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An overview of the consumer-centric disruptive technology research: Insights from topic modelling and literature review

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Abstract

This review aims to assess the most prevalent disruptive technologies of the past decade and evaluate them from a dual perspective. This study utilises the technology life cycle framework to classify disruptive technologies into three phases, (i) emerging, (ii) industry, and (iii) customer-focused research outcomes. Subsequently, entities using six thematic categories via topic modelling are assessed to determine the research trajectory about customers, industries, and theory. The present study utilises the Latent Dirichlet Allocation framework for topic modelling, a quantitative tool that employs advanced statistical methodology to extract semantic knowledge from large text corpora. This approach offers a more comprehensive and insightful categorisation of information compared to traditional research review models such as archive review, meta-review analysis, and systematic literature review. After the review, over 750 articles were analysed and classified according to their unique themes and technological emphasis. The study suggests practical applications that could enhance industrial progress through disruptive technology. Furthermore, by identifying gaps, the authors suggest multiple research prospects for forthcoming investigations on disruptive technologies and their impact on consumer behaviour. This research is novel in various aspects. This research is by far the only research record in the last decade that provides a systematic literature review of disruptive technologies with an extensive focus on customers. Considering the methodological perspective, this research uses topic modelling as a new literature review model, enabling analysing more research outputs and yielding more valuable findings than traditional methodologies.

1 | INTRODUCTION

Companies have found it increasingly difficult to maintain profitability due to constantly changing consumer demands and emerging technologies. Success was formerly typically measured by production method and product cost. However, in today's business era, a company's success relies on its ability to adapt to disruptive technologies and customisation, which plays a vital role in its success or failure (Liu et al., 2022). As a complex and controversial field, Disruptive technologies can potentially revolutionise industries (Taeihagh et al., 2021). The COVID-19 pandemic proved how technological advancements allowed professionals to offer better care, leverage the Internet of Things (IoT) and 5G, and keep education standards high (Abdel-Basset et al., 2021; Love et al., 2020). Several newly developed technologies like machine learning or digital twin, along with other disruptive technologies like face and fingerprint recognition, have been critical in improving customer satisfaction and enabling managers to make informed decisions over the last few years (Ajibade & Mutula, 2020).

Understanding consumer behaviour is crucial for disruptive technologies, as innovative products can only be delivered when

customers' demands and preferences are known (Chen et al., 2018). Disruptive technologies such as online shopping, mobile banking, payment systems, and ridesharing have revolutionised industries by providing customers with convenience (Kim, Choi, & Li, 2021; Țoniș-Bucea-Manea & Blăjină, 2019). Customer segments vary in their adoption of these technologies (Yarimoglu & Binboga, 2018), which can result in challenges. Despite technology's potential for boosting profits, privacy and security issues and usability challenges may hinder success depending on customer preferences (Dhagarra et al., 2020). As an example of such failures, technologies like augmented reality (AR) glasses have failed to dominate the market due to privacy concerns and a need for consumer interest in different nations. At the same time, intelligent homes are still struggling due to customer concerns for security and privacy (Zhao et al., 2021).

Hence, grasping the psychology behind consumer purchasing patterns is pivotal in identifying market disparities and the technological advancements required to meet those demands (Cao, 2021). Interestingly, some disruptive technologies, such as fingerprint or face recognition, have become part and parcel of customers' lives. Nevertheless, others still need to be made clear to users whether they are being monitored or analysed by technologies prioritising industry over consumers (Bamakan et al., 2022). By identifying the most researched disruptive technologies in recent years, we need to know whether these innovations are being focused on in favour of businesses or consumers. To comprehend and categorise disruptive technologies effectively, scholars must assess the gap in knowledge regarding their impact on consumer behaviour-especially concerning new ventures like computer vision or edge computing. This research aims to bridge that gap by comprehensively analysing the status of disruptive technologies concerning their contribution to consumers and industry from 2012 to 2022. The authors seek to understand how scholars have focused on technologies in different areas. Therefore, we must classify research outputs in distinct and assess disruptive technologies to find the research direction on industry, consumers, or theory. In addition, insufficient evidence evaluates disruptive technologies together and assesses their maturity and contribution to the customer.

Using the technology life cycle model (hereafter TRIO), this research categorises disruptive technologies into three stages and then evaluates them based on six unique topic groupings through topic modelling. This method provides a more comprehensive and quantitative literature review by examining a broader corpus of documents than classic research reviews models such as archive review, meta-review analysis, and systematic literature review, offering insights into current standing and trends in this field. The results of this review provide benefits for future research efforts and insight into the potential impact of disruptive technologies on consumer behaviour, guiding organisations to develop innovative technologies that better align with consumers' needs and preferences. By highlighting the gaps in industry studies and emerging technology, this study also provides an opportunity for competitive advantage, driving long-term business growth and sustainability, which promises to unlock the potential of these technologies from various perspectives.

The results emphasise the necessity for further investigation of the effect of innovative technologies on consumer benefits and highlight gaps in disruptive technology investigation in different themes. It also shows the shift of scholars' attention over the last decade from articles focusing on consumer behaviour regarding disruptive technologies to industrial benefits. This research identifies present study limitations and lays the foundation for future customer-oriented research, providing valuable insights for academics and practitioners. Considering the swift development of technologies such as artificial intelligence (AI) in daily life, this research bridges an important gap in the current literature on disruptive technologies' effect on customer behaviour, comprehensively reviewing the potential merits of the most popular disruptive technologies. The discoveries from this research can assist in further developing innovative technologies that cater to consumers' needs and guide future research in this field.

2 | RESEARCH FRAMEWORK

Within disruptive technology research, various subcategories necessitate a comprehensive examination of scholarly publications to extract relevant information. Our study first entailed identifying the disruptive technology literature from the past decade, which was accomplished through systematic reviews, online libraries, and scholarly articles such as Dong et al. (2021), Cruz-Cárdenas et al. (2021), and Singh and Garg (2022). However, a complete and exhaustive catalogue of disruptive technology subcategories remains elusive. To overcome this, we expanded our search with databases like Statista, which led to valuable insights regarding the economic impact of these technologies (McKinsey, 2017). The effectiveness of a literature review hinges upon the research topic and objective (Kraus et al., 2021). For our study on consumer perception and technology interaction, we started with keyword searches like "consumer behaviour + disruptive technology" and "technology + consumer." After analysing about 1000 search results and primary sources, we generated a list of disruptive technologies in Table 1. Some technologies on the list were newly emerging or author-invented, making their presence in literature scant, leading to several iterations of the list.

We collected a decade of disruptive technology reviews from various domains, executing a triangular model derived from the technology life cycle (Barbieri et al., 2020) and the technology adoption curve (Dube & Gumbo, 2017). The technology adoption curve has four distinct phases. In the first phase, the focus is on disseminating complicated aspects of emerging technology. At the same time, consumer acceptance is contingent upon academia and industry collaboration to transition from early to mainstream markets (Park et al., 2021). Once the technology reaches the fourth stage, like fingerprint recognition, it becomes mature enough for widespread use by the industry and consumers (Fu et al., 2021). Technology progression leads to a saturated phase, where consumers have successfully adopted the technology (Kalthaus, 2020). In this study, we use an alternative model for technology adoption. Accordingly, when scholarly research identifies an emerging technology (emerging stage), it is evaluated by the industry.

TABLE 1 Top researched disruptive technologies (2012–2022).

Disruptive technology	Abv.	Disruptive technology	Abv.	Disruptive technology	Abv.
3D printing	3D	Digital currency	DC	NFT	NFT
5G and improved connectivity	5G	Drones	DD	Nanotechnology	NN
Autonomous vehicles	AA	Decision intelligence	DI	Online lodging	OL
AI and machine learning	AIL	Deep learning	DL	Predictive analysis	PA
Automated risk management	AM	Data mining	DM	Process mining	PM
Augmented reality	AR	Digital transformation	DT	Renewable Energies	RE
Automation and robotics	AUR	Digital twins	DTw	RFID	RF
Blockchain	BB	Edge computing	EC	Smart cities	SC
Big data	BD	Fog computing	FC	Sharing economy	SE
Chatbots and smart assistants	CA	Fingerprints	FF	Social media	SM
Crypto currency	CC	Facial recognition	FR	Smart retailing	SR
Cloud services	CS	IoT	IoT	Self-service Technology	ST
Computer vision	CV	NFC	NFC	Virtual reality	VR

TABLE 2 Records of individual disruptive technologies literature review.

Citation	Scope (year-articles)	Focus	Citation	Scope (year-articles)	Focus
(Taufik et al., 2021)	2015–2021 (24)	Virtual reality	(Attaran & Attaran, 2020)	2017–2020 (∼20)	5G, digital transformation
(Spanaki et al., 2021)	2012–2022 (50)	AI and machine learning	(Beniwal & Singhrova, 2022)	2011–2021 (∼2500)	IoT
(Casino et al., 2019)	2011–2019 (∼50)	Blockchain	(Hansen et al., 2020)	2000–2020 (15)	3D printing
(Verma et al., 2021)	1982–2020 (∼1500)	Smart retailing	(Zhao et al., 2022)	2000–2022 (113)	Robotics and automation
(Kraus et al., 2021)	2000–2021 (>100)	Digital transformation	(Taylor et al., 2020)	2008–2020 (∼100)	Crypto, cyber security
(Paliwal et al., 2020)	2015–2020 (∼200)	Blockchain	(Kalyani & Collier, 2021)	2015–2021 (∼50)	Cloud services, edge computing
(Radu, 2020)	2010–2020 (>100)	Smart cities	(Bertolini et al., 2021)	2000–2021 (>100)	AI and machine learning
(Aryal et al., 2018)	2010–2015 (>50)	Big data, IoT	(Ometov et al., 2022)	2017–2022 (∼20)	Fog, edge, and cloud computing
(Yigitcanlar et al., 2020)	2010–2020 (∼100)	AI and machine learning	(Xi & Hamari, 2021)	2010–2021 (72)	Virtual reality
(Ukobitz, 2020)	2000–2020(>100)	3D printing	(Perwej et al., 2021)	2010–2021 (∼30)	Cyber security
(Cheng et al., 2022)	2015–2022 (∼15)	Digital twin, 5G	(Kim, Laine, & Åhlund, 2021)	2001–2021 (23)	Augmented reality, IoT
(Manimuthu et al., 2019)	2000–2019 (∼30)	Crypto currency	(Marocco & Garofolo, 2021)	2011–2022 (70)	Digital transformation
(Tan & Sidhu, 2022)	2010–2022 (∼25)	RFID, IoT	(Al-Sai et al., 2020)	2007–2019 (16)	Big data
(Shiwen et al., 2021)	2012–2022 (∼20)	Self-service technology	(Boholm & Larsson, 2019)	2002–2018 (∼40)	Nanotechnology
(Ahmed et al., 2020)	2008–2020 (∼35)	Blockchain, smart cities	(Scavarelli et al., 2020)	2012–2021 (∼50)	Augmented reality, virtual reality

Once companies integrate it into their products (Industry stage), consumer barriers decrease as the technology approaches the saturation point over time (Customer stage).

Finally, it is worth noting that literature reviews in each domain (Table.2) provide insights into the current research focus. For instance, Verma et al. (2021) highlight the benefits of retail innovations in sales planning and customer satisfaction. Ometov et al. (2022) reveal that fog and edge computing technologies are relatively new and need more consumer awareness. We use the content in this literature review evidence and plot them to the triangular model.

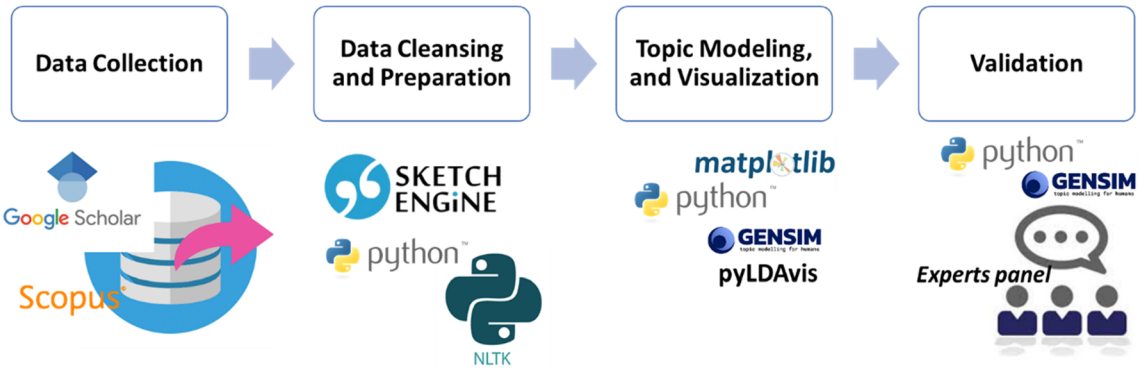

FIGURE 1 Research steps, employed approaches, applications, and libraries.

Combined with topic modelling themes, we seek to find the research direction and assess each technology individually in this research.

3 | METHODOLOGY

Through a captivating lens, Figure 1 unveils the crucial stages of the research methodology, fusing manual and automated processes to collect, refine, prepare, topic modelling, and data visualisation. A diverse mix of tools, programming languages, and libraries is mobilised to produce desired outcomes.

3.1 | Data collection

Based on Vrontis and Christofi's (2021) research guideline, this study examines the past 10 years' most impactful hot research contributions in disruptive technology. To collect literature, we searched well-known electronic databases such as ScienceDirect, Emerald, and Scopus. In addition, we analysed articles with related themes, even with non-matching keywords, to ensure comprehensive coverage of relevant publications. Keywords were generated to facilitate the literature review process and collect initial findings. To achieve optimal outcomes, non-academic sources, such as book chapters, editorials, and conference papers, were excluded from the analysis (Suchek et al., 2021). non-English articles were disregarded, even though they may have restricted interpretation scope (Christofi et al., 2021). The final dataset included all relevant publications related to disruptive technologies queried from the title, abstract, and keywords of papers published on Scopus, as shown in Table 1 (e.g., AI and machine learning technologies).

> TITLE-ABS-KEY (AI OR "Artificial Intelligence" OR "AI Technology" OR "ML" OR "Machine Learning" OR "ML Technology") AND TITLE-ABS-KEY ("Consumer Behavior" OR "Customer behaviour") AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j") OR LIMIT-TO (SRCTYPE, "p")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp"))

The primary objective during data collection was to gather important information, resulting in identifying 894 publications. However, after downloading and importing papers into Mendeley and compiling all the data in a Comma-Separated Values (.CSV) feature, some findings were excluded due to insufficient metadata or lower-tier publications. Hence, the final collection comprises 746 articles used for further analysis.

3.2 | Data cleansing and preparation

In previous studies, researchers used article abstracts for analysis which is a common approach (Evangelopoulos, 2015). Comprehensive abstracts summarise the essence of research papers and help identify research subjects quickly (Mortenson & Vidgen, 2016). Data cleansing includes multiple steps. First, keywords were standardised to eliminate duplicates, like "IoT" and "Internet of Things," and "CRM" and "Customer Relationship Management" were identified as synonyms. Second, multi-word terms were preserved by substituting spaces with underscores to retain the n-grams' significance in findings. The "terminology extraction, multi-word phrases" feature of SketchEngine was used to identify n-grams impartially. A visual examination of the resulting. CSV file showed a list of relevant multi-word phrases that merit preservation. Third, prevalent single words were retrieved using Sketchengine's "terminology extraction, single words" feature. Several terms, such as research, paper, purpose, target, and objective, were summarised for findings. Finally, the dataset was prepared for analysis by translating terms to singular forms, tokenising, lemmatising, and identifying synonyms using the Python Natural Language Toolkit (NLTK) package.

3.3 | Topic modelling and visualisation

The analysis of extensive textual data can be done through topic modelling, a quantitative tool that harnesses advanced statistical methodologies to derive semantic knowledge from large text corpora. Hofmann (2017) initially developed topic modelling with Probabilistic Latent Semantic Indexing (pLSI), and it has continuously been refined

TABLE 3 Topics with distribution in years.

Topics (% of corpus)	Top 20 contributing terms to the topic	Frequency (2012–2022)	Percentage (2012–2022)
Sustainability (15.8%)	User, acceptance, smart, vehicle, city, benefit, public, autonomous, application, development, renewable, trust, payment, people, energy, participant, risk, economy, automation, environment		
Smart economy (15.3%)	Service, satisfaction, change, intelligence, economy, artificial, platform, human, robot, knowledge, hotel, tool, provider, financial, interaction, characteristic, employee, manager, tourism, evaluation		
Iron triangle (11.7%)	Product, blockchain, management, process, cloud, application, design, food, strategy, cost, success, delivery, chain, quality, price, time, problem, solution, advantage, performance		
Consumer experience (17.1%)	Online, experience, brand, reality, retail, marketing, engagement, virtual, store, purchase, shop, device, retailer, augment, advance, restaurant, journey, perception, content, shopping		
Consumer behaviour prediction (17.9%)	Social, learn, market, machine, decision, commerce, predict, technique, network, prediction, preference, purchase, time, analytics, communication, real, sale, churn, learning, algorithm		
Consumer perception (22.2%)	Intention, perceive, acceptance, adoption, usefulness, mobile, attitude, bank, structural, trust, equation, ease, banking, behavioural, perceived, usage, risk, security, performance		

to enhance subject modelling algorithms (Vayansky & Kumar, 2020). Open-source and proprietary software options are available for topic modellings, such as Python's Gensim and Scikit-learn packages, R's tidytext, SAS Text Miner, and Leximancer (Mao, 2020). One sophisticated open-source Python toolkit for Topic modelling is Gensim, designed by Rehurek and Sojka (2010), which uses data streaming and incremental techniques to extract semantic themes. This toolkit includes methods such as Latent Dirichlet Allocation (LDA), Random Projection (RP), Latent Semantic Analysis (LSA), Term Frequency-Inverse Document Frequency (TF-IDF), Hierarchical Dirichlet Processes (HDPs), Latent Semantic Indexing (LSI), Singular Value Decomposition (SVD) topic modelling (Albalawi et al., 2017). The study used Gensim's LdaModel for topic modelling and created visualisations using "ggplot2," "matplotlib," and "pyLDAvis" libraries. The research followed Griffiths and Steyvers' (2004) recommendation to determine the optimal topic count and tested six scenarios utilising Gibbs sampling with T from 5 to 15 and 1000 iterations. Table 3 presents the main 20 keywords for each topic and the order of papers by year of publication. The findings of topic six, which centres on customers' perceptions regarding disruptive technologies, are depicted in Figure 2.

3.4 | Validation

To test the relevance and effectiveness of the topics (outperforming the earlier reported levels of complexity), we utilised the Python library Gensim with six topics. A comparison of the results with another prominent algorithm, Scikit, did not reveal better results, as the insights gained from Gensim were more comprehensible thanks to the highest expressions gleaned from this method. Moreover, validation was sought from a panel of three academic experts and two industry insiders, each with over 5 years of experience in consumer behaviour. The goal was to confirm the relevance and practicality of the proposed topics. Unanimously, the experts acknowledged that the themes covered critical aspects of consumer behaviour.

4 | TOPICS INTERPRETATION

Using topic modelling leads to identifying the most significant factors that contribute to specific industrial verticals or consumer characteristics. These must be translated into coded and labelled entities to appropriately represent each domain's constituents (Grisales et al., 2023). Table 4 presents the line-up of themes alongside their corresponding keyword encoding.

4.1 | Sustainability

Maintaining sustainability is paramount in an era of rapid technological advancements. Sustainability aims to balance economic growth (A_{18}), environmental protection (A_{20}), and social well-being (A_7)—all essential components of human progress—without jeopardising prospects (Govindan et al., 2021). Disruptive technologies like smart cities

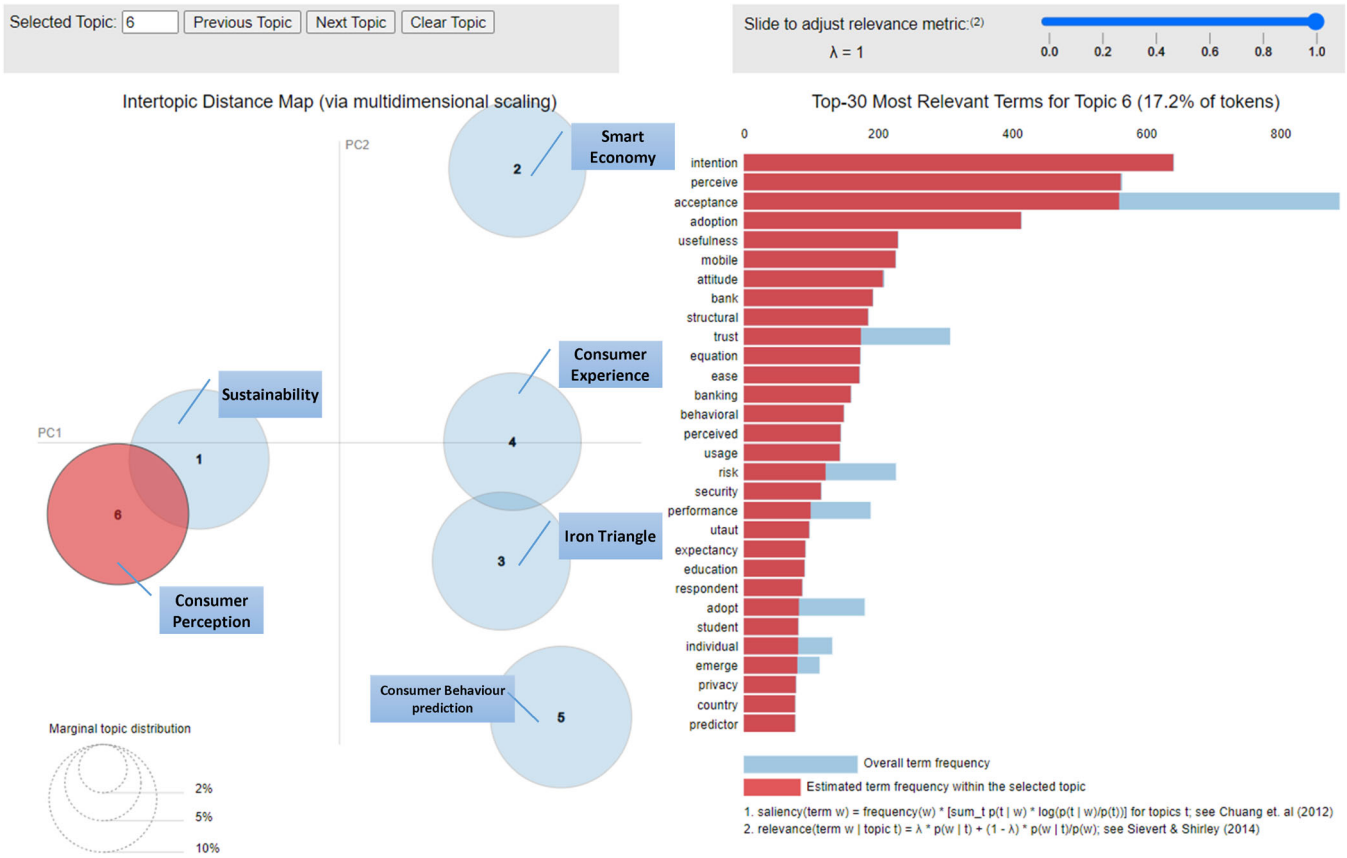

FIGURE 2 Interactive LDAVis presentation of topics (topic 6: Consumer's Perception).

(A_5, A_3) exemplify the essence of sustainability by reducing risks (A_{17}) and promoting efficient resource allocation and energy management (Shruti et al., 2020). However, the successful adoption of innovative technologies depends on consumer trust (A_{12}) and acceptance (A_2) (Papoutsi & Sodhi, 2020). This study highlights sustainability's pivotal role in disruptive technologies and illustrates the intricacies and opportunities of a sustainable approach to innovation through topic modelling.

4.2 | Smart economy

Globalisation has given rise to the concept of a "smart economy", a crucial tool for navigating the disruptive technologies prevailing across various industries. By transforming (B_3) economies (B_5) into knowledge-intensive environments (B_{10}) powered by innovation and technological advancements, nations can significantly enhance the overall quality of their citizen's life (Popova & Popovs, 2022). The financial activities and services (B_1) that drive consumer behaviour (B_2) can be better understood through this transformation. Disruptive technologies such as AI and robotics have impacted multiple aspects of industries, making a notable contribution to the tourism (B_{19}) sector through platforms like Airbnb and Tripadvisor, which have diversified options, providing greater convenience to users (Indrawati et al., 2018; Purnomo et al., 2021). Adopting such cutting-edge technologies (B_{12}) benefits both marketing managers (B_{18}) and consumers (B_1) alike. They can optimise offers and services more effectively by harnessing data, ultimately boosting the smart economy (Fridayani & Rifaid, 2019).

4.3 | Iron triangle

Managers must focus on three critical aspects while developing (C_7) strategic plans (C_9): cost (C_{15}), time (C_{16}), and quality (C_{14}). Considering Huang and Chen (2020), these elements within the "Iron Triangle" framework ensure the best results in deploying disruptive technologies. This framework has a specific impact on supply chain innovations (C_{18}). For instance, technological solutions have empowered individuals in underdeveloped nations to access better quality (C_{19}) services and food, addressing pressing issues like hunger (C_8). While the indirect relationship between the "Iron Triangle" and consumer behaviour is apparent, these limitations eventually shape their choices and preferences, as outlined by Bronte-Stewart (2015).

4.4 | Consumer experience

Despite the seemingly unending growth of the digital landscape, many purchases still occur at brick-and-mortar stores (D_9). However, there

TABLE 4 Topics code list.

Code	Sustainability	Code	Smart economy	Code	Iron triangle	Code	Consumer experience	Code	Consumer behaviour prediction	Code	Consumer perception
A1	User	B1	Service	C1	Product	D1	Online	E1	Social	F1	Intention
A2	Acceptance	B2	Satisfaction	C2	Blockchain	D2	Experience	E2	Learn	F2	Perceive
A3	Smart	B3	Change	C3	Management	D3	Brand	E3	Market	F3	Acceptance
A4	Vehicle	B4	Intelligence	C4	Process	D4	Reality	E4	Machine	F4	Adoption
A5	City	B5	Economy	C5	Cloud	D5	Retail	E5	Decision	F5	Usefulness
A6	Benefit	B6	Artificial	C6	Application	D6	Marketing	E6	Commerce	F6	Mobile
A7	Public	B7	Platform	C7	Design	D7	Engagement	E7	Predict	F7	Attitude
A8	Autonomous	B8	Human	C8	Food	D8	Virtual	E8	Technique	F8	Bank
A9	Application	B9	Robot	C9	Strategy	D9	Store	E9	Network	F9	Structural
A10	Development	B10	Knowledge	C10	Cost	D10	Purchase	E10	Prediction	F10	Trust
A11	Renewable	B11	Hotel	C11	Success	D11	Shop	E11	Preference	F11	Equation
A12	Trust	B12	Tool	C12	Delivery	D12	Device	E12	Purchase	F12	Ease
A13	Payment	B13	Provider	C13	Chain	D13	Retailer	E13	Time	F13	Banking
A14	People	B14	Financial	C14	Quality	D14	Augment	E14	Analytics	F14	Behavioural
A15	Energy	B15	Interaction	C15	Price	D15	Advance	E15	Communication	F15	Perceived
A16	Participant	B16	Characteristic	C16	Time	D16	Restaurant	E16	Real	F16	Usage
A17	Risk	B17	Employee	C17	Problem	D17	Journey	E17	Sale	F17	Risk
A18	Economy	B18	Manager	C18	Solution	D18	Perception	E18	Churn	F18	Security
A19	Automation	B19	Tourism	C19	Advantage	D19	Content	E19	Learning	F19	Performance
A20	Environment	B20	Evaluation	C20	Performance	D20	Shopping	E20	Algorithm	F20	UTAUT

has been a notable shift in brand strategy (D_3) due to the widespread usage of smartphones and the internet, which has resulted in the implementation of innovative online solutions (D_1) (Fan et al., 2020). These state-of-the-art online platforms offer many benefits, such as utilising cutting-edge virtual (D_8) and augmented reality (D_{14}) technologies. This assists customers in making well-informed purchasing decisions (Xia, 2021). Furthermore, marketing managers' meticulous analysis of a customer's purchasing journey (D_6) helps tailor promotional deals and discounts according to individual preferences (D_{17}). A symbiotic relationship exists between online platforms and consumer engagement (D_7). Customers are more inclined to share shoutouts (D_{19}) and brand information across social media platforms, playing a vital role in brand awareness and customer satisfaction (D_2).

4.5 | Consumer behaviour prediction

The swift progression of technology has led to deeper and more frequent interactions between consumers and industries (Kareena, 2019). Gaining insights into consumer learning (E_2) is fundamental to research and development across various sectors. By integrating chatbots within social media platforms (E_1), businesses can construct instantaneous communication channels (E_9) to engage directly with customers. This results in increased efficiency and cost-saving. To predict consumer behaviour, companies can utilise advanced, sophisticated algorithms (E_7), such as machine learning (E_{19}) and data mining (Lee et al., 2021). These models are invaluable for anticipating consumer churn (E_{18}) and guiding product development (E_5). Using cutting-edge behavioural prediction algorithms (E_{20}) enables businesses to better understand their customer's preferences and needs and, in turn, provide better service (Matar et al., 2020).

4.6 | Consumer perception

Consumers nowadays must embrace cutting-edge technology based on its effectiveness. Thus, innovative technology must satisfy the practical and compelling needs of consumers. Consequently, experts have devised theoretical frameworks, including the Unified Theory of Acceptance and Use of Technology (UTAUT) and Technology Acceptance Model (TAM), to comprehend consumers' reactions to novelty better (Zahra et al., 2019). Various factors influence how people perceive (F_{15}) new technologies, which can either help or hinder their adoption. For instance, people in developing nations may find mobile banking solutions (F_6, F_8) challenging to use and understand, whereas those in developed countries may have already embraced this technology (Chaudhary et al., 2021). Therefore, it is vital to thoroughly evaluate any risks (F_{17}) associated with introducing new technology and with having the necessary tools and strategies in place to encourage its adoption (F_4) (Barragán-Hernández et al., 2020).

5 | A DESCRIPTIVE REVIEW OF THE LITERATURE

This section provides an extensive analysis of topics resulting from topic modelling, covering the status of each associated technology within the delta framework obtained from the technology life cycle. We aim to ascertain the present state of these innovative technologies and their direct impact on customers. Such insights are of great significance to scholars, based on statistical, empirical research alongside expert opinions. These findings bring a more nuanced understanding of the subject matter, allowing researchers to allocate their attention wisely. Our approach seeks to improve the functionality of these innovations, making them more accessible and beneficial to the consumer market.

Figure 3, a Pareto chart with a cumulative curve, shows that academic focus on technological advances has been limited to a handful over the last decade. The diagram indicates that 80% of articles relate to just 17 of the 39 technologies discussed, effectively highlighting critical research areas. Four disruptive technologies, AI, Machine Learning, digital transformation, and social media, are at the forefront and outpacing their competitors. AR and VR are taking over the modern business and daily life in retail, entertainment, education, and healthcare, significantly impacting consumers. The chart reveals that emerging technologies such as fog computing, edge computing, or non-fungible token (NFT) have received inadequate scholarly attention.

Further research and in-depth discussion on these technologies are essential as they have the potential to influence consumer behaviour significantly. Interestingly, face recognition, a mature technology used in smartphones and home appliances, has been the second-least researched technology. It is unsurprising, as its development has stalled with little room for further research. This study establishes a foundation for identifying how disruptive technologies can shape and enhance consumers' daily lives by examining academic disparities in the spotlight on these technologies.

The last decade's disruptive technologies' research records' emergence, emphasis and societal impact can be seen in Figure 4 data. It uses the delta model to classify scholarly journals and highlight the ever-changing nature of technological advances. Each technology follows a standard development path, beginning with theoretical concepts, transitioning to empirical methods and industry applications, and finally implementing frameworks such as UTAUT or TAM for adoption (Robles-Gomez et al., 2021). Take virtual reality (VR), for example, which only began to take shape in 2018 but swiftly flourished into a practical tool used across various industries by 2020. Although radio frequency identification technology has been around for longer, privacy and security concerns, as mentioned by (Abdulghani et al., 2022), remain a hot topic of scholarly focus. Despite the decline in research on older technologies, the emphasis on customer behaviour in creating smart retailing, self-service technology, and smart cities has increased in the past 3 years, leading to more significant benefits for the end user. Meanwhile, on the lower end of the graph, technologies such as big data remain in a world of theoretical discussions with little to no relevance to the industry or customers.

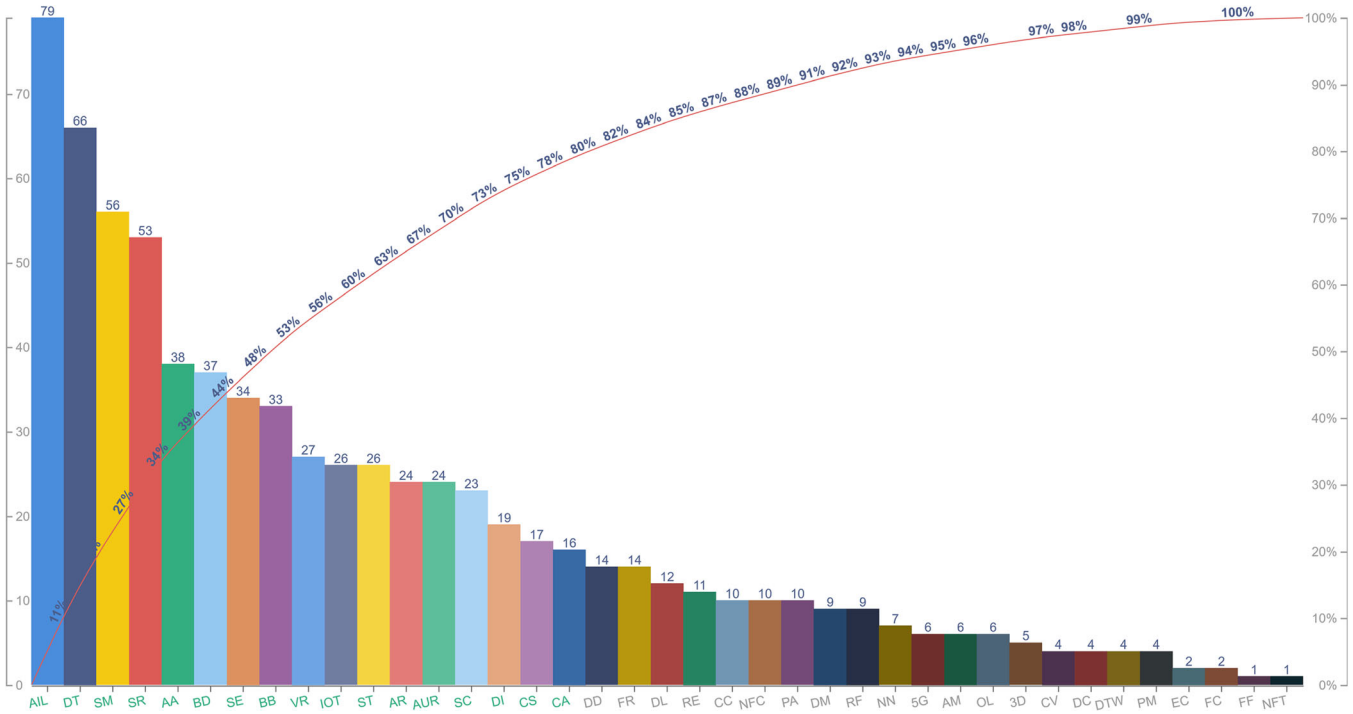

FIGURE 3 Customer-centred disruptive technologies distribution (2012–2022).

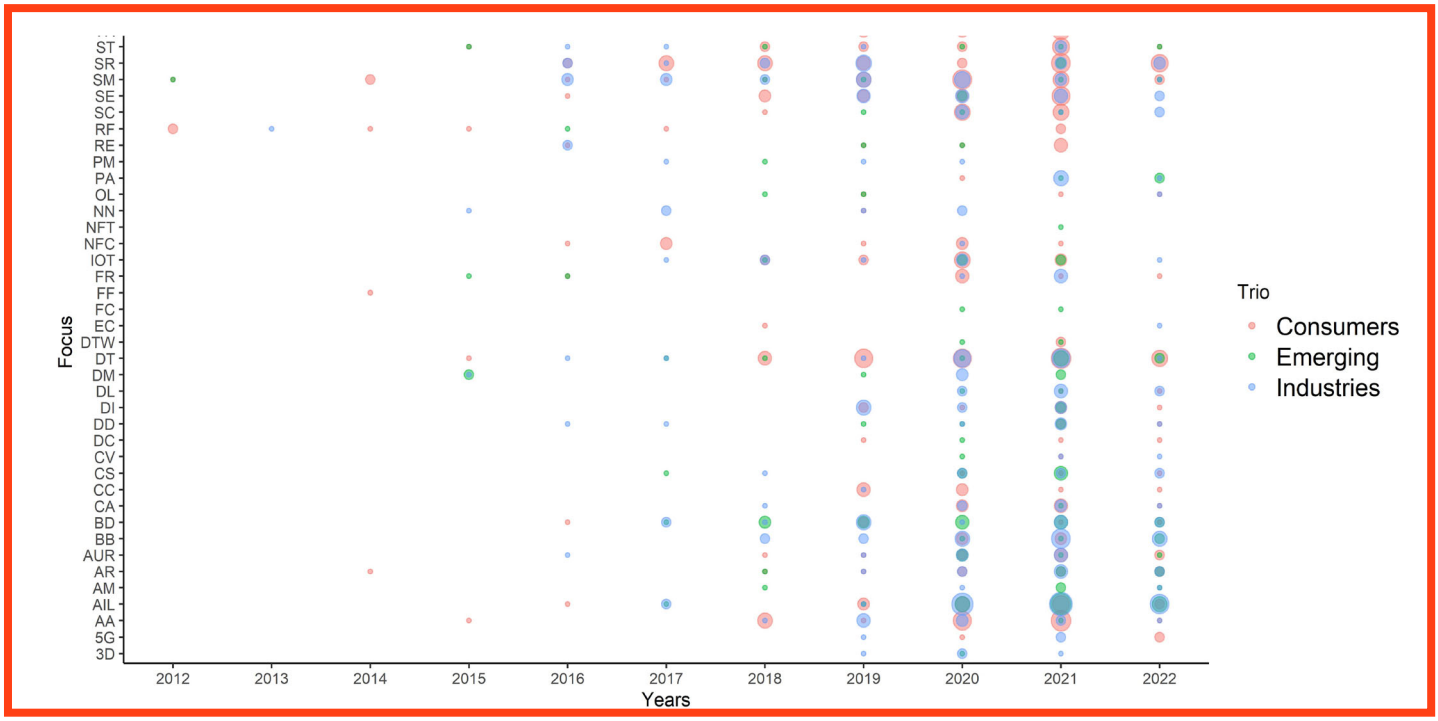

FIGURE 4 Last decade's disruptive technologies spread concerning the delta model.

This insightful overview of technological advancements offers numerous guidelines to researchers. They should pinpoint potential shortcomings linked to technologies' potential to boost customer experiences and devise empirical methodologies to implement them in developing nations. Additionally, they need to explore pathways that would facilitate the adoption of emerging technologies in various settings. Finally, diverse technologies increasingly adopted by industries present excellent opportunities for businesses worldwide to incorporate them into their operations, augmenting consumers' experiences and bolstering competitive efficacy.

Figure 5 illustrates the 15 foremost journals that centre on disruptive technologies in this corpus, their impact on various themes,

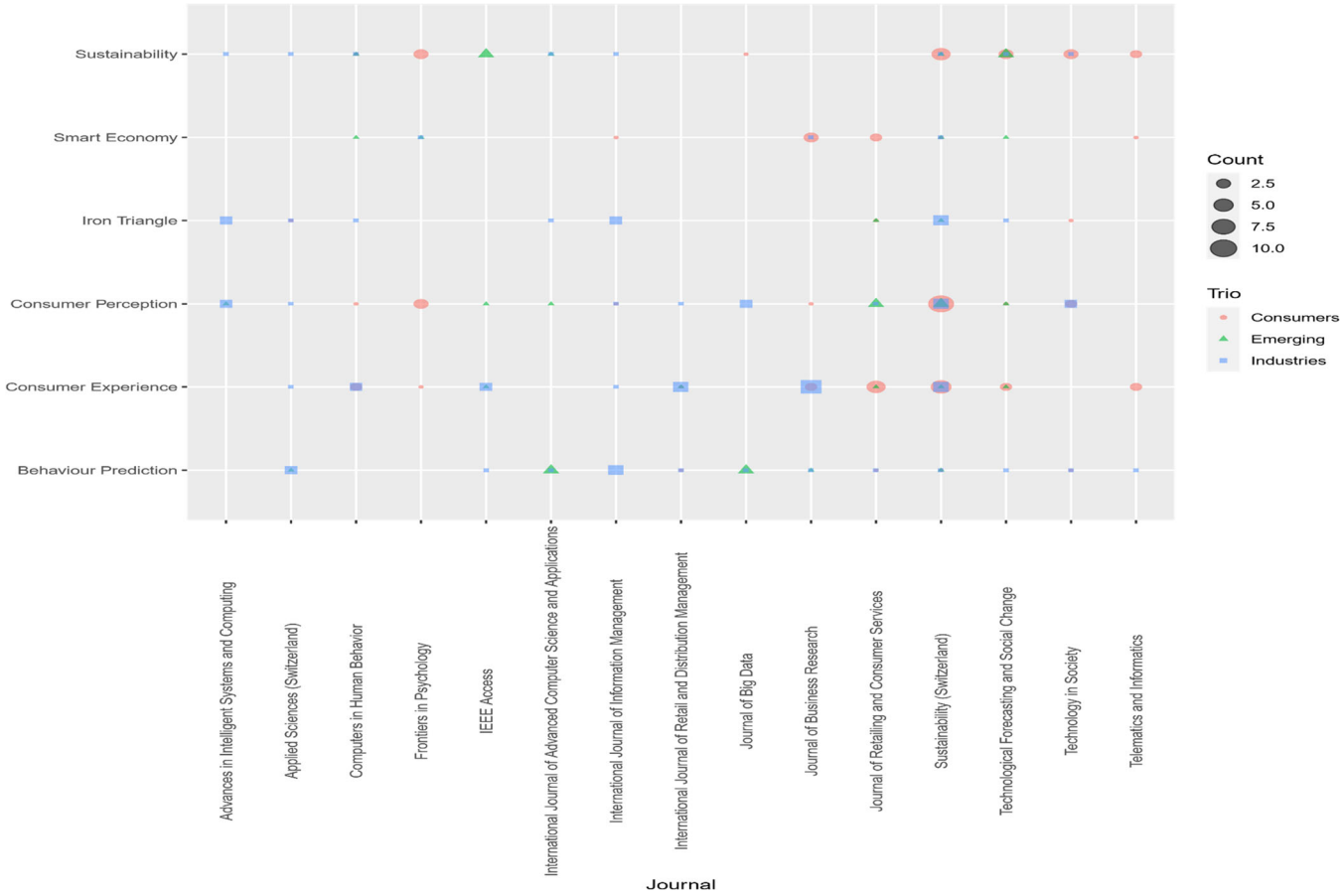

FIGURE 5 Top Journals contributed to the consumer-centric disruptive technologies (Topic-Trio).

and their corresponding areas of emphasis. The chart's Y axis is based on topic modelling themes, with the proposed inclusion of Trio technology life cycles represented through distinct shapes and colours to enhance comprehension. The dimensions of the shapes are contingent upon the proportionate magnitude of each journal's contribution to disruptive technologies during the preceding decade. Discussing the Y axis, the graph reveals that while topics like consumer behaviour prediction and iron triangle delve deeply into emerging and industrial aspects of technological assets, a fair balance between different technology life cycles can be observed in other themes, such as sustainability and the smart economy. Prominent journals, including the *Journal of Applied Sciences* and the *International Journal of Advanced Computer Science and Applications*, have highlighted emerging and industrial aspects instead of customer-focused solutions. On the contrary, the *Journal of Sustainability* and the *Journal of Retailing and Consumer Services* published many articles across various themes, making it the preeminent publication in this study. The journal has struck a good balance between discussing emerging and developing technologies, establishing itself as an influential figure in disruptive technologies research and impact analysis. The most common theme among all journals is consumer perception. However, consumer behaviour prediction and smart economy, which highly contributes to consumer attitudes, have received less attention over the last decade. This illustration shows that journals have different perspectives regarding their publication, which is prudent. Yet, some themes, like the iron triangle, need more attention in future. This allows scholars to focus on less focused themes and technologies corresponding to customer behaviour.

The national perspective on disruptive technologies is a critical point to address since it shows how different countries encourage their citizens to use these technologies in favour of their everyday life quality (Akpan et al., 2020). Industrialised countries like the United States, China, and South Korea have succeeded in equally contributing to six key themes, which showcase their strategic and comprehensive approaches to intellectual excellence. Developing nations, such as Iran and Sri Lanka, are taking a different route by prioritising the foundation of their industries and addressing issues like cost, time, and quality, which is evident in their focus on the "Iron Triangle." They can further expand and innovate by embracing this approach aligned with their developmental stage. On the other hand, some European countries like the Netherlands, Czech Republic, and the United Kingdom are committed to ensuring a sustainable future by focusing on Sustainability. Their responsible leadership in this area is commendable and essential in preserving the global environment. It's remarkable how nations like India and Malaysia are fostering disruptive technologies, especially surrounding the idea of "customer

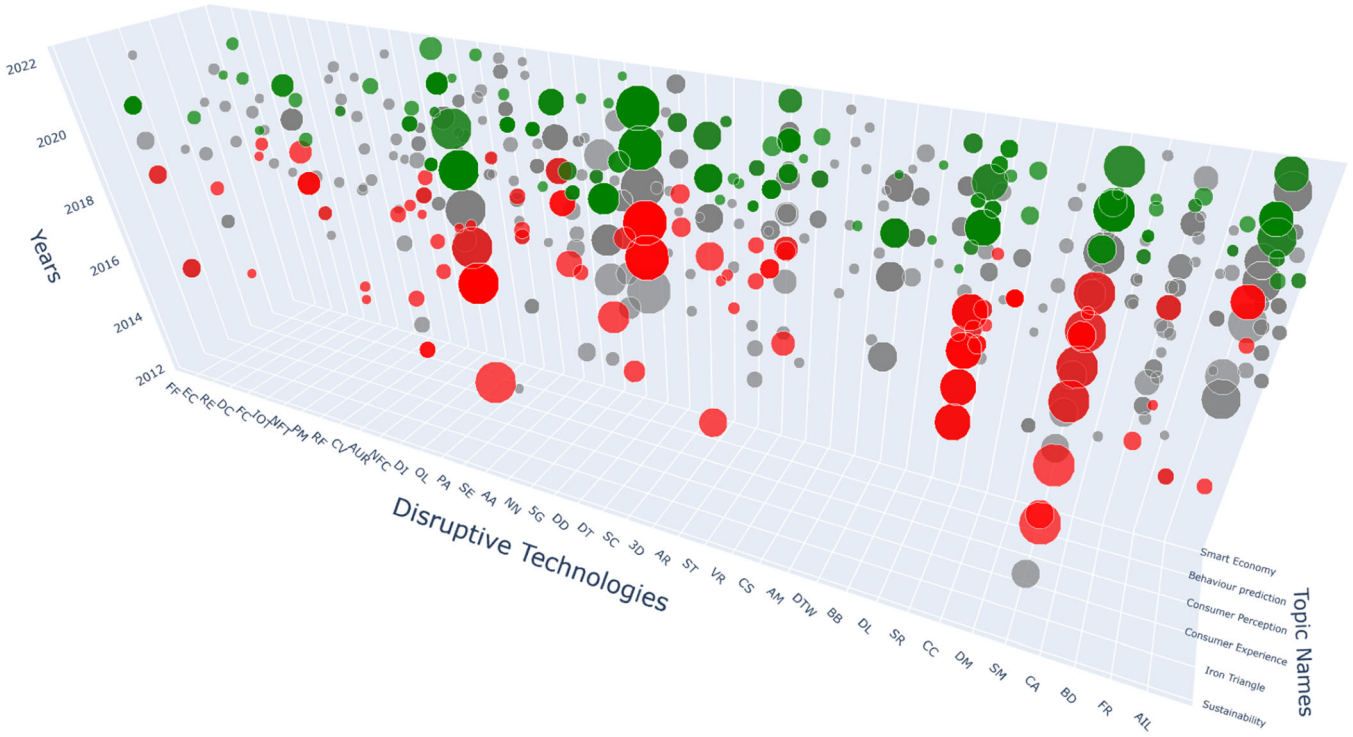

FIGURE 6 Overview of the last decade's disruptive technologies spread (Green: recent consumer-centric articles | Red: before 2018 | Grey: industrious or emerging).

perception." Their progress indicates a shift in the global economy towards innovation. Data suggests that "Customer Perception" has received the most interest worldwide. This highlights the significance of identifying and satisfying customer requirements, driving innovation, and creating a competitive global market.

Figure 6 provides an extensive overview of this research findings. In this graph, the X-axis demonstrates the list of disruptive technologies we attained from Table 1. Additionally, the Y- and Z-axis shows the topic themes we achieved through topic modelling and publication years, respectively. The bubble size is determined by the count of publications from the interaction of each technology and their related topic. The difference in bubble colour is based on their historical records (i.e., recent customer-focused articles in green and older publication records in red). Accordingly, the grey bubbles represent the emerging and industrial-focused publications which is not our focus in this research. For specific technologies, namely autonomous vehicles, smart retailing, and digital transformation, especially in finance, the trend over the year has been kept with many publications focusing on customer behaviour. Conversely, some technologies, such as nanotechnology and fingerprinting, once hot topics, have received low attention in the last 4 years. Accordingly, due to their characteristics or current state of emergence, several disruptive technologies are stuck in the emerging and industrial phase and were given nadir attention concerning customer benefits. These advancements, including data mining and risk management, are subject to more research attempts in favour of consumers' benefits. On the other hand, this graph depicts that digital currencies, deep learning and augmented reality are among the trend technologies that have been given attention to consumer benefits in the last 4 years. These gaps and hot topics will help address future research direction.

Unsurprisingly, by looking at this graph from the topic names angle, the consumer perception theme has the highest number of publications focusing on consumers. Nonetheless, the iron triangle and behaviour prediction were given the least attention in the last decade. Even though technologies such as big data and machine learning are highly beneficial for their industrial use in addressing problems, we suggest future research takes the potential of these tools to aid consumers directly as well.

6 | IMPLICATION AND DISCUSSION

This section builds on earlier results to identify gaps in our understanding and suggest future studies by proposing the theoretical and practical implications of the six themes based on the list of technologies and codes assigned to each theme in Table 4. Understanding the significance of each theme and how they relate to the overall research topic is essential. By exploring each theme in depth, future studies can better comprehend the factors contributing to the technologies' influence on customers from different viewpoints. Additionally, it provides insights into how these technologies can be improved and applied in favour of customers or industries by examining the codes associated with each theme.

6.1 | Sustainability

Smart cities (A_5, A_3) were highlighted as a solution and technology for sustainability. Most technologies in this area are customer-centric, as shown in Figure 6. This paradigm calls for public participation in urban planning (A_{14}), which has been called for earlier by (Nieminen et al., 2020). Future research should encourage the incorporation of less-studied disruptive technologies in income distribution and their contribution to sustainable economic growth, as economic growth (A_{18}) is one of the critical determinants of sustainability. Customers need to be assessed for promoting economic growth using cryptocurrencies and blockchain technology. This area could also be investigated further for IoT-related technologies. Future research should concentrate on how technology can assist customers in enhancing their cultural beliefs besides economic growth. This type of research offers customers long-term cost savings and increases service accessibility (A_{20}). These findings also reveal a deficiency in evaluating the impact of disruptive technologies on social equity (A_7). Since we could not locate sufficient documentation on how technological innovations can address ethical concerns in developing nations, Future research is encouraged to highlight the knowledge and culture of sustainability for customers. As a pivotal part of a sustainable nation, scholars need to investigate the function of AI in optimising resource allocation, which leads to waste management. Customers' willingness to use energy preserving through AI and smart homes should be evaluated since this could help nations to save energy resources for specific conditions. Such studies will also aid industries in creating environmentally friendly products and repurposing resources.

6.2 | Smart economy

Customers and industries will benefit from productivity improvements by leveraging disruptive technologies in the modern economy. This study includes several case studies demonstrating the significance of technology in achieving automation and data-driven decision-making, which is the main essence of a smart economy. Yet, we must broaden our understanding of whether disruptive technologies such as Blockchain or AI can alter buyers' perspectives (B_3). Future studies need to assess whether using AI and machine learning in different sectors, such as healthcare or transportation, would make a difference in customer behaviour. Customers' greater understanding of technology allows businesses to be more innovative and provide superior service. Investigating how knowledge-intensive environments (B_{10}) affect customer purchase decisions is essential. Future research is encouraged to analyse this using big data (B_{12}) and data science (B_{10}). Scholars can leverage data analytics (B_1) to customise customer services and optimise supply chain management in various industries using technologies such as IoT. As one of the least contributed topics in this theme, the potential of 5G and advanced communication services in enhancing the business models needs to be assessed.

6.3 | Iron triangle

This theme has made a significant contribution to developing nations. Most research outputs are produced in either a theoretical or industrial context. Unsurprisingly, only some customer-relevant records exist for most of these technologies. It is highly recommended that IoT and blockchain, as two efficient disruptive technologies in resource management (Xu et al., 2020), be assessed for terms such as the classic term "Investor's dilemma" proposed by (Birnbaum et al., 2005) in value creation for investment in rapidly growing advancements. Additionally, additional research on time reduction (C_{16}) is necessary. This includes investigating machine learning's potential for enhancing decision-making and using drones and VR in supply chain management (C_{19}). The industry must continue researching IoT to improve manufacturing efficiency and customer satisfaction. This is essential in the food industry (C_8), where technology can make the transition to sustainable food production more efficient. Leveraging technology in this theme will benefit the industry and customers by lowering the risk of investment and resource use.

6.4 | Consumer experience

According to our research results, most records in this category focused on smart retailing and VR (D_{14}) to enhance the customer experience in various situations. It also demonstrates how machine learning is gaining the interest of scholars. All the records are still in the theoretical stage. Future research should evaluate this topic concerning technologies that enhance customer perception in physical (D_9) and online (D_1) stores. Due to the preponderance of retail-related research, it is suggested that future studies investigate other sections, such as sharing economies, healthcare, and virtual tourism, to explore the obstacles that influence customer satisfaction (D_2). Big data, one of the most underutilised technologies in this space, can assist marketing managers in evaluating the buyer's journey (D_{17}). These strategies will empower industry decision-making, giving customers more personalised and enhanced offers.

6.5 | Consumer behaviour prediction and perception

Customer tracking after a purchase is crucial in determining whether a customer will remain loyal or churn from a service. Chatbots and machine learning are essential technologies for enhancing customer response (E_5), and future studies need to analyse the advantages and challenges of using such tools regarding customer satisfaction. Using these tools aids in comprehending (E_2) buyer engagement patterns and provides real-time responses. Machine learning (E_{19}), as a service that assists managers in learning customer behaviour and making optimised decisions for treating them, needs to be addressed further in investigating customer habits and real-time attitudes toward shopping. This theme has not yet addressed several technologies, including

NFT and digital twin. Analysing these algorithms (E_{20}) is suggested for researchers interested in personalised experiences and frictionless transactions. Future studies are encouraged to put the feedback and ratings from the sharing economy platforms in assessment using disruptive technologies to offer high-quality, customised services. Buyers in developing nations must be educated on realising the presence of technology and the fact that its company assists them in boosting their life quality.

In addition to these themes and the list of disruptive technologies provided in this review, the authors found a gap and necessity for further research evidence on other disruptive technologies that we could not link to this research due to the absence of research evidence relevant to customer benefits. For instance, quantum computing, one of the most advanced emerging disruptive technologies, which has recently been used in assessing the future of cryptocurrencies (Fernandez-Carames & Fraga-Lamas, 2020), can be used in future studies to address its potential use in shaping customer benefits. In addition, research records for specific technologies, such as the metaverse, could be more accurate. Hence, future research is suggested to find the potential of this advancement in tourism, branding and all other sectors beneficial for individuals.

7 | CONCLUSION

This review presents a quantitative literature review based on a novel systematic methodology to examine the past decade's most widely used disruptive technologies. The study's primary objective was to determine whether disruptive technologies could directly benefit consumers. Indeed, this work's worth can be assessed from various perspectives. First, a complete analysis of the published works over the past 10 years using topic modelling reveals little indication of a systematic review of disruptive technologies as a topic with numerous subfields. In other words, this research is new in applying many categories to collect and analyse a higher proportion of scholarly works. This grouping is advantageous since it highlights the focus on various technologies during the past decade. Second, this study's attempt to assess consumer-focused research outputs about disruptive technology makes it distinctive. The proposed delta model, impacted by the technological life cycle, was utilised successfully to classify titles into three identical categories. This method assisted us in demonstrating how the trend shifts toward a commercial rather than a consumer focus for certain disruptive technologies.

Like every research, this study has several limitations. First, we restricted our analysis to academic journals and collected data from a database library. As a result, we accept the possibility that some records will be missed. Chapter books and conference proceedings have also been excluded from the review, as qualified publications utterly find their way to be published in academic journals. However, future research may incorporate this information (especially from leading IS conferences such as ICIS and ECIS) and compare the results. Second, we only covered abstracts of the papers in our dataset, as in line with much prior research, abstracts are the most helpful source for the topic modelling purpose. Further, we did not compare the results, where the titles or keywords of papers are also included in the corpus. Then, it could be examined in future research. Third, the employed Gensim algorithm for topic modelling uses sampling to generate topics, meaning that every time, the algorithm creates a bit different distribution of top terms per topic and even a different optimum number of issues. To overcome this limitation, we set the random state at one and the iterations at 300, which fixed the optimum number of topics in different runs. Still, slight differences in the distributions of top terms in each run were observable. Fourth, we did not also aim to compare the results of the utilised Gensim algorithm with other algorithms, as algorithmic contributions and comparisons were not our concern. Nevertheless, for validation purposes, a quick comparison of Scikit with our employed Gensim algorithms revealed that the latter outperforms in terms of interpretability. This is also confirmed by the expert panel. Nevertheless, there is room for future research to use other algorithms, such as Structural Topic Modelling and Bi-term Topic Modelling and compare the results. Fifth, we combined topic modelling and literature review to understand the themes. This approach gave us an adequate understanding of themes. However, it could be more comprehensive regarding reproducibility, given the large corpus size. Future research is encouraged to use more advanced techniques such as text mining and combine findings with topic modelling to understand the revealed themes better.

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None.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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