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A roadmap of consumer empowerment through digital technologies: A systematic review

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Abstract

Background: In today's digital age, understanding consumer behavior in digital environments has emerged as a critical imperative for both industries and academic research.
Aims: This study develops a comprehensive roadmap for consumer empowerment through modern digital technologies.
Methodology: The study employs a systematic review methodology to address four core research questions examining the fundamental aspects of digital consumer empowerment. A rigorous search of Scopus and Web of Science databases initially identified 3,201 studies, which underwent multiple filtering stages including title and abstract screening, quality assessment, and ten-criterion evaluation. The final sample of 84 relevant studies was analyzed using thematic analysis through MAXQDA and Excel software to ensure comprehensive data extraction and synthesis.
Findings: The analysis reveals dual dimensions of consumer empowerment: behavioral and psychological. The study identifies critical digital tools, including VR, AR, MR, AI, Blockchain, IoT, and Metaverse technologies, that significantly enhance consumer experiences. Implementation mechanisms emerge as crucial elements, particularly AI integration, user-centric design, and continuous data analysis. The research further identifies key functionalities including personalized recommendations, smart interactions, and collaborative creation, which collectively enhance consumer satisfaction and decision-making capabilities.
Conclusion: By bridging neoliberal and Foucauldian theoretical perspectives, this study advances a unified conceptual foundation for digital consumer empowerment. The proposed roadmap equips businesses and scholars with an actionable framework to strategically leverage emerging technologies while addressing ethical, privacy, and implementation challenges.

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1. Introduction

In today's digital age, understanding consumer behavior in digital environments has emerged as a critical imperative for both industries and academic research. The digital landscape has fundamentally transformed consumer behavior, dissolving traditional boundaries between online and offline worlds (Sağkaya Güngör & Ozansoy Çadırcı, 2022; Mariani et al., 2022). This transformation has made understanding consumer interactions with digital environments increasingly crucial, particularly as technologies like artificial intelligence (AI) and conversational agents reshape consumer experiences (Flavián et al., 2024; Lee & Kim, 2023). Within this context, consumer empowerment- defined as the process through which consumers gain greater control and influence over their decision-making and consumption behaviors- has become a central focus (Zimmerman, 1995; Kumar et al., 2024).

Consumer empowerment manifests through multiple channels, including democratic participation in social communities, increased environmental awareness, and most significantly, through technological engagement. The rapid advancement of Information Technology (IT), particularly in areas such as artificial intelligence, augmented reality, blockchain, and the Internet of Things (IoT), has revolutionized the empowerment process. These technologies provide consumers with unprecedented choice and information access, making consumer empowerment not just desirable but a strategic necessity for modern businesses (Broniarczyk & Griffin, 2014).

The integration of these technologies into consumer experiences enables sophisticated personalization, enhanced interaction, and innovative service delivery (Hoffman & Novak, 2015). For instance, AI-powered conversational agents can now provide personalized recommendations and support, significantly improving customer satisfaction and loyalty (Mariani et al., 2022). Blockchain technology ensures data integrity and transparency, building consumer trust through verifiable transactions (Wei & Prentice, 2022). Moreover, digital platforms increasingly facilitate consumer co-creation in product development, fostering deeper engagement and satisfaction (Pitardi & Marriott, 2021).

Contemporary consumers have evolved to become more active, participatory, resilient, and influential in their social behaviors than ever before (Cova & Pace, 2006; Crolic et al., 2022). The concept of consumer power has gained significant attention in marketing literature, reflecting the dynamic shift in consumer-company relationships in the digital age. This power refers to consumers' perceived ability to influence and resist company actions and marketing efforts (Akhavannasab et al., 2022; Mostafa & Kasamani, 2021).

The rapid evolution of digital technologies presents both

unprecedented opportunities and significant challenges for consumer empowerment. While AI, AR, blockchain, and IoT transform consumer experiences and create new possibilities, they also raise important concerns about data privacy, security, and ethical considerations (Chen et al., 2022). The implementation of these technologies requires careful consideration of technical expertise, infrastructure requirements, and ethical implications (Shankar, 2018; Mariani et al., 2022).

Modern consumers are increasingly empowered to make informed decisions due to vast information availability and real-time brand interactions (Kim & Kim, 2020; Hernández-Ortega et al., 2021). This empowerment represents a key objective for marketers and companies, as it can lead to improved customer satisfaction and increased loyalty (Hunter & Garnefeld, 2008). However, companies must carefully navigate the challenges associated with these technologies, balancing consumer empowerment with responsible technology implementation (Murtarelli et al., 2020).

Despite the significant potential of these technologies, the literature on consumer empowerment through digital technologies remains fragmented and incomplete (Brannon Barhorst et al., 2021; Kauppinen-Räisänen et al., 2020). Prior studies have predominantly examined individual technologies in isolation, without providing an integrated framework that simultaneously addresses the objectives, tools, implementation mechanisms, and functionalities required for effective digital consumer empowerment. Moreover, no systematic review to date has synthesized these dimensions into a comprehensive and actionable roadmap for businesses and researchers. There is a pressing need for systematic and comprehensive research to understand how these technologies can be effectively utilized to empower consumers while addressing potential risks and challenges. This study aims to address this gap by providing a detailed roadmap for consumer empowerment through emerging digital technologies.

This research seeks to make both theoretical and practical contributions by focusing on the objectives, functions, tools, and mechanisms of these technologies. By synthesizing existing knowledge and incorporating recent technological developments, we aim to provide actionable insights for businesses and advance the academic literature on consumer behavior and technology adoption. The findings can serve as a foundation for future research and practical applications, helping businesses develop strategies to engage and empower their consumers effectively in an increasingly digital world.

2. Literature review

2.1. Concept of power and consumer empowerment

The concept of power and consumer empowerment has emerged as a critical area of study across multiple disciplines, including sociology, marketing, and technology. As digital technologies continue to reshape

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market dynamics, understanding consumer empowerment- defined as the process through which consumers gain increased control and influence over their purchasing decisions and consumption behaviors- has become increasingly vital (Watkins et al., 2022). This empowerment manifests through various channels, from enhanced decision-making capabilities to increased market influence, fundamentally altering how consumers interact with brands and make decisions (Pranić & Roehl, 2012; Kumar et al., 2024).

Michel Foucault's theoretical framework provides a foundational perspective on empowerment, emphasizing its internal dimensions such as perceived control and self-efficacy. Foucault's work suggests that empowerment extends beyond mere choice availability to encompass the psychological capacity and confidence to make decisions effectively (Foucault, 1980). Recent research has built upon this foundation, demonstrating how digital technologies can enhance psychological empowerment by providing consumers with unprecedented access to information and decision-support tools (Flavián et al., 2019; Mostafa & Kasamani, 2021).

The neoliberal perspective on consumer empowerment, as articulated by Berlin (1969) and expanded by contemporary scholars, emphasizes the relationship between market choice and consumer influence. This viewpoint has gained renewed relevance in the digital era, where technology-enabled transparency and information access have dramatically expanded consumer choice and market influence. Recent studies indicate that digital platforms and AI-driven services have significantly amplified consumers' ability to influence market dynamics through more informed and efficient decision-making processes (Ozkan & Sekerkaya, 2024).

Psychological empowerment remains a crucial dimension of consumer power, particularly as digital interactions become more prevalent. Modern research emphasizes that true empowerment requires not only access to choices, but also the confidence and capability to make informed decisions (Crolic et al., 2022). This psychological aspect of empowerment is enhanced through transparency in business practices, trust-building through consistent digital interactions, and access to comprehensive product information. Studies show that maintaining high levels of psychological empowerment requires continuous investment in transparent and ethical practices, particularly in digital environments (Schwartz et al., 2012; Hernández-Ortega et al., 2021).

2.2. Digital technologies and consumer empowerment

The integration of advanced digital technologies such as artificial intelligence (AI), augmented reality (AR), blockchain, and the Internet of Things (IoT) has fundamentally transformed consumer empowerment. These technologies have created new paradigms for

consumer-business interaction, enabling personalized recommendations, enhanced engagement, and innovative product and service offerings (Hoffman & Novak, 2015; Rohden & Zeferino, 2022).

Artificial Intelligence has revolutionized consumer interactions through sophisticated data analysis and personalized experiences. AI systems can now process vast amounts of consumer data to understand preferences and behaviors, enabling businesses to provide highly tailored offerings (Ping et al., 2019). Recent research demonstrates that AI-powered conversational agents significantly enhance consumer satisfaction and engagement by providing more natural and contextually relevant interactions (Mariani et al., 2022). However, studies also emphasize the importance of balancing automation with human touch to ensure meaningful consumer experiences (Flavián et al., 2019; Prentice et al., 2020).

Augmented Reality technology has transformed how consumers interact with products and services before purchase. AR applications enable consumers to visualize products in real-world contexts, significantly reducing purchase uncertainty and enhancing satisfaction (Poushneh & Vasquez-Parraga, 2017). Recent studies have shown that AR can positively impact consumer engagement and purchase intentions by creating immersive, multisensory shopping experiences (Huang & Liao, 2017). Despite these benefits, implementation challenges remain, including development costs and the need for user-friendly interfaces (Grzegorczyk et al., 2019).

Blockchain technology has emerged as a crucial tool for building consumer trust and transparency in digital transactions. The technology provides a decentralized and secure method for recording transactions, particularly valuable in industries requiring high levels of trust such as finance and healthcare (Angraal et al., 2017). Recent research demonstrates that blockchain implementation can significantly improve consumer trust and loyalty by providing transparent and immutable transaction records (Wei & Prentice, 2022). However, widespread adoption faces challenges including regulatory uncertainties and the need for industry collaboration (Conti et al., 2018).

The Internet of Things has enabled unprecedented connectivity between physical devices and digital systems, transforming how consumers interact with products and services. IoT-enabled devices can monitor usage patterns and provide real-time personalized recommendations, enhancing consumer convenience and satisfaction. Contemporary research highlights how IoT integration enhances consumer empowerment by providing greater control over product usage and service customization (Murtarelli et al., 2020). However, the proliferation of connected devices raises significant concerns about data security and privacy, necessitating robust infrastructure and protection measures (Weber, 2010).

Recent studies have begun to explore the challenges and limitations

associated with digital consumer empowerment. Key concerns include technical implementation barriers, data privacy and security issues, and the need for consumer digital literacy (Mariani et al., 2022). Research suggests that successful implementation requires careful consideration of both technological capabilities and human factors, emphasizing the need for balanced approaches that maximize benefits while addressing potential risks (Ozkan & Sekerkaya, 2024).

Through this comprehensive review of literature, it becomes clear that consumer empowerment in the digital age represents a complex interplay of technological, psychological, and social factors. The integration of advanced digital technologies has created new opportunities for consumer empowerment while also introducing novel challenges that must be carefully managed. Understanding these dynamics is crucial for developing effective strategies that enhance consumer engagement and satisfaction while maintaining trust and ensuring sustainable value creation in the digital marketplace.

3. Design of research

This research aims to develop a comprehensive roadmap for consumer empowerment through modern digital technologies. The study employs a systematic review methodology to synthesize existing knowledge and evaluate the goals, tools, mechanisms, and functions of digital technologies in consumer empowerment. This section details the research design, including the methodological approach, review process, and analytical procedures.

3.1. Research framework and questions

The study adopts an interpretive research philosophy with a systematic review methodology to synthesize existing literature on consumer empowerment through digital technologies. This approach enables a deep understanding of how digital technologies contribute to consumer empowerment while acknowledging the complex interplay between technological capabilities and consumer experiences (Walsham, 1995; Klein & Myers, 1999). The research incorporates studies using quantitative, qualitative, and mixed methods to capture both measurable impacts and rich contextual insights.

Four research questions guide this study:

RQ1: What objectives can be established for implementing modern digital technologies to empower consumers?

RQ2: What modern digital tools contribute to consumer empowerment?

RQ3: What mechanisms are needed to implement modern digital technologies for consumer empowerment?

RQ4: What are the functions of modern digital technologies in empowering consumers?

These questions draw from empowerment theory (Zimmerman, 1995), digital transformation literature (Vial, 2019), technology adoption models (Venkatesh et al., 2016), and consumer behavior frameworks to develop a comprehensive understanding of consumer empowerment through digital technologies.

3.2. Search strategy

The systematic review followed the PRISMA protocol to ensure transparency and reproducibility. The search strategy development involved four key steps:

a) Primary keyword identification through literature review and expert consultation,
b) Analysis of reference papers from highly-cited articles,
c) Identification of alternative keywords and related terms,
d) Construction of comprehensive search strings using Boolean operators.

Two premier academic databases were selected: Scopus and Web of Science, chosen for their comprehensive coverage of peer-reviewed literature and focus on technology and management journals. The search period covered January 2000 to January 2024.

Table 1 presents the search strategy configuration used across both databases.

Table 1. Search strategy configuration

Parameter	Specification
Search fields	Title, Abstract, Keywords, Full text
Document types	Articles, Reviews, Conference papers
Language	English
Time period	2000-2024
Subject areas	Business, Management, Computer science, Information systems

The search strings combined key concepts using Boolean operators, focusing on consumer empowerment and various digital technologies. The primary search string was:

("consumer empowerment" OR "customer empowerment") AND ("digital technology" OR "digital transformation") AND ("artificial intelligence" OR "virtual reality" OR "blockchain" OR "internet of things" OR "metaverse")

3.3. Selection and analysis process

To ensure methodological rigor, explicit eligibility criteria were established prior to the screening phase. Articles were included if they were peer-reviewed empirical or theoretical studies published in English between January 2000 and January 2024, and explicitly focused on the intersection of modern digital technologies and consumer empowerment. Conversely, exclusion criteria encompassed non-peer-

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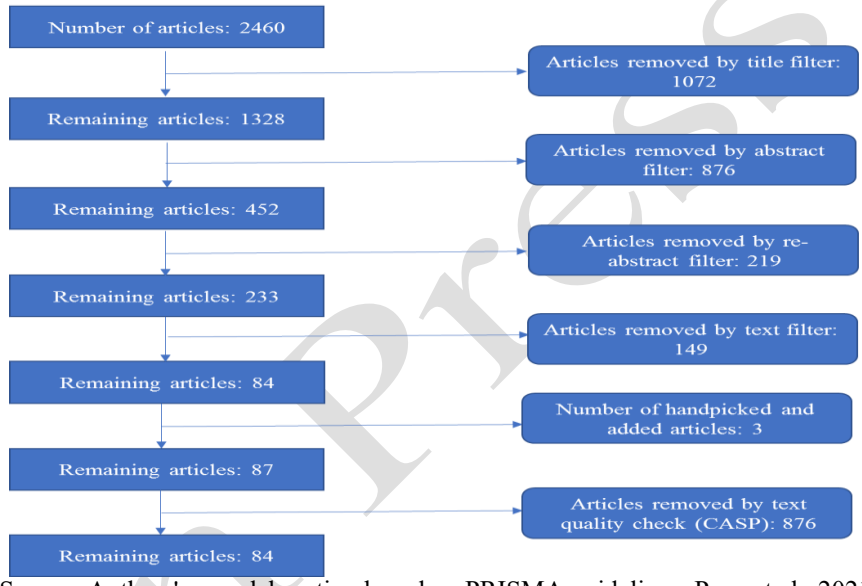
reviewed materials (e.g., conference proceedings, book chapters, and gray literature), duplicated records across databases, and studies strictly addressing the technical or engineering architecture of digital systems without exploring consumer behavioral dimensions.

The study selection process followed multiple stages, as illustrated in Figure 1. Initial database searches yielded 3,201 articles. After removing duplicates, 2,460 articles remained for screening. Title screening eliminated 1,072 articles, followed by abstract screening which reduced the pool to 452 articles. Full-text assessment resulted in 84 articles meeting all inclusion criteria. Three additional articles were identified through hand searching, bringing the final sample to 87 articles.



Source: Authors' own elaboration based on PRISMA guidelines; Page et al., 2021

Figure 1. Algorithm of selecting papers

Quality assessment employed modified Critical Appraisal Skills Programme (CASP, 2008) criteria, evaluating:

- Research design and methodology,
- Theoretical framework and contribution,
- Practical implications and recommendations.

Studies scoring 12 or higher out of 15 points were included in the final analysis. Data extraction and analysis involved systematic coding using MAXQDA software for qualitative analysis and Excel for data management. Two researchers independently conducted the coding process, with regular inter-coder reliability checks ensuring consistency.

3.4. Validity and reliability measures

To ensure research quality and reliability, several measures were

implemented:

- Expert panel review and pilot testing of search strategies,
- Double-blind review process with third-reviewer arbitration,
- Systematic coding procedures with regular reliability checks,
- Detailed documentation of all research decisions and processes.

These procedures ensured the systematic review's thoroughness, transparency, and replicability, providing a strong foundation for the development of the consumer empowerment roadmap.

3.5. Data coding process

To ensure transparency in our qualitative analysis and clarify the origin of the extracted themes, the transition from raw literature to the initial themes was systematically documented. Initially, open coding generated numerous raw codes capturing specific technological functions and consumer empowerment objectives. Through an iterative review process, overlapping codes were merged, and the refined codes were aggregated to form the Basic Themes.

To avoid redundancy with the overarching framework presented in the Results section, Table 2 provides an illustrative excerpt focused solely on this initial abstraction phase (demonstrating the pathway from raw literature extracts to Basic Themes). The subsequent categorization of these Basic Themes into the 12 Organizing Themes and the 2 Comprehensive Themes (Behavioral and Psychological Empowerment) is fully detailed in Chapter Four.

Table 2. Illustrative excerpt of the initial coding phase

Illustrative extract from literature (Raw data)	Initial code (Raw code)	Basic theme
"AI algorithms analyze past purchase behaviors to offer highly tailored product suggestions."	Algorithmic preference tracking and customization	Personalization of products and services
"AR applications allow users to interact with 3D product models, increasing active participation."	Immersive pre-purchase product interaction	Behavioral engagement
"Consumers use digital platforms to actively participate in the design and modification of services."	Customer-led product modification	Co-creation of value
"Smart dashboards provide consumers with clear, real-time insights into their usage patterns."	Real-time monitoring and data visibility	Enhancement of consumer perception and knowledge
"Blockchain technology provides transparent, immutable records that reduce perceived risks."	Verifiable transaction tracking	Trust building

4. Results

4.1. Objectives of applying digital technologies for consumer empowerment

Identifying the objectives for utilizing digital technologies to empower

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consumers is crucial for ensuring effective use of technology, preventing resource waste, and enhancing productivity. Through systematic review and thematic analysis of 84 selected articles, we identified key objectives, categorized into basic themes which were then organized into 12 organizing themes and 2 comprehensive themes (Table 3).

Table 3. Objectives of utilizing digital technologies for consumer empowerment

Basic themes	Organizing themes	Comprehensive theme
Customer analysis for personalized recommendations, creating engaging personalized experiences, personalized solutions, personalizing experiences with AI, developing AR for user needs, personalization for seniors and people with disabilities	Personalized products and services	Behavioral empowerment
Enhancing engagement, collaborative decision-making with AR, strengthening creative collaboration, interaction dynamics, facilitating co-creation, user interaction with the metaverse	Behavioral engagement	
Enhancing social interaction, advanced social interactions with AI, playful sharing and interaction, consumer engagement with AR	Social interactions and sharing	
Supporting customer decision-making, advanced decision support systems, promoting sustainable purchase decisions, advanced decision-making with VR, enhancing managerial decision-making with blockchain	Data-driven decision improvement	
Enhancing service quality through social robots, improving service quality, service design for mr experiences, transforming service management, enhancing user experience through AREM	Service and experience enhancement	
Creating value partnerships, increasing value co-creation, generating added value, improving customer outcomes	Co-creation of value	
Enhancing customer value perception, improving perceived fairness, increasing customer awareness, strengthening online consumer skills	Perception and knowledge improvement	Psychological empowerment
Control over purchasing process, protecting consumer assets, increasing trust in technology, authentication verification, enhancing consumer protection	Trust building	
Enhancing reliability, increasing safety and product quality, improving service quality	Quality assurance and reliability	
Enhancing security, increasing privacy, strengthening individual rights	Security and privacy protection	
Increasing convenience and accessibility, improving ease of use, enhancing daily life, information accessibility, geographic flexibility	Increased convenience and ease	
Emotional connection in virtual spaces, emotional triggers in retail experience, enabling reliable	Emotional interaction	

Basic themes	Organizing themes	Comprehensive theme
customer emotional feedback		

Using an inductive-deductive approach (Braun & Clarke, 2023), we developed. The identified comprehensive themes- behavioral and psychological empowerment- align with foundational theories of consumer empowerment while incorporating emerging dimensions introduced by modern digital technologies.

Our analysis revealed that contemporary digital technologies introduce novel objectives beyond traditional empowerment goals. For instance, recent research indicates that AI-enabled personalization now aims not just at customizing offerings but at anticipating consumer needs through predictive analytics. Similarly, AR/VR technologies have expanded behavioral empowerment objectives to include immersive decision-making experiences (Rauschnabel et al., 2019).

4.1.1. Consumer behavioral empowerment

The personalization of products and services emerges as a primary objective of digital consumer empowerment. AI-driven personalization has evolved significantly, enabling businesses to analyze consumer behavior patterns and deliver tailored recommendations (Knof et al., 2023). Modern AI systems can now predict preferences and provide contextualized suggestions, significantly enhancing customer satisfaction and engagement (Smith & Linden, 2017; Kumar et al., 2024).

Recent research indicates that while AI recommendation agents can reduce choice overload in online shopping, they may increase decision uncertainty and reduce perceived control (Rohden & Espartel, 2024).

Behavioral engagement through digital technologies has transformed how consumers interact with products and services. Augmented Reality (AR) particularly enhances collaborative decision-making by allowing consumers to visualize and assess products in real-world contexts (Heller et al., 2019; Rauschnabel et al., 2019). The integration of emerging technologies like the Metaverse has further expanded these capabilities, enabling immersive social experiences and deeper engagement (Dwivedi et al., 2021).

Social interactions and information sharing have emerged as key objectives in digital consumer empowerment. AR technology enhances social engagement by enabling consumers to share virtual experiences and product interactions with peers (Rauschnabel et al., 2019). AI-powered platforms facilitate more natural social interactions, with intelligent chatbots creating engaging experiences that boost customer satisfaction and social engagement (Go & Sundar, 2019). Recent metaverse developments have further expanded these capabilities, enabling synchronized social experiences that enhance community engagement and purchase decisions (Dwivedi et al., 2023; Blut et al., 2024).

Data-driven decision improvement represents another crucial objective, with digital technologies enhancing consumer decision-

making through precise information and advanced analytics. AI systems now process vast amounts of data to provide accurate product information and personalized recommendations (Davenport & Ronanki, 2018; Flavián et al., 2019). Virtual Reality (VR) technologies enable consumers to experience products before purchase, significantly reducing uncertainty in decision-making (Pantano & Vannucci, 2019).

Service and experience enhancement through digital technologies has become increasingly sophisticated. Social robots and AI-powered systems provide 24/7 customer support, while VR and Mixed Reality (MR) create immersive service experiences (Følstad & Skjuve, 2019; Wei & Prentice, 2022). Recent advancements in these technologies have enabled more natural and intuitive interactions, leading to improved customer satisfaction and loyalty (Blut et al., 2024).

The co-creation of value has emerged as a significant objective, with digital technologies facilitating collaborative innovation between businesses and consumers. Modern platforms enable consumers to participate in product development and service improvement processes, fostering deeper engagement and satisfaction (Mariani et al., 2022).

4.1.2. Consumer psychological empowerment

The enhancement of consumer perception and knowledge represents a fundamental objective of psychological empowerment. Digital technologies, particularly AI and AR, improve customers' understanding of product value and fairness through precise information delivery (Davenport & Ronanki, 2018; Kumar et al., 2024). Modern AI systems analyze consumer behavior patterns to provide targeted educational content, strengthening online consumer skills and perceived convenience (Gregory et al., 2015; Flavián et al., 2019).

Trust building emerges as a critical psychological objective, with blockchain technology enhancing transaction transparency and consumer asset protection. Recent studies indicate that blockchain implementation can increase consumer trust by providing verifiable transaction records and enhanced security measures (Wei & Prentice, 2022). AR technology further strengthens consumer confidence through interactive product visualization and authentic demonstrations (Heller et al., 2019).

Quality assurance and reliability objectives focus on maintaining high standards through AI-enhanced product monitoring and quality control. AI systems analyze performance data to predict maintenance needs and ensure consistent service quality (Davenport & Ronanki, 2018). VR technology enables thorough product testing and quality verification, boosting consumer confidence in purchase decisions (Pantano & Vannucci, 2019).

Security and privacy protection have gained prominence, with AI enhancing threat detection and blockchain ensuring data privacy. Recent advancements in privacy-preserving technologies have

improved consumer trust while maintaining personalization capabilities (Casino et al., 2019; Blut et al., 2024). These technologies strengthen individual rights while ensuring secure transactions in digital environments.

Increased convenience and ease of use remain central objectives, with VR enabling instant virtual shopping experiences and AI streamlining customer interactions. The metaverse has further enhanced accessibility by eliminating geographical barriers and providing seamless access to services (Dwivedi et al., 2021). Recent studies show that improved accessibility features significantly increase consumer satisfaction and engagement (Mariani et al., 2022).

Emotional interaction objectives focus on building strong connections through digital technologies. VR creates immersive experiences that foster emotional engagement, while AR enhances retail experiences through emotional triggers (Rauschnabel et al., 2019). These technologies enable reliable emotional feedback collection, helping businesses create more engaging and satisfying customer experiences (Pantano & Vannucci, 2019).

4.2. Digital tools for consumer empowerment

Through comprehensive review of the literature, various innovative technological tools were identified that play crucial roles in consumer empowerment. Table 4 organizes these tools into four major categories: virtual/ augmented/ mixed reality tools, artificial intelligence and related tools, blockchain and IoT, and metaverse technologies. The classification demonstrates how different digital technologies serve distinct yet complementary functions in empowering consumers.

4.2.1. Virtual, augmented, and mixed reality tools

a) Virtual Reality (VR)

Virtual Reality transforms consumer empowerment by creating immersive digital environments for enhanced product interaction and decision-making. Through head-mounted displays and interactive interfaces, VR enables sophisticated product evaluation in virtual spaces (Chen et al., 2022; Hoffman & Novak, 2015). Platforms like Oculus facilitate collaborative experiences where multiple users can interact simultaneously, particularly valuable in high-involvement purchase decisions where detailed product assessment is crucial (Wu et al., 2024). VR environments allow consumers to evaluate products in contextualized settings, enhancing decision confidence while reducing purchase uncertainty.

Table 4. Innovative technological tools for consumer empowerment

Basic themes	Organizing themes	Comprehensive theme
Virtual reality headsets, VR-based gamification, virtual reality-based videos,	Virtual Reality (VR)	Virtual, augmented, and

Basic themes	Organizing themes	Comprehensive theme
shopping, and events, head-mounted displays (HMDs), immersive virtual reality interfaces, virtual reality configurations, collaboration in virtual reality using oculus medium, virtual and augmented reality for true immersion, interactive virtual environments		mixed reality tools
Mixed reality (MR) design tools, mixed reality (MR) systems	Mixed Reality (MR)	
Augmented reality as a tool for experiential marketing, AR for in-store interaction, consumer empowerment using AR, AR as a driver of authentic experiences, personalized and interactive features of AR, combining text and images in AR, AR social applications, AR-based services, AR interfaces, AR devices, interactive AR technology, AR virtual testing tools, AR-based e-commerce websites	Augmented Reality (AR)	
Innovation and predictive capability in chatbot performance, intelligent chatbots, chatbots as virtual assistants, AI-based chatbots, AI-empowered chatbots, contextually appropriate text responses in chatbots, AI self-service technology, digital assistants as task managers, AI-driven voice interactions, voice assistant integration	Chatbots and virtual assistants	Artificial intelligence and related tools
Service robots as social actors, concierge robot services, customer appeal and acceptance of robots, customer preference for human-like robots, robotic advisory services, social robots with conversational skills, artificial intelligence as an autonomous actor	Service robots and social interaction	
Artificial intelligence, blockchain, big data analytics, data mining, and machine learning, integration of big data and CRM, AI-enabled frameworks, AI predictive systems for customer preferences, machine learning deployment calculators for monitoring, AI-enabled tools	Big data and machine learning	
Blockchain technology, integration of blockchain with IoT and AI, blockchain for secure transactions	Blockchain and security	Blockchain and Internet of Things (IoT)
Sensors and embedded technologies, RFID tags	Internet of Things (IoT)	
Consumer empowerment in the metaverse, avatars, holograms, and digital twins, product innovation with digital twins, avatars in virtual environments, metaverse platforms, natural interfaces in metaverse marketing	Metaverse	Metaverse and supporting technologies
Tangible User Interfaces (TUI), 3D printed TUI, kinect sensor, unity3D game engine	Supporting Technologies	

b) Augmented Reality (AR)

Augmented Reality enhances consumer empowerment by merging digital information with the physical world, creating interactive shopping experiences (Huang & Liao, 2017; Kumar et al., 2024). Through mobile applications and advanced interfaces, consumers access dynamic product information and virtual try-ons, transforming how they evaluate products in real-world contexts (Muthaffar et al., 2024). AR's ability to provide contextual information and personalized experiences has revolutionized sectors like beauty and fashion, enabling more informed purchase decisions (Sağkaya Güngör & Ozansoy Çadırcı, 2022; Hilken et al., 2021).

c) Mixed Reality (MR)

Mixed Reality combines VR and AR capabilities to create comprehensive immersive experiences, enabling simultaneous interaction with virtual and physical elements (Poushneh & Vasquez-Parraga, 2017). This integration enhances consumer decision-making through detailed product visualization and comparison capabilities. MR demonstrates particular effectiveness in retail, education, and healthcare sectors, where complex visualization and interaction requirements exist (Chen et al., 2022). The technology's ability to seamlessly blend digital and physical elements advances consumer empowerment across various contexts.

4.2.2. Artificial intelligence and related tools

a) Chatbots and virtual assistants

AI significantly enhances user interactions with digital systems, improving customer experiences (Ivančić et al., 2024; Li et al., 2022a). Chatbots and virtual assistants, powered by complex algorithms and machine learning, provide personalized responses and assist with daily tasks. Their predictive capabilities and innovations enhance user engagement (Acikgoz et al., 2023), while AI-powered self-service technologies boost efficiency and productivity (Huang & Rust, 2018).

b) Service robots and social interaction

Service robots, powered by AI, significantly enhance social interactions and user services. These robots act as social actors, transforming company-customer interactions (Lu et al., 2020). Conversational AI allows for personalized experiences and automates repetitive tasks (El-Ansari & Beni-Hssane, 2023). Concierge and social robots with conversational skills improve user experience and customer acceptance. Customer preference for human-like robots further enhances digital interactions and service delivery.

c) Big data and machine learning

Big data and machine learning are essential for analyzing vast data

volumes, providing valuable insights for better decision-making and business strategies. Integrating big data with CRM systems enhances user experience and customer satisfaction, ensuring seamless, consistent interactions across channels (Zhang & Ming, 2022). Smart technologies integrated into offline retail environments enable retailers to analyze their customers and provide personalized shopping experiences, with sensor technologies collecting and interpreting data about customers' physical behavior and emotions (Knof et al., 2023).

4.2.3. Blockchain and Internet of Things (IoT)

a) Blockchain and security

Blockchain technology is valued for its security and unique capabilities. It reduces transaction costs and enhances energy system efficiency (Fernando et al., 2021). Its decentralized structure ensures secure and transparent transactions. Integrating blockchain with IoT and AI improves security and system efficiency. Blockchain provides secure transactions, transparency, and data integrity, increasing consumer trust and reducing fraud risks.

b) Internet of Things (IoT)

The Internet of Things (IoT) enables seamless communication and data exchange between devices without human intervention. It uses sensors, smart devices, and networks to provide real-time data and advanced analytics. IoT helps optimize energy consumption, manage resources, enhance security, and improve quality of life. For example, IoT creates "energy-aware" environments through smart metering, allowing better energy management (Ahmadi et al., 2022; Stojkoska & Trivodaliev, 2017). Overall, IoT empowers consumers with precise, up-to-date information for better control and efficiency.

4.2.4. Metaverse and supporting technologies

a) Metaverse

According to a 2023 McKinsey Digital report, over 79% of consumers who have participated in metaverse experiences engaged in social activities, highlighting the platform's potential for enhancing social interactions and consumer engagement (McKinsey & Company, 2023). The Metaverse, through avatars, holograms, and digital twins, enables complex and realistic interactions in a comprehensive virtual space (Rosedale, 2017).

Empowering consumers in the Metaverse involves providing tools for personalized experiences and virtual activities. Digital twins allow users to preview and test products before purchase, enhancing user experience and customer satisfaction.

b) Supporting and complementary technologies

Supporting technologies enhance user experiences in digital

environments. Tangible User Interfaces (TUI) and sensors like Kinect improve virtual interactions. The Unity3D game engine allows for the creation of complex, interactive environments. These tools enhance user interactions and satisfaction, empowering consumers.

4.3. Implementation mechanisms of digital technologies for consumer empowerment

The review revealed multiple implementation mechanisms essential for deploying digital technologies effectively. Table 5 presents these mechanisms, from AI integration and user experience design to data analytics and ethical considerations, providing a framework for successful technology deployment in consumer empowerment.

Table 5. Implementation mechanisms of digital technologies for consumer empowerment

Basic themes	Organizing themes	Comprehensive theme
Trust and commitment in AI integration, trust and information privacy, impact of voice-activated services on service quality	Implementing AI with customer trust	Integrating intelligence in customer interaction
Integration of emotional intelligence, addressing emotional responses to AI, managing gender-based emotional expressions	Emotional intelligence and emotional responses	
UX as an AR and UWB mediator, collaboration between retailers and AR companies, integration of AR in omnichannel retail strategy, agile development for mobile applications, integration of VR, AR, and TUI, application of the S-O-R model in augmented reality programs	User experience and VR/AR marketing	Augmented and virtual reality in customer experience
Design elements from a customer perspective, contextual content and features, optimal social settings for AR, balancing privacy and visibility	Sensory interaction in VR and AR	
VR engagement motives and meaning-making, optimal level of VR interaction, sustained post-VR interaction experience	Immersive and sustainable experience in VR	
Real-time analysis and dynamic capabilities, deep learning for monitoring customer satisfaction, performance analysis of SAR features	Real-time analysis and monitoring	Data analysis and continuous improvement
Customer feedback and adaptation in chatbots, continuous monitoring and adaptation in chatbots, utilizing consumer feedback	Feedback and adaptation	
Real-time data integration and analysis, data: fuel for AI, data integration and analysis in AI	Data integration and analysis	
User-centered design, user-friendly technology for customer interaction, designing user-friendly AR features	User-friendly design and interaction	User-centered design and user experience

Basic themes	Organizing themes	Comprehensive theme
Creating multisensory experiences, developing safe and reliable systems, balancing real and artificial experiences	Multisensory and immersive experiences	
Agile development for mobile applications, training and skill development, user onboarding and education	Agile development and user training	
Chatbot support as a "Friend", integration of chatbots and smart assistants, integration of chatbots with human support	Chatbots and human interaction	AI in customer service
Incorporating verbal and nonverbal cues in robots, humor in chatbots, handling engagement-induced errors	Integration of verbal and nonverbal cues	
Integration of emotional intelligence, user training and awareness, feedback mechanisms in chatbots	Enhancing chatbot capabilities	
Strategic management of AI-CRM integration, managerial insights for AI-CRM integration, strategic integration	Strategic management	Business and marketing strategies
Interactive marketing and conversational commerce, strategic approach to AI and ML in CRM	Interactive marketing	
Data management with blockchain, value co-creation through blockchain, encouraging creativity and engagement, promoting social empowerment	Increasing engagement and creativity	
Integration of VR, AR, and TUI, integration of augmented reality and virtual reality technologies, combining audio and visual inputs	Integration of emerging technologies	Digital integration of processes
Modular and customizable systems, flexibility and user-friendly interfaces, integration with existing design processes	Modular and flexible systems	
Evaluating economic and social value, prioritizing improvements, continuous feedback and improvement	Continuous evaluation and improvement	
Digitalizing all stages of the visitor process, adapting to technological evolution, framework for technology-based co-creation	Digitalizing processes	
Addressing legal and ethical issues, integrated legal framework, emphasis on ethical practices	Legal and ethical considerations	Ethics and regulations
Trust and information privacy, enhancing privacy and convenience, balancing privacy and visibility	Privacy and security maintenance	
Sensory factors in creating immersive MR experiences, high-quality VR content enhances customer immersion, disclosing chatbot identity after interaction	Creating immersive experiences	Sensory and human experiences
Integration of virtual reality and emotion recognition, emotional calibration and simplified	Emotion integration and adaptation	

Basic themes	Organizing themes	Comprehensive theme
interactions in VR, integration of human-like emotional perception		
Balancing personalization and AI identity, maintaining human touch and avoiding dehumanization in AI	Balancing human and artificial elements	

4.3.1. Integrating AI and customer interaction

a) Implementing AI with customer trust

Implementation of AI technologies requires careful attention to building customer trust through transparent and ethical data practices (Wei & Prentice, 2022; Hoffman & Novak, 2015). This involves developing AI systems that protect privacy while delivering high-quality personalized services. Voice-activated services and secure data handling mechanisms enhance service quality while maintaining consumer confidence (Flavián et al., 2019; Kumar et al., 2024).

b) Emotional intelligence and emotional responses

Integration of emotional intelligence in AI systems enables more natural and effective consumer interactions. Modern AI implementations address varying emotional responses and gender-based expressions, creating more empathetic and personalized experiences (Prentice et al., 2020). This emotional awareness enhances consumer engagement and satisfaction across digital platforms.

4.3.2. Augmented and virtual reality in customer experience

a) User experience and VR/AR marketing

The implementation of AR and VR in marketing requires careful consideration of user experience design and integration with existing retail strategies (Rauschnabel et al., 2019; Huang & Liao, 2017). Companies must focus on seamless omnichannel integration and agile development approaches to enhance consumer engagement. This includes optimizing mobile applications and ensuring consistent experiences across platforms (Chen et al., 2022).

b) Sensory interaction and immersive experience

Successful implementation of VR and AR technologies depends on creating compelling sensory experiences that enhance consumer engagement (Muthaffar et al., 2024; Bonetti et al., 2018). This involves developing contextually relevant content and features while optimizing social settings for AR interactions. The focus remains on balancing privacy concerns with visibility requirements in virtual environments.

c) Immersive and sustainable experience in VR

Virtual Reality (VR) offers an immersive and sustainable experience

that transports customers to new and different worlds. The interaction incentives and meaning-making in VR can create memorable experiences for customers. Key considerations include optimizing the level of interaction in VR and maintaining a sustainable interaction experience after using VR.

4.3.3. Data analytics and continuous improvement

a) Real-time analysis and monitoring

Implementation mechanisms must include robust real-time analysis capabilities and dynamic monitoring systems (Zhang & Ming, 2022). Deep learning technologies enable continuous monitoring of customer satisfaction and performance analysis of various features, facilitating rapid response to changing consumer needs.

b) Feedback and adaptation

Successful implementation requires systematic collection and utilization of consumer feedback for continuous system improvement. This involves developing adaptive chatbot systems and implementing comprehensive feedback mechanisms that enable rapid service enhancement based on user interactions.

c) Data integration and analysis

Real-time data integration and analysis enable AI to enhance service delivery and accurately predict customer needs, leading to continuous service improvement and customer empowerment.

4.3.4. User-centered design and user experience

a) User-friendly design and interaction

Implementation of digital technologies requires a strong focus on user-centered design principles that prioritize accessibility and ease of use (Chen et al., 2022; Hoffman & Novak, 2015). This approach emphasizes creating intuitive interfaces and seamless interactions, particularly in AR features and mobile applications. User-friendly technology implementation enhances consumer confidence and promotes sustained engagement with digital platforms (Muthaffar et al., 2024).

b) Multi-sensory and immersive experiences

Successful implementation involves creating engaging multi-sensory experiences that balance real and artificial elements (Rauschnabel et al., 2019; Ivančić et al., 2024). This requires developing safe and reliable systems that enhance user immersion while maintaining practical functionality. The focus remains on creating experiences that meaningfully engage multiple senses while ensuring user comfort and safety.

c) Agile development and user training

Implementation success depends on agile development methodologies

combined with comprehensive user training programs (Kumar et al., 2024; Wei & Prentice, 2022). This involves continuous iteration based on user feedback and systematic skill development initiatives. The approach emphasizes flexible adaptation to user needs while ensuring effective onboarding and ongoing education for optimal technology utilization.

4.3.5. AI in customer service

a) Chatbots and human interaction

Chatbots, acting as "friends", provide effective and human-like support to customers. Integrating chatbots with human systems and utilizing verbal and non-verbal cues creates a natural and engaging experience for users.

b) Integrating verbal and non-verbal cues

Implementation of AI in customer service requires sophisticated integration of both verbal and non-verbal communication elements (Wei & Prentice, 2022; Lu et al., 2020). Modern robots and chatbots incorporate natural language processing and emotional recognition capabilities, enhancing interaction quality through appropriate humor and personality traits. The focus remains on addressing engagement-related errors while maintaining authentic communication patterns.

c) Enhancing chatbot capabilities

Successful implementation involves continuous enhancement of chatbot functionalities through emotional intelligence integration and advanced learning capabilities (El-Ansari & Beni-Hssane, 2023). This includes developing robust feedback mechanisms and comprehensive user training systems. Implementation strategies emphasize personalization while maintaining consistent service quality across interactions.

4.3.6. Business and marketing strategies

a) Strategic management

Implementation requires strategic integration of AI-CRM systems and careful management of digital transformation initiatives (Zhang & Ming, 2022; Chen et al., 2022). This involves developing comprehensive frameworks for technology adoption while ensuring alignment with business objectives. Focus remains on creating value through effective digital technology deployment.

b) Interactive marketing

Implementation of interactive marketing strategies leverages conversational commerce and AI-driven engagement (Kumar et al., 2024). This includes blockchain integration for enhanced data security and value creation. The approach emphasizes building dynamic marketing capabilities while maintaining consumer trust.

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c) Enhancing engagement and creativity

Implementation mechanisms focus on fostering creativity and engagement through blockchain-enabled value co-creation (Fernando et al., 2021). This involves developing collaborative platforms that encourage consumer participation while promoting social empowerment. The emphasis remains on creating innovative engagement opportunities through digital technologies.

4.3.7. Technology development and innovation

a) Integration of advanced technologies

Implementation success requires seamless integration of VR, AR, and TUI technologies with existing business processes (Chen et al., 2022). This involves combining audio and visual inputs effectively to create cohesive user experiences. Implementation strategies focus on optimizing technology integration while maintaining system reliability.

b) Modular and flexible systems

Successful implementation depends on developing adaptable systems that can evolve with changing consumer needs (Wu et al., 2024; Zhang & Ming, 2022). This includes creating flexible user interfaces and ensuring compatibility with existing design processes. The approach emphasizes scalability and system adaptability while maintaining performance standards.

c) Digitizing processes

Implementation involves comprehensive digitization of customer journey touchpoints (Mariani et al., 2022; Kumar et al., 2024). This includes developing technology-based collaborative frameworks and adapting to technological evolution. Focus remains on creating seamless digital experiences while ensuring process efficiency.

4.3.8. Ethics and regulations

a) Legal and ethical considerations

Implementation of digital technologies requires comprehensive ethical frameworks that address the challenges of disruptive technologies while protecting consumer interests (Holmner, 2025). Organizations must develop integrated legal approaches that align with international information ethics policies while emphasizing transparency, fairness, and accountability in consumer interactions. Key focus remains on building trust through ethical technology deployment, considering both immediate and long-term implications of digital innovations in consumer empowerment (Wei & Prentice, 2022; Holmner, 2025).

b) Privacy and security

Implementation requires robust privacy protection and security measures (Chen et al., 2022; Fernando et al., 2021). This includes

enhancing user privacy while maintaining service visibility and accessibility. Strategies emphasize balancing security requirements with user convenience.

4.3.9. Sensory and human experiences

a) Creating immersive experiences

Implementation focuses on developing engaging sensory experiences through advanced technologies (Muthaffar et al., 2024). This involves creating high-quality VR content and immersive environments. The emphasis remains on enhancing user engagement through multi-sensory stimulation.

b) Integrating and adapting emotions

Implementation involves sophisticated emotion recognition and calibration systems (El-Ansari & Beni-Hssane, 2023). This includes developing natural emotional perception capabilities in digital systems. Focus remains on creating authentic emotional connections through technology.

c) Balancing human and artificial interaction

Implementation requires careful balance between automated and human elements (Kumar et al., 2024; Wei & Prentice, 2022). This involves maintaining human touch while leveraging technological advantages. Strategies emphasize creating harmonious human-technology interactions while avoiding dehumanization.

4.4. Functions of digital technologies for consumer empowerment

Analysis of the literature identified specific functions that digital technologies serve in empowering consumers. Table 6 organizes these functions into categories including visualization, personalization, prediction, innovation, and interaction capabilities, showing how different technological features contribute to consumer empowerment.

Table 6. Functions of digital technologies for consumer empowerment

Basic themes	Organizing themes	Comprehensive theme
Experience-based service design with MR, sensory effects in MR environments, sensory design and immersion, all-encompassing sensory immersion with the metaverse,sensory stimulation with VR, enhancing shopping experience through AR, sensory, cognitive, emotional, and relational experiences with robots	Sensory experience and immersion	Consumer visualization and immersion
AR as a customer engagement tool, AR as an experiential tool, designing AR marketing for enjoyment, simulation, aesthetics, and functionality, features of	Advanced interactions	

Basic themes	Organizing themes	Comprehensive theme
experiential AR applications (informative, personalized, and interactive), interactive virtual reality (IVR) in digital marketing, interactive marketing with artificial intelligence		
Advanced real estate visualization with MR, impact of technology visualization in VR, combining text and images in AR, textual visualization	Data visualization	
Personalization with AI, personalized recommendations, analyzing customer purchase history with AI, AI predictive systems for customer preferences, data collection and personalization	Personalizing consumer experiences	Personalization and smart recommendations
Recommender systems and process mining, collaborative and content-based filtering, customer analysis for personalized recommendations, decision-making support, AR for personalized recommendations	Improving decision-making processes	
Predictive capabilities of chatbots, predicting impulsivity through POS and INT, non-invasive signals for predicting impulsivity, text mining and deep learning (ML), sentiment analysis in CRM	Behavioral prediction and analysis	Consumer prediction and analysis
Predicting impulsivity through POS and INT, non-invasive signals for predicting impulsivity, text mining and deep learning (ML), sentiment analysis in CRM, analyzing customer purchase history with AI	Data prediction and analysis	
Presence in the metaverse, metaverse marketing innovation with XR, metaverse tourism transformation, virtual testing, product innovation with digital twins	Innovation in customer experience	Service and product innovation
Innovative ideas from various fields in MR, advanced interaction and storytelling with AI, increasing openness to innovation	Technological innovations	
ethical data utilization with AI, big data and CRM integration, 3D printing of tangible user interfaces (TUI)	Development and integration of emerging technologies	
Appeal and sensory design in chatbot services, customer assistance with chatbots, humor in chatbot interactions, chatbot responsiveness, humanizing chatbots, chatbots as virtual assistants	Intelligent interactions with chatbots	Intelligent communications and interactions
Verbal and nonverbal communication with robots, charm and customer acceptance with robots, emotional expression in customer service	Smart communications with robots	

Basic themes	Organizing themes	Comprehensive theme
interactions with AI, advanced service interaction, artificial empathy		
ethical data utilization with AI, data ownership and control with blockchain, equal access to data with blockchain, data management with AI	Ethical and secure data management	Data management and transparency
Transparency and information sharing, environmental footprint reporting, monitoring energy consumption and carbon footprint, real-time monitoring and tracking	Data transparency	
Simulated physical control, enabling direct user feedback in the design process, real-time feedback and iteration, clarity of information in chatbots, personalized viewing settings	Process control	
Role of AR in the co-creation process, technological functions in co-creation, co-creation of value with AI, location-based services for delivering personalized content, experiencing collaboration with the metaverse	Co-creation and collaborative innovation	Co-creation and social interactions
Democratizing education with the metaverse, metaverse marketing innovation with XR, AR as an operand resource for co-creation, new service experiences, changing behavioral intentions with VR, communication and social interactions with robots, extended reality (XR) for collaboration	Social interactions and group experiences	

4.4.1. Consumer visualization and immersion

a) Sensory and immersive experience

Mixed reality environments should be designed to engage multiple sensory channels effectively. Immersive design elements must be implemented to enhance consumer understanding through interactive features and sensory stimulation (Rauschnabel et al., 2019). The system should incorporate experiential service design principles that prioritize user engagement and natural interaction patterns.

b) Advanced interactions

AR serves as a powerful tool for customer engagement, offering experiential features that enhance consumer-product interactions (Kumar et al., 2024). Through informative, personalized, and interactive applications, digital technologies enable sophisticated marketing approaches that combine enjoyment, simulation, and functionality (Chen et al., 2022). These interactions create more meaningful and effective consumer experiences.

c) Data visualization

Visualization tools should be designed to present complex product information in easily digestible formats. MR systems must implement advanced visualization techniques that enable detailed product examination and comparison (Wu et al., 2024). The design should focus on creating clear, intuitive information displays that support informed decision-making. Visual interfaces should be implemented with adaptive features that accommodate different user preferences and needs (Mariani et al., 2022).

4.4.2. Personalization and smart recommendations

a) Personalizing consumer experiences

Effective consumer empowerment relies on AI systems capable of delivering highly personalized experiences. Implementation requires deep analysis of consumer behavior patterns and purchase histories to generate tailored recommendations (Wei & Prentice, 2022). The integration of advanced predictive algorithms enables systems to anticipate individual preferences and adapt service delivery accordingly, while maintaining user privacy (Kumar et al., 2024).

b) Enhancing decision-making processes

Modern recommendation systems benefit from incorporating multi-dimensional data analysis for enhanced decision support. The development of intelligent algorithms facilitates accurate, contextually relevant suggestions based on real-time consumer behavior analysis (Pizzi et al., 2024). Implementing collaborative and content-based filtering mechanisms enables more precise and personalized recommendation delivery, enhancing consumer confidence in purchase decisions.

4.4.3. Consumer prediction and analysis

a) Behavioral prediction and analysis

Effective consumer empowerment emerges through integration of sophisticated behavioral prediction capabilities. AI-powered systems gain accuracy by analyzing interaction patterns and contextual data points over time (Wei & Prentice, 2022). The implementation of deep learning and sentiment analysis tools enables more nuanced understanding of consumer needs, leading to improved service delivery and satisfaction (Mariani et al., 2022).

For instance, AI tools using NLP and deep learning can predict personality traits from social media posts and messages, aiding in psychological counseling and targeted marketing (Feizi-Derakhshi et al., 2022).

b) Data prediction and analysis

Real-time processing capabilities form the foundation of effective consumer behavior analysis. Advanced analytical frameworks benefit

from incorporating non-invasive behavioral signal analysis, enabling precise prediction of consumer preferences while maintaining privacy (Wu et al., 2024). Integration of machine learning algorithms supports continuous improvement in prediction accuracy through adaptive learning mechanisms.

4.4.4. Service and product innovation

a) Innovation in customer experience

Metaverse and augmented reality environments should be designed to create meaningful interactions. Digital twins must be synchronized with real products to enable accurate product evaluation pre-purchase (Muthaffar et al., 2024). The design should focus on creating immersive experiences that enhance consumer decision-making capabilities.

b) Technological innovations

Technological innovations empower consumers by enhancing their decision-making abilities and interactions with products and services. By improving digital skills, consumers become more aware and engaged in online shopping, leading to better and more sustainable purchasing decisions. Additionally, AI and machine learning enable personalized services that meet individual needs, increasing satisfaction and consumer involvement (Hoffman & Novak, 2009). In the industrial sector, digital tools boost innovation by creating flexible and adaptable structures (Li et al., 2022b). Overall, these innovations enhance consumer experiences and benefit the economy.

c) Development and integration of emerging technologies

Successful technological advancement relies on ethical data utilization and seamless integration of emerging tools. The implementation of AI frameworks alongside big data analytics enables enhanced service delivery while maintaining data privacy and security (Zhang & Ming, 2022). Integration of 3D printing capabilities with user interface development creates more intuitive and accessible consumer interaction points.

4.4.5. Intelligent communication and interaction

a) Intelligent interactions with chatbots

Communication systems should be designed to incorporate emotional intelligence and contextual awareness. Chatbots must be developed with sophisticated natural language processing capabilities to understand and respond appropriately to consumer emotions (El-Ansari & Beni-Hssane, 2023). The design should emphasize personalized dialogue patterns that adapt to individual consumer communication styles.

b) Intelligent communication with robots

Service robots enable sophisticated verbal and non-verbal communications, incorporating emotional expression and artificial

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empathy (Lu et al., 2020). These systems enhance customer acceptance through charm and personality traits while maintaining advanced service interactions. Focus remains on creating natural, engaging customer experiences through robotic interfaces (Mariani et al., 2022).

4.4.6. Data management and transparency

a) Data management and transparency

Blockchain implementations should be designed to ensure verifiable business operations and reliable information sharing. Systems must maintain transparent audit trails while protecting sensitive data. The design should enable consumers to easily access and verify product and service information.

b) Process control and improvement

Security protocols should be implemented with a focus on protecting consumer data without compromising service accessibility. Authentication systems must be designed with multiple layers of protection while maintaining user-friendly interfaces (Chen et al., 2022). Privacy controls should enable consumers to manage their data sharing preferences effectively.

4.4.7. Co-creation and social interactions

a) Co-creation and collaborative innovation

Technologies like AR and AI enhance co-creation and innovation. AR's interactive features and AI's data analysis allow users to actively participate in creating personalized experiences. This fosters collaboration, leading to innovative solutions and increased user satisfaction.

b) Social interactions and group experiences

Community-building features should be implemented to enable effective peer-to-peer knowledge sharing. Social technologies must be designed to facilitate authentic consumer interactions while maintaining privacy (Mariani et al., 2022). The implementation should focus on creating trusted environments for collective decision-making support.

4.5. Roadmap of consumer empowerment through digital technologies

The comprehensive analysis resulted in a detailed roadmap for consumer empowerment through digital technologies. Figure 2 presents this roadmap by integrating objectives, tools, mechanisms, and functions into a coherent framework for implementing consumer empowerment initiatives.

4.5.1. Analysis of the relationship between roadmap components

The roadmap of consumer empowerment through digital technologies represents a complex interweaving of objectives, tools, implementation

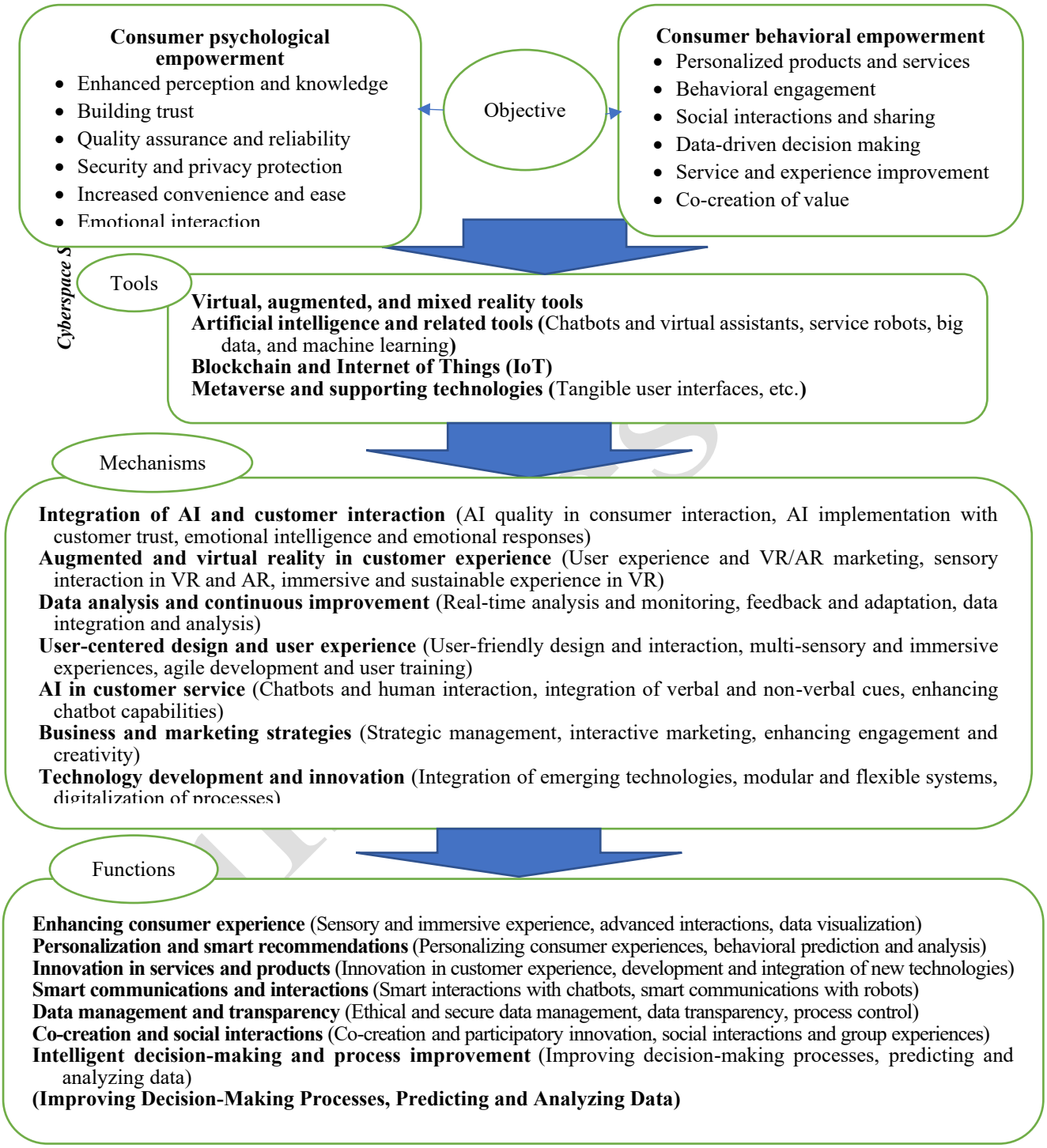
mechanisms, and functionalities. Analysis reveals intricate relationships between these components, demonstrating how they collectively create an integrated ecosystem for enhanced consumer empowerment in the digital age.

The relationship between objectives and digital tools manifests through sophisticated technological implementations. Advanced AI systems analyze consumer behavior patterns to deliver increasingly personalized recommendations, fundamentally transforming how consumers interact with products and services (Knof et al., 2023). This transformation extends to immersive technologies, where AR and VR enhance product visualization and decision-making capabilities, creating more engaging consumer experiences (Rumokoy & Frank, 2024). Blockchain systems further complement these technologies by ensuring secure transactions and building trust, addressing critical consumer concerns about digital interactions (Wei & Prentice, 2022).

Implementation mechanisms demonstrate vital connections with both digital tools and their functions. The integration of emotional intelligence in AI systems enables more natural interactions, while user-centric design approaches enhance AR/VR implementations (Prentice et al., 2020). Performance expectancy and effort expectancy significantly influence consumer adoption of these technologies, highlighting the importance of thoughtful implementation strategies (Rather, 2024; Venkatesh et al., 2016). These mechanisms extend to user experience design in AR applications and integration with existing retail strategies, ensuring seamless consumer experiences across different platforms (Lemon & Verhoef, 2016).

The functional aspects of digital technologies emerge through careful implementation of various mechanisms. Continuous data analysis and improvement systems enable real-time monitoring and adaptation capabilities, allowing businesses to respond quickly to changing consumer needs (Zhang & Ming, 2022; Rather, 2024). Advanced chatbot capabilities enhance customer service through sophisticated verbal and non-verbal communication elements (Wei & Prentice, 2022; Lu et al., 2020), while personalized recommendation systems create more targeted and relevant consumer experiences (Kumar et al., 2024).

The integration of behavioral and psychological empowerment elements creates a comprehensive framework for consumer engagement. Behaviorally, AI-driven preference analysis enables highly customized recommendations and services (Kumar et al., 2024), while AR/VR interactions create immersive experiences that enhance engagement (Rauschnabel et al., 2019; Huang & Liao, 2017). Advanced analytics and real-time insights support data-driven decision-making, providing consumers with better information for purchase decisions (Zhang & Ming, 2022; Mariani et al., 2022).



Source: Authors' own elaboration based on systematic review findings

Figure 2. Roadmap of consumer empowerment through digital technologies

Psychological empowerment manifests through various technological implementations. AI-powered learning systems and interactive educational tools enhance consumer perception and knowledge (Gregory et al., 2015), while secure blockchain systems and transparent transactions build trust in digital interactions (Wei & Prentice, 2022; Casino et al., 2019). Intelligent monitoring systems and real-time quality control mechanisms ensure consistent service delivery and product quality (Zhang & Ming, 2022; Chen et al., 2022).

The convergence of these elements creates a dynamic ecosystem where behavioral and psychological aspects of consumer empowerment reinforce each other. This holistic approach ensures that empowerment occurs not only through enhanced functional capabilities but also through psychological enablement, leading to more meaningful and satisfying consumer interactions with digital technologies (Rather, 2024; Rumokoy & Frank, 2024). The roadmap thus provides a comprehensive framework for understanding and implementing consumer empowerment strategies in the digital age, acknowledging both the technological and human aspects of this transformation.

This integrated approach to consumer empowerment reflects the evolving nature of digital consumer interactions, where technology serves not merely as a tool but as an enabler of enhanced consumer capabilities and experiences. The roadmap demonstrates how various digital technologies can be effectively implemented to create value for consumers while addressing their needs for security, personalization, and meaningful engagement (Rather, 2024).

5. Discussion

Empowering consumers through digital technologies is complex and multifaceted, requiring comprehensive research. This study enhances understanding of how digital technologies impact consumer behavior. For instance, AI is widely used in marketing, shaping consumer preferences and influencing purchasing decisions (Chen et al., 2022; Rohden & Zeferino, 2022; Rohden & Espartel, 2024). Previous research has lacked a cohesive approach to this topic, often focusing on a single theoretical framework. This study aims to integrate multiple frameworks, offering a more holistic perspective on consumer empowerment.

This study employs a systematic review method. Initially, a mixed-method metasynthesis was considered, which examines findings from both quantitative and qualitative studies (Sandelowski & Barroso, 2006). However, after filtering articles, it became clear that review studies needed to be examined for their concepts and codes, leading to the choice of a systematic review. Six research questions were formulated to guide the study. Articles were searched in Scopus and Web of Science using keywords related to digital technologies in consumer empowerment, yielding 3201 studies. After removing

duplicates, 2460 studies remained, and only high-quality, English-language articles were retained. Three stages of filtering based on title, abstract, and full text reduced the number to 84 studies. Additionally, 3 studies were manually selected. Using the CASP method, 3 studies were excluded, leaving a final total of 84 studies. The coding process was extensive due to the variety and number of articles and the broad topic of consumer empowerment through digital technologies. Codes were extracted and categorized using Excel and MaxQDA software. These codes were recorded in six categories based on research objectives and questions. Base themes were extracted and recorded, resulting in a structured framework displayed in Section 4. Finally, similar base themes were grouped into organizing themes, and these organizing themes were categorized into overarching themes. This comprehensive approach facilitated the development of a robust model for consumer empowerment through digital technologies, providing valuable insights for researchers and practitioners.

Empowering consumers through modern digital technologies enhances their decision-making abilities in purchasing and using services. This is achieved through better access to information, increased transparency, and effective interaction tools, leading to more informed decisions and improved consumer experiences. This empowerment fosters trust, satisfaction, and positive interactions between consumers and service providers (Paul et al., 2024; Johnson & Gustafsson, 2019).

This research integrates neoliberal and Foucauldian perspectives on consumer empowerment, highlighting the potential of modern digital technologies. By combining these viewpoints, the study provides a comprehensive understanding of consumer empowerment, addressing various aspects of the concept.

The neoliberal approach focuses on enhancing consumer choice and customization, suggesting that more options lead to better satisfaction and improved product quality (Berlin, 1969; Friedman & Friedman, 1962, 1980). The Foucauldian approach sees empowerment as interaction within societal power discourses, where consumers shape their identity and behavior through available knowledge (Foucault, 1980; Butler, 1997).

By integrating these approaches, the research creates a roadmap for empowering consumers with digital technologies. Specifically, personalized recommendations instantiate the neoliberal emphasis on choice and customization, enabling consumers to exercise market agency through algorithmically curated options. Smart interactions operationalize the Foucauldian notion of self-constitution within power-knowledge discourses, as consumers actively shape their identities through technologically mediated engagements. Co-creation, in turn, embodies both dimensions simultaneously— extending consumer choice while positioning individuals as entrepreneurial

subjects who co-produce value within digitally governed social spaces.

The objectives of consumer empowerment are divided into behavioral and psychological categories (Meyer & Schwager, 2007; Prahalad & Ramaswamy, 2004). Behavioral empowerment includes improving data-driven decision-making, enhancing social interactions, and co-creating value. Psychological empowerment focuses on improving perception and knowledge, building trust, and ensuring quality and assurance.

Modern digital technologies, such as VR, AR, MR, AI, Blockchain, and IoT, empower consumers by providing access to real-time information, enhancing decision-making through big data analysis and machine learning (Porter & Heppelmann, 2017; Wirtz et al., 2018). The growing use of AR and VR in marketing allows consumers to virtually examine products before purchase, improving satisfaction and confidence in their choices (Tan et al., 2022; McKinsey & Company, 2024). These technologies enable personalized experiences, effective interactions with products and services, and better-informed decisions, resulting in unique and engaging consumer experiences.

Effective implementation requires integrating emotional intelligence into AI, utilizing AR and VR, real-time data analysis, user-centric design, AI in customer service, strategic business approaches, integrating new technologies, adhering to ethical standards, and creating sensory experiences (Hoffman & Novak, 2018; Rust & Huang, 2014).

These technologies enhance consumer immersion, personalized recommendations, behavior prediction, innovation in services, smart interactions, data transparency, and collaborative creation. They enable rich, interactive experiences and better decision-making (Verhoef et al., 2009; Parasuraman et al., 2005).

From a neoliberal standpoint, personalized recommendations and smart interactions extend consumer sovereignty by expanding the range of meaningful choices available (Berlin, 1969; Friedman & Friedman, 1980). From a Foucauldian perspective, however, these same functionalities function as technologies of the self (Foucault, 1980), through which consumers internalize market norms, practice self-surveillance, and constitute themselves as productive subjects within digital consumption regimes. Co-creation likewise reflects the neoliberal ideal of the entrepreneurial consumer while simultaneously enacting Foucauldian subject-formation, as participation in value co-production is both a free choice and a form of governmentality.

5.1. Implications

The roadmap's goals, tools, mechanisms, and functions interact cohesively to enhance consumer experiences. The set goals guide the use of modern digital tools, which, through appropriate implementation mechanisms, achieve these goals, ultimately improving the overall

consumer experience. Critically, this cohesion must be understood through both the neoliberal lens— where each function expands consumer choice— and the Foucauldian lens— where these same functions constitute new forms of self-governance, urging practitioners to design empowerment mechanisms that are genuinely liberatory rather than merely disciplinary.

For instance, the goal of increasing transparency and security is achieved through blockchain technology. This technology provides a secure and transparent system for transactions, thereby boosting consumer trust. Implementation mechanisms include establishing security and legal standards to protect consumer information. The ultimate function of this technology is to enhance consumer experience and satisfaction.

In the context of personalized experiences, the goal is to create tailored interactions with consumers. This is achieved through tools like artificial intelligence and machine learning, which analyze user data and provide suitable recommendations. Implementation mechanisms involve real-time data collection and analysis, utilizing advanced algorithms to predict consumer needs and preferences. The function of this technology is to improve consumer decision-making processes and increase satisfaction.

Finally, new interactive and social experiences are realized through the Metaverse. This technology creates interactive virtual environments, allowing consumers to engage with others virtually and enjoy immersive experiences. Implementation mechanisms include developing technical infrastructure to support virtual environments and providing educational tools to help consumers use these technologies. The function of this technology is to enhance social interactions and improve the overall consumer experience.

This research highlights a novel perspective on consumer empowerment, emphasizing its critical role in the presence of modern digital technologies. The study underscores the increased significance and necessity of consumer empowerment for organizations, attributing it to enhanced trust and long-term growth. By addressing previous barriers and disadvantages, the research aims to fill existing gaps and assist company managers and policymakers in developing more effective strategies for consumer empowerment. This study not only addresses research voids but also provides actionable insights for strategic planning.

5.2. Research limitations

In this research, a comprehensive framework has been presented, though it acknowledges inherent limitations. First, the study utilized only Scopus and WoS databases for article collection. While these databases enhance research validity, they exclude articles outside these repositories. Future researchers should explore additional databases to

ensure a broader scope. Secondly, the study focused solely on English-language articles. Despite the novelty of the topic and the absence of relevant Persian-language research, investigating sources in other languages could offer diverse perspectives and enrich the findings. Methodologically, qualitative approaches like thematic analysis may introduce subjective interpretations and potential errors. Future research should consider these limitations and incorporate a wider range of sources and databases to achieve more accurate and comprehensive results, thereby enhancing consumer empowerment models and related topics.

5.3. Future research implications

While this study presents a comprehensive roadmap for consumer empowerment through digital technologies based on a systematic review, several critical avenues for future research emerge. First, as the current proposed framework is derived from qualitative metasynthesis, future research should empirically validate this roadmap. Researchers are encouraged to employ quantitative methods, such as structural equation modeling (SEM) or experimental designs, to test the precise impact of specific digital technologies (e.g., Artificial Intelligence, VR/AR, and Blockchain) on both the behavioral and psychological dimensions of empowerment. Second, future studies should explore the "dark side" of digital empowerment. This includes investigating how challenges like data privacy risks, algorithmic bias in personalized marketing, and digital fatigue might paradoxically constrain consumer empowerment. Finally, since consumer interactions with digital technologies are highly context-dependent, future research should examine cross-cultural and demographic differences to determine how the proposed empowerment framework applies across varying global markets and distinct consumer segments.

6. Conclusion

This study addressed a critical void in the consumer behavior literature by developing the first integrated roadmap for consumer empowerment through modern digital technologies. Synthesizing 84 peer-reviewed studies via a PRISMA-guided systematic review, the analysis revealed that digital consumer empowerment is a dual-layered construct—simultaneously behavioral and psychological— whose dimensions are not merely parallel but mutually constitutive. Behavioral empowerment, operating through personalization, engagement, co-creation, and data-driven decision-making, cannot be sustained without the psychological foundation of trust, emotional connection, and perceived security; and conversely, psychological empowerment remains latent without behavioral affordances to actualize it. The roadmap's central theoretical contribution lies in resolving a long-standing conceptual tension in the empowerment literature. By

integrating the neoliberal framework's emphasis on choice and market sovereignty with the Foucauldian account of self-governance and power-knowledge relations, the study demonstrates that digital technologies do not simply serve one logic or the other— they instantiate both simultaneously. Personalized recommendations extend consumer agency in the neoliberal sense while constituting the consumer as a self-optimizing, algorithmically-governed subject in the Foucauldian sense.

Recognizing this dual operation is not a philosophical abstraction; it carries a direct design imperative: empowerment architectures must be deliberately constructed to amplify genuine autonomy rather than producing compliance under the appearance of freedom. The proposed roadmap— integrating objectives, tools, mechanisms, and functions— offers a coherent framework that transcends technology-specific analyses and provides a transferable logic applicable across sectors, market contexts, and consumer segments. As digital environments grow more immersive and algorithmically mediated, the distinction between technologies that genuinely empower and those that merely simulate empowerment will become the defining challenge for researchers, practitioners, and policymakers alike.

Conflict of interest

The authors declared no conflicts of interest.

Ethical considerations

The authors have completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc. This article was not authored by artificial intelligence.

Data availability

The dataset generated and analyzed during the current study is available from the author on reasonable request.

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Appendix

Table A1. The 84 studies that met all inclusion criteria following the systematic screening process

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
1	E1	Lampropoulos, G.; Reinhold, O.; Siakas, K. & Viana, J.	2022	Artificial intelligence, blockchain, big data analytics, machine learning and data mining in traditional CRM and social CRM: A critical review	*IEEE/WIC/ACM International Joint Conference on Web Intelligence and Intelligent Agent Technology (WI-IAT)*	https://doi.org/10.1109/WI-IAT55865.2022.00080
2	E2	Ledro, C.; Nosella, A. & Vinelli, A.	2022	Artificial intelligence in customer relationship management: Literature review and future research directions	*Journal of Business & Industrial Marketing*, 37(13), 48–63	https://doi.org/10.1108/JBIM-07-2021-0332
3	E3	Alimamy, S. & Nadeem, W.	2022	Is this real? Cocreation of value through authentic experiential augmented reality: The mediating effect of perceived ethics and customer engagement	*Information Technology & People*, 35(2), 577–599	https://doi.org/10.1108/ITP-07-2020-0455
4	E4	Sidaoui, K.; Jaakkola, M., & Burton, J.	2020	AI feel you: Customer experience assessment via chatbot interviews	*Journal of Service Management*, 31(4), 745–766	https://doi.org/10.1108/JOSM-11-2019-0341
5	E5	Chen, R.; Perry, P.; Boardman, R. & McCormick, H.	2021	Augmented reality in retail: A systematic review of research foci and future research agenda	*International Journal of Retail & Distribution Management*, 50(4), 498–518	https://doi.org/10.1108/IJRDM-11-2020-0472
6	E6	Jiménez-Barreto, J.; Rubio, N. & Molinillo, S.	2021	"Find a flight for me, Oscar!" Motivational customer experiences with chatbots	*International Journal of Contemporary Hospitality Management*, 33(11), 3860–3882	https://doi.org/10.1108/IJCHM-10-2020-1244
7	E7	Peltier, J.W.; Dahl, A.J. &	2024	Artificial intelligence in interactive marketing: A conceptual	*Journal of Research in Interactive Marketing*, 18(1), 54–90	https://doi.org/10.1108/JRIM-01-

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
		Schibrowsky, J.A.		framework and research agenda		2023-0030
8	E8	Chen, J. S.; Le, T.T. & Florence, D.	2021	Usability and responsiveness of artificial intelligence chatbot on online customer experience in e-retailing	*International Journal of Retail & Distribution Management*, 49(11), 1512–1531	https://doi.org/10.1108/IJRDM-08-2020-0312
9	E9	Christ-Brendemühl, S. & Schaarschmidt, M.	2022	Customer fairness perceptions in augmented reality-based online services	*Journal of Service Management*, 33(1), 9–32	https://doi.org/10.1108/JOSM-01-2021-0012
10	E10	Dogra, P.; Kaushik, A.K.; Kalia, P. & Kaushal, A.	2023	Influence of augmented reality on shopping behavior	*Management Decision*, 61(7), 2073–2098	https://doi.org/10.1108/MD-02-2022-0136
11	E11	El-Jarn, H. & Southern, G.	2020	Can co-creation in extended reality technologies facilitate the design process?	*Journal of Work-Applied Management*, 12(1), 28–45	https://doi.org/10.1108/JWAM-04-2020-0022
12	E12	Zhang, T.; Lu, C.; Torres, E. & Cobanoglu, C.	2020	Value co-creation and technological progression: A critical review	*European Business Review*, 32(4), 687–707	https://doi.org/10.1108/EBR-08-2019-0149
13	SC1	Kalaiyarasan, B.; Gurumoorthy, K. & Kamalakannan, A.	2023	AI-Driven Customer Relationship Management (CRM): A review of implementation strategies	*Proceedings of the International Conference on Computing Paradigms (ICCP2023)*	ISBN: 978-81-964545-7-9.
14	SC2	Sung, E.; Kwon, O. &	2023	NFT luxury brand marketing in the metaverse: Leveraging	*Psychology & Marketing*, 40(11), 2306–2325	https://doi.org/10.1002/mar.21854

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
		Sohn, K.		blockchain-certified NFTs to drive consumer behavior		
15	SC3	Awate, A.S. & Sharma, S.K.	2023	Understanding customer behaviour: A comprehensive survey of segmentation and classification techniques in the age of big data	*International Journal of Intelligent Systems and Applications in Engineering*, 11(7s), 486–514	https://doi.org/10.5281/zenodo.7891234
16	SC4	Choi, Y.; Nosrati, S.; Hailu, T.B. & Kim, S.S.	2023	Psychological dynamics in the metaverse: Evaluating perceived values, attitude, and behavioral intention in metaverse events	*Journal of Travel & Tourism Marketing*, 40(7), 602–618	https://doi.org/10.1080/10548408.2023.2276435
17	SI1	Sung, E. (C.); Bae, S.; Han, D. I.D. & Kwon, O.	2021	Consumer engagement via interactive artificial intelligence and mixed reality	*International Journal of Information Management*, 60, 102382	https://doi.org/10.1016/j.ijinfomgt.2021.102382
18	SI2	Poushneh, A. & Vasquez-Parraga, A.Z.	2017	Discernible impact of augmented reality on retail customer's experience, satisfaction and willingness to buy	*Journal of Retailing and Consumer Services*, 34, 229–234	https://doi.org/10.1016/j.jretconser.2016.10.005
19	SI3	Lee, M.; Lee, S.A.; Jeong, M. & Oh, H.	2020	Quality of virtual reality and its impacts on behavioral intention	*International Journal of Hospitality Management*, 90, 102595	https://doi.org/10.1016/j.ijhm.2020.102595
20	SI4	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
21	SI5	Kushwaha, A.K.; Kumar, P. & Kar, A.K.	2021	What impacts customer experience for B2B enterprises on using AI-enabled chatbots? Insights from Big data analytics	*Industrial Marketing Management*, 98, 207–221	https://doi.org/10.1016/j.indmarman.2021.08.011
22	SI6	Ameen, N.; Tarhini, A.; Reppel, A. &	2021	Customer experiences in the age of artificial intelligence	*Computers in Human Behavior*, 114, 106548	https://doi.org/10.1016/j.chb.2020.106548

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
		Anand, A.				
23	SI7	Qin, H.; Peak, D.A. & Prybutok, V.	2021	A virtual market in your pocket: How does mobile augmented reality (MAR) influence consumer decision making?	*Journal of Retailing and Consumer Services*, 58, 102337	https://doi.org/10.1016/j.jretconser.2020.102337
24	SI8	Hollebeek, L.D.; Clark, M.K.; Andreassen, T.W.; Sigurdsson, V. & Smith, D.	2020	Virtual reality through the customer journey: Framework and propositions	*Journal of Retailing and Consumer Services*, 55, 102056	https://doi.org/10.1016/j.jretconser.2020.102056
25	SI9	Jung, T.; Cho, J.; Han, D.I.D. et al.	2024	Metaverse for service industries: Future applications, opportunities, challenges and research directions	*Computers in Human Behavior*, 151, 108039	https://doi.org/10.1016/j.chb.2023.108039
26	SI10	Prentice, C. & Nguyen, M.	2020	Engaging and retaining customers with AI and employee service	*Journal of Retailing and Consumer Services*, 56, 102186	https://doi.org/10.1016/j.jretconser.2020.102186
27	SI11	Huang, D.; Chen, Q.; Huang, J.; Kong, S. & Li, Z.	2021	Customer-robot interactions: Understanding customer experience with service robots	*International Journal of Hospitality Management*, 99, 103078	https://doi.org/10.1016/j.ijhm.2021.103078
28	SI12	Hsu, S.H.Y.; Tsou, H.T. & Chen, J.S.	2021	"Yes, we do. Why not use augmented reality?" Customer responses to experiential presentations of AR-based applications	*Journal of Retailing and Consumer Services*, 62, 102649	https://doi.org/10.1016/j.jretconser.2021.102649
29	SI13	Jung, J.; Yu, J.; Seo, Y. & Ko,	2019	Consumer experiences of virtual reality: Insights from VR luxury	*Journal of Business Research*, 117, 508–520	https://doi.org/10.1016/j.jbusres.2019.

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
		E.		brand fashion shows		10.038
30	SI14	Carrozzi, A.; Chylinski, M.; Heller, J.; Hilken, T.; Keeling, D.I. & de Ruyter, K.	2019	What's mine is a hologram? How shared augmented reality augments psychological ownership	*Journal of Interactive Marketing*, 48, 71–88	https://doi.org/10.1016/j.intmar.2019.05.004
31	SI15	Golf-Papez, M.; Heller, J.; Hilken, T.; Chylinski, M.; de Ruyter, K.; Keeling, D.I. & Mahr, D.	2022	Embracing falsity through the metaverse: The case of synthetic customer experiences	*Business Horizons*, 65(6), 739–749	https://doi.org/10.1016/j.bushor.2022.07.007
32	SP1	Pierański, B. & Strykowski, S.	2017	Towards a personalized virtual customer experience	*Advances in Digital Marketing and eCommerce*, Springer, 185–198	https://doi.org/10.1007/978-3-319-56660-3_17
33	SP2	Neuhofer, B.; Magnus, B. & Celuch, K.	2020	The impact of artificial intelligence on event experiences: A scenario technique approach	*Electronic Markets*, 31(3), 601–617	https://doi.org/10.1007/s12525-020-00433-4
34	SP3	Hilken, T.; Keeling, D.I.; de Ruyter, K.; Mahr, D. & Chylinski, M.	2020	Seeing eye to eye: Social augmented reality and shared decision making in the marketplace	*Journal of the Academy of Marketing Science*, 48(2), 143–164	https://doi.org/10.1007/s11747-019-00688-0
35	SP4	Thorun, C. & Diels, J.	2019	Consumer_Tech: An investigation into the potentials of new digital technologies for consumer policy	*Journal of Consumer Policy*, 42(4), 1–17	https://doi.org/10.1007/s10603-019-09411-6
36	SP5	Arrighi, P.A. & Mougenot, C.	2016	Towards user empowerment in product design: A mixed reality	*Journal of Intelligent Manufacturing*, 30(3), 743–754	https://doi.org/10.1007/s10845-016-

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
				tool for interactive virtual prototyping		1276-0
37	SP6	Morotti, E.; Stacchio, L.; Donatiello, L.; Roccetti, M.; Tarabelli, J. & Marfia, G.	2022	Exploiting fashion x-commerce through the empowerment of voice in the fashion virtual reality arena	*Virtual Reality*, 26(3), 871–884	https://doi.org/10.1007/s10055-021-00602-6
38	SP7	Liu-Thompkins, Y.; Okazaki, S. & Li, H.	2022	Artificial empathy in marketing interactions: Bridging the human-AI gap in affective and social customer experience	*Journal of the Academy of Marketing Science*, 50(6), 1198–1218	https://doi.org/10.1007/s11747-022-00892-5
39	SP8	Hilken, T.; de Ruyter, K.; Chylinski, M.; Mahr, D. & Keeling, D.I.	2017	Augmenting the eye of the beholder: Exploring the strategic potential of augmented reality to enhance online service experiences	*Journal of the Academy of Marketing Science*, 45(6), 884–905	https://doi.org/10.1007/s11747-017-0541-x
40	W1	Holopainen, J.M.; Mattila, O.P.A.; Pöyry, E.; Parvinen, P.M.T. & Seppälä, K.	2018	Employing mixed reality applications: Customer experience perspective	*Proceedings of HICSS 2018*, 1168–1176	https://doi.org/10.24251/HICSS.2018.145
41	W2	Dampage, U.; Egodagamage, D.A.; Waidyaratne, A.U.; Dissanayaka,	2021	Spatial augmented reality based customer satisfaction enhancement and monitoring system	*IEEE Access*, 9, 97990–98004	https://doi.org/10.1109/ACCESS.2021.3093829

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
		D.A.W. & Senarathne, A.G.N.M.				
42	W3	Kazmi, S.H.A.; Ahmed, R.R.; Soomro, K.A. et al.	2021	Role of augmented reality in changing consumer behavior and decision making: Case of Pakistan	*Sustainability*, 13(24), 14064	https://doi.org/10.3390/su132414064
43	W4	Peštek, A. & Osmanović, A.	2022	Systematic mapping study: Application of augmented reality in marketing	*Ekonomski vjesnik/Econviews*, 35(2), 399–416	https://doi.org/10.51680/ev.35.2.12
44	W5	Bajpai, A. & Islam, T.	2022	Impact of augmented reality marketing on customer engagement, behavior, loyalty, and buying decisions	*Cardiometry*, (23), 545–553	https://doi.org/10.18137/cardiometry.2022.23.545-553
45	W6	Moghaddasi, M.; Marín-Morales, J.; Khatri, J. et al.	2021	Recognition of customers' impulsivity from behavioral patterns in virtual reality	*Applied Sciences*, 11(10), 4399	https://doi.org/10.3390/app11104399
46	W7	Grzegorczyk, T.; Sliwinski, R. & Kaczmarek, J.	2019	Attractiveness of augmented reality to consumers	*Technology Analysis & Strategic Management*, 31(11), 1257–1269	https://doi.org/10.1080/09537325.2019.1603368
47	W8	Frank, D.A.; Peschel, A.O.; Otterbring, T.; DiPalma, J. & Steinmann, S.	2024	Does metaverse fidelity matter? Testing the impact of fidelity on consumer responses in virtual retail stores	*The International Review of Retail, Distribution and Consumer Research*, 34(2), 251–284	https://doi.org/10.1080/09593969.2024.2304810
48	W9	Deb, S.K.; Jain, R. & Deb, V.	2018	Artificial intelligence—Creating automated insights for customer relationship management	*Proceedings of the 2018 8th International Conference on Cloud Computing, Data Science &*	https://doi.org/10.1109/CONFLUENCE.2018.8442900

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
					Engineering (Confluence), IEEE, 758–764	
49	W10	Ping, N.L.; Hussin, A.R.C. & Ali, N. M.	2019	Constructs for artificial intelligence customer service in e-commerce	*2019 6th International Conference on Research and Innovation in Information Systems (ICRIIS)*, IEEE, 1–6	https://doi.org/10.1109/ICRIIS48246.2019.9073486
50	W11	Ameen, N.; Cheah, J.H. & Kumar, S.	2022	It's all part of the customer journey: The impact of augmented reality, chatbots, and social media on body image and self-esteem of Generation Z female consumers	*Psychology & Marketing*, 39(11), 2110–2129	https://doi.org/10.1002/mar.21715
51	W12	Prentice, C.; Lopes, S.D. & Wang, X.	2020	The impact of artificial intelligence and employee service quality on customer satisfaction and loyalty	*Journal of Hospitality Marketing & Management*, 29(7), 739–756	https://doi.org/10.1080/19368623.2020.1722304
52	W13	Chen, J.V.; Ha, Q.A. & Vu, M.T.	2022	The influences of virtual reality shopping characteristics on consumers' impulse buying behavior	*International Journal of Human-Computer Interaction*, 39(17), 3473–3491	https://doi.org/10.1080/10447318.2022.2098566
53	W14	Gregor, B. & Gotwald, B.	2021	Perception of artificial intelligence by customers of science centers	*Problemy Zarządzania – Management Issues*, 19(91), 29–38	https://doi.org/10.7172/1644-9584.91.2
54	W15	Hashem, T.; Allan, M.; Abu-Alsondos, I. & Shehadeh, M.	2023	Employing metaverse marketing through gaming and its impact on customer experience	*Quality-Access to Success*, 24(196), 193–206	https://doi.org/10.47750/QAS/24.196.25
55	W16	Brill, T.; Munoz, L. & Miller, R.	2019	Siri, Alexa, and other digital assistants: A study of customer satisfaction with artificial intelligence applications	*Journal of Marketing Management*, 35(15–16), 1401–1436	https://doi.org/10.1080/0267257X.2019.1687571

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
56	W17	Katicic, J.; Häfner, P. & Ovtcharova, J.	2015	Methodology for emotional assessment of product design by customers in virtual reality	*Presence: Teleoperators and Virtual Environments*, 24(1), 62–73	https://doi.org/10.1162/PRES_a_00215
57	W18	Gupta, A.; Toteja, R. & Gupta, Y.	2021	Exploratory analysis of factors influencing AI-enabled customer experience for e-commerce industry	*Bioscience Biotechnology Research Communications*, 14(05), 104–112	https://doi.org/10.21786/bbrc/14.5.25
58	W19	Sari, H. & Adinda, R.	2023	Examining customer experience in using a chatbot	*International Journal of Asian Business and Information Management*, 14(1), 1–16	https://doi.org/10.4018/IJABIM.322438
59	W20	Luo, X.; Tong, S.; Fang, Z. & Qu, Z.	2019	Frontiers: Machines vs. humans: The impact of artificial intelligence chatbot disclosure on customer purchases	*Marketing Science*, 38(6), 937–947	https://doi.org/10.1287/mksc.2019.1192
60	W21	Flavián, C.; Ibáñez-Sánchez, S. & Orús, C.	2019	Integrating virtual reality devices into the body: Effects of technological embodiment on customer engagement and behavioral intentions toward the destination	*Journal of Travel & Tourism Marketing*, 36(7), 847–863	https://doi.org/10.1080/10548408.2019.1618781
61	W22	Zhao, T.; Cui, J.; Hu, J.; Dai, Y. & Zhou, Y.	2022	Is artificial intelligence customer service satisfactory? Insights based on microblog data and user interviews	*Cyberpsychology, Behavior, and Social Networking*, 25(2), 110–117	https://doi.org/10.1089/cyber.2021.0155
62	W23	Tyan, I.; Yagüe, M.I. & Guevara-Plaza, A.	2020	Blockchain technology for smart tourism destinations	*Sustainability*, 12(22), 9715	https://doi.org/10.3390/su12229715
63	W24	Gursoy, D.; Lu, L.; Nunkoo, R. & Deng, D.	2023	Metaverse in services marketing: An overview and future research directions	*The Service Industries Journal*, 43(15–16), 1140–1172	https://doi.org/10.1080/02642069.2023.2252750

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
64	W25	Castillo, D.; Canhoto, A.I. & Said, E.	2020	The dark side of AI-powered service interactions: Exploring the process of co-destruction from the customer perspective	*The Service Industries Journal*, 41(13–14), 900–925	https://doi.org/10.1080/02642069.2020.1787993
65	W26	Shin, H.; Bunosso, I. & Levine, L.R.	2022	The influence of chatbot humour on consumer evaluations of services	*International Journal of Consumer Studies*, 47(2), 545–562	https://doi.org/10.1111/ijcs.12849
66	W27	Almarashda, H.A.H.A.; Baba, I.B.; Ramli, A.A. & Memon, A.H.	2022	User expectation and benefits of implementing artificial intelligence in the UAE energy sector	*Journal of Applied Engineering Sciences*, 12(1), 1–10	https://doi.org/10.2478/jaes-2022-0001
67	W28	Pan, Y.; Sinclair, D. & Mitchell, K.	2018	Empowerment and embodiment for collaborative mixed reality systems	*Computer Animation and Virtual Worlds*, 29(3–4), e1838	https://doi.org/10.1002/cav.1838
68	W29	Davidavičienė, V.; Raudeliūnienė, J. & Viršilaitė, R.	2021	Evaluation of user experience in augmented reality mobile applications	*Journal of Business Economics and Management*, 22(2), 467–481	https://doi.org/10.3846/jbem.2020.13999
69	W30	Pratticò, F.G. & Lamberti, F.	2020	Mixed-reality robotic games: Design guidelines for effective entertainment with consumer robots	*IEEE Consumer Electronics Magazine*, 10(1), 6–16	https://doi.org/10.1109/MCE.2020.2988578
70	W31	Damaševičius, R. & Zailskaitė-Jakštė, L.	2024	The rise of virtual influencers in the metaverse: A new era of customer engagement	In *Connecting with Consumers through Effective Personalization and Programmatic Advertising*, IGI Global, 221–242	https://doi.org/10.4018/978-1-6684-9146-1.ch012
71	W32	Zamarreño Aramendia,	2021	Digitalization of the wine tourism experience: A literature review	*Doxa Comunicación*, 33, 257–283	https://doi.org/10.31921/doxacom.n33

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
		G.; Cruz Ruíz, E. & Hernando Nieto, C.		and practical applications		a930
72	W33	Maeng, Y.; Lee, C.C. & Yun, H.	2023	Understanding antecedents that affect customer evaluations of head-mounted display VR devices through text mining and deep neural network	*Journal of Theoretical and Applied Electronic Commerce Research*, 18(3), 1238–1256	https://doi.org/10.3390/jtaer18030063
73	W34	Adikari, S.B.; Ganegoda, N.C.; Meegama, R.G.N. & Wanniarachchi, I.L.	2020	Applicability of a single depth sensor in real-time 3D clothes simulation: Augmented reality virtual dressing room using Kinect sensor	*Advances in Human-Computer Interaction*, 2020, 1314598	https://doi.org/10.1155/2020/1314598
74	W35	Huynh, B.; Ibrahim, A.; Chang, Y.S.; Höllerer, T. & O'Donovan, J.	2019	User perception of situated product recommendations in augmented reality	*International Journal of Semantic Computing*, 13(3), 289–310	https://doi.org/10.1142/S1793351X19400129
75	W36	Piotrowski, D. & Orzeszko, W.	2023	Artificial intelligence and customers' intention to use robo-advisory in banking services	*Equilibrium. Quarterly Journal of Economics and Economic Policy*, 18(4), 967–1007	https://doi.org/10.24136/eq.2023.031
76	W37	Romano, B.; Sands, S. & Pallant, J.I.	2020	Augmented reality and the customer journey: An exploratory study	*Australasian Marketing Journal*, 28(4), 191–199	https://doi.org/10.1016/j.ausmj.2020.06.010
77	W38	Glebova, E.; Book, R.; Su, Y.; Perić, M.	2023	Sports venue digital twin technology from a spectator virtual visiting perspective	*Frontiers in Sports and Active Living*, 5, 1289140	https://doi.org/10.3389/fspor.2023.1289140

No.	Code	Author(s)	Year	Title	Journal / Source	DOI/ URL
		& Heller, J.				
78	W39	Holz, H.F.; Becker, M.; Blut, M. & Paluch, S.	2024	Eliminating customer experience pain points in complex customer journeys through smart service solutions	*Psychology & Marketing*, 41(3), 592–609	https://doi.org/10.1002/mar.21938
79	W40	Tang, Y.M.; Lau, Y.Y. & Ho, U.L.	2023	Empowering digital marketing with interactive virtual reality (IVR) in interior design: Effects on customer satisfaction and behaviour intention	*Journal of Theoretical and Applied Electronic Commerce Research*, 18(2), 889–907	https://doi.org/10.3390/jtaer18020046
80	W41	Gazzola, P.; Colombo, G.; Pezzetti, R. & Nicolescu, L.	2017	Consumer empowerment in the digital economy: Availing sustainable purchasing decisions	*Sustainability*, 9(5), 693	https://doi.org/10.3390/su9050693
81	W42	Forgas-Coll, S.; Huertas-Garcia, R.; Andriella, A. & Alenyà, G.	2023	Social robot-delivered customer-facing services: An assessment of the experience	*The Service Industries Journal*, 43(3–4), 154–184	https://doi.org/10.1080/02642069.2022.2163995
82	W43	Kindylidi, I. & Cabral, T. S.	2021	Sustainability of AI: The case of provision of information to consumers	*Sustainability*, 13(21), 12064	https://doi.org/10.3390/su132112064
83	W44	Koolen, C.	2023	Consumer protection in the age of artificial intelligence: Breaking down the silo mentality between consumer, competition, and data	*European Review of Private Law*, 2–3(2023), 427–468	https://doi.org/10.54648/ERPL2023018
84	W45	Korte, A.; Tiberius, V. & Brem, A.	2021	Internet of Things (IoT) technology research in business and management literature: Results from a co-citation analysis	*Journal of Theoretical and Applied Electronic Commerce Research*, 16(6), 2073–2090	https://doi.org/10.3390/jtaer16060116

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