions in the context of an emerging digital market. *International Journal of Engineering and Advanced Technology,* 8(6), 5056-5061. https://doi.org/10.35940/ijeat.F9550.088619

Lee, H., & Leonas, K.K. (2018). Consumer experiences, the key to surviving in an omni-channel environment: Use of virtual technology. *Journal of Textile and Apparel, Technology and Management,* 10(3). Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85044364718&partnerID=40&md5=aadea184a984b68cf31bb053c20f2a4e

Lee, W. (2020). Unravelling consumer responses to omni-channel approach. *Journal of Theoretical and Applied Electronic Commerce Research,* 15(3), 37-49. https://doi.org/10.4067/S0718-18762020000300104

Lehrer, C., & Trenz, M. (2022). Omnichannel Business. *Electronic Markets,* 32(2), 687-699. https://doi.org/10.1007/s12525-021-00511-1

Leu, J.F.Y., & Masri, R. (2021). Omni-Channel Retailing and Digital Business: A Case Study in Malaysia. *Journal of Asian Finance, Economics and Business,* 8(4), 403-412.

Luo, X., Zhang, Y., Zeng, F., & Qu, Z. (2020). Complementarity and cannibalization of offline-TO-ONLINE targeting: A field experiment on omnichannel commerce. *MIS Quarterly: Management Information Systems,* 44(2), 957-982. https://doi.org/10.25300/MISQ/2020/15630

Maheshwari, P., Kamble, S., Pundir, A., Belhadi, A., Ndubisi, N.O., & Tiwari, S. (2021). Internet of things for perishable inventory management systems: an application and managerial insights for micro, small and medium enterprises. *Annals of Operations Research,* 1-29. https://doi.org/10.1007/s10479-021-04277-9

Miell, S., Gill, S., & Vazquez, D. (2018). Enabling the digital fashion consumer through fit and sizing technology. *Journal of Global Fashion Marketing,* 9(1), 9-23. https://doi.org/10.1080/20932685.2017.1399083

Mishra, R. (2021). An analysis of factors influencing omnichannel retailing adoption using ISM-DEMATEL approach: An Indian perspective. *International Journal of Retail and Distribution Management,* 49(4), 550-576. https://doi.org/10.1108/IJRDM-03-2020-0108

Mrutzek-Hartmann, B., Kotzab, H., Yumurtacı-Hüseyinoğlu, I.Ö., & Kühling, S. (2022). Omni-channel retailing resources and capabilities of SME specialty retailers - insights from Germany and Turkey. *International Journal of Retail and Distribution Management,* 50(8-9), 1129-1155. https://doi.org/10.1108/IJRDM-10-2021-0503

Nam, H., & Kannan, P.K. (2020). Digital Environment in Global Markets: Cross-Cultural Implications for Evolving Customer Journeys. *Journal of International Marketing,* 28(1), 28-47. https://doi.org/10.1177/1069031X19898767

Narayan, A., & Hungund, S. (2022). Enhancing firm performance through adoption of innovation: An empirical evidence from Indian biotechnological firms. *Journal of the Knowledge Economy,* 13(3), 2431-2456. https://doi.org/10.1007/s13132-021-00821-x

Nguyen, T.T.N. (2020). Developing and validating five-construct model of customer satisfaction in beauty and cosmetic E-commerce. *Heliyon,* 6(9), e04887. https://doi.org/10.1016/j.heliyon.2020.e04887

Niranjanamurthy, M., Kavyashree, N., Jagannath, S., & Chahar, D. (2013). Analysis of e-commerce and m-commerce: advantages, limitations and security issues. *International Journal of Advanced Research in Computer and Communication Engineering,* 2(6), 2360-2370.

Obokoh, L., Arogundade, S., Sthembiso, N., & Akinola, S. (2024). The effect of digital transformation on the productivity of business enterprises in South Africa. *Journal of Infrastructure, Policy and Development,* 8(5), 3114. https://doi.org/10.24294/jipd.v8i5.3114

Omrani, N., Rejeb, N., Maalaoui, A., Dabić, M., & Kraus, S. (2022). Drivers of digital transformation in SMEs. *IEEE Transactions on Engineering Management,* 71, 5030-5043

Parise, S., Guinan, P.J., & Kafka, R. (2016). Solving the crisis of immediacy: How digital technology can transform the customer experience. *Business Horizons,* 59(4), 411-420. https://doi.org/10.1016/j.bushor.2016.03.004

Piotrowicz, W., & Cuthbertson, R. (2014). Introduction to the special issue information technology in retail: Toward omnichannel retailing. *International Journal of Electronic Commerce,* 18(4), 5-16. https://doi.org/10.2753/JEC1086-4415180400

Saghiri, S., Aktas, E., & Mohammadipour, M. (2023). Grocery omnichannel perishable inventories: performance measures and influencing factors. *International Journal of Operations & Production Management,* 43(12), 1891-1919. https://doi.org/10.1108/IJOPM-06-2022-0397

Saghiri, S., & Mirzabeiki, V. (2021). Omni-channel integration: the matter of information and digital technology. *International Journal of Operations and Production Management,* 41(11), 1660-1710. https://doi.org/10.1108/IJOPM-04-2021-0262

Saghiri, S., Wilding, R., Mena, C., & Bourlakis, M. (2017). Toward a three-dimensional framework for omni-channel. *Journal of Business Research,* 77, 53-67. https://doi.org/10.1016/j.jbusres.2017.03.025

Saura, J.R., Palacios-Marqués, D., & Ribeiro-Soriano, D. (2023). Leveraging SMEs technologies adoption in the Covid-19 pandemic: A case study on Twitter-based user-generated content. *The Journal of Technology Transfer,* 48(5), 1696-1722. https://doi.org/10.1007/s10961-023-10023-z

Savastano, M., & Anagnoste, S. (2020). Pioneering Strategies in Retail Settings: An Empirical Study of Successful Practices. *Management and Marketing,* 15(4), 643-663. https://doi.org/10.2478/mmcks-2020-0037

Savastano, M., Bellini, F., D'Ascenzo, F., & De-Marco, M. (2019). Technology adoption for the integration of online-offline purchasing: Omnichannel strategies in the retail environment. *International Journal of Retail and Distribution Management,* 47(5), 474-492. https://doi.org/10.1108/IJRDM-12-2018-0270

Schrage, R., Meißner, L., Schuette, R., & Kenning, P. (2022). Acceptance of in-store apps: Factors that influence the intention to adopt location-based retail apps-Insights from Germany. *International Journal of Retail & Distribution Management,* 50(6), 760-777. https://doi.org/10.1108/IJRDM-06-2020-0202

Solem, B.A.A., Fredriksen, J.I., & Sørebø, Ø. (2023). Dynamic capabilities in the realisation of omnichannel retailing. *International Journal of Retail and Distribution Management,* 51(1), 21-38. https://doi.org/10.1108/IJRDM-12-2021-0599

Song, H.G., & Jo, H. (2023). Understanding the continuance intention of omnichannel: Combining TAM and TPB. *Sustainability,* 15(4), 3039.https://doi.org/10.3390/su15043039

Szymczyk, K. (2020). The Level of Omnichannel Use in Polish MSMEs. *Operations Research and Decisions,* 30(3), 113-122. https://doi.org/10.37190/ord200307

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence informed management knowledge by means of systematic review. *British Journal of Management,* 14(3), 207-222. https://doi.org/10.1111/1467-8551.00375

Tripathi, A., & Singh, A. (2024). SMEs Awareness and Preparation for Digital Transformation: Exploring Business Opportunities for Entrepreneurs in Saudi Arabia's Ha'il Region. *Sustainability,* 16(9), 3831. https://doi.org/10.3390/su16093831

van-der-Loo, S., Chen, L., Edwards, P., Holden, J.A., Karamperidis, S., Kollingbaum, M.J. et al. (2015). Development of a digital tool to overcome the challenges of rural food SMEs. *Scottish Geographical Journal,* 131(3-4), 212-219. https://doi.org/10.1080/14702541.2014.994673

Vazquez, D., Dennis, C., & Zhang, Y. (2017). Understanding the effect of smart retail brand-Consumer communications via mobile instant messaging (MIM)-An empirical study in the Chinese context. *Computers in Human Behavior,* 77, 425-436. https://doi.org/10.1016/j.chb.2017.08.018

Verhoef, P.C., Kannan, P.K., & Inman, J.J. (2015). From Multi-Channel Retailing to Omni-Channel Retailing: Introduction to the Special Issue on Multi-Channel Retailing. *Journal of Retailing,* 91(2), 174-181. https://doi.org/10.1016/j.jretai.2015.02.005

Verhoef, P.C., Stephen, A.T., Kannan, P.K., Luo, X., Andrews, M., Bart, Y. et al. (2017). Consumer Connectivity in a Complex, Technology-enabled, and Mobile-oriented World with Smart Products. *Journal of Interactive Marketing,* 40, 1-8. https://doi.org/10.1016/j.intmar.2017.06.001

von-Briel, F. (2018). The future of omnichannel retail: A four-stage Delphi study. *Technological Forecasting and Social Change,* 132, 217-229. https://doi.org/10.1016/j.techfore.2018.02.004

Ziółkowska, M.J. (2021). Digital transformation and marketing activities in small and medium-sized enterprises. *Sustainability,* 13(5), 2512. https://doi.org/10.3390/su13052512