

Internet of things and consumer engagement on retail: state-of-the-art and future directions

IoT and
consumer
engagement

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Abstract

Purpose – The growing complexity of consumer engagement (CE) due to the impact of Internet of things (IoT) has been attracting significant attention from both academics and industry practitioners especially in recent times. Hence, understanding this phenomenon remains very crucial to the body of knowledge. This study conducted a systematic review on IoT and CE with the aim of proposing future research opportunities using the TCCM model. **Design/methodology/approach** – Extant literature studies were systematically examined by sourcing high ranking ABS journals from EBSCO, ScienceDirect and Emerald. A total of 58 articles were included in the final analysis of this research.

Findings – The analysis established the need to conduct more research on CE due to the impact of new technological implementation in retail. The results further suggest the need for extensive research across African countries and emerging markets to enable broader empirical generalizations of research outcomes. Using the TCCM framework, the authors indicated directions for future empirical research.

Originality/value – This study exposes the current trends in CE and IoT. The results and analysis are both compelling and verifiable, hence, establishing a firm base of reference for future research in related fields.

Keywords Internet of things (IoT), Consumer engagement, Consumer behavior, New technologies, Consumer retention

Paper type Research paper

1. Introduction

The concept of Internet of things (IoT) has attracted a lot of attention, largely attributed to its importance due to its considerable internalization in our daily lives (Kotb and Adel, 2020). Its evolution in the retail space has been very intense due to its dynamic nature and further escalated thanks to the recent global pandemic (Kotb and Adel, 2020). Academic practitioners in recent times have highlighted several outlooks on the concept of IoT especially as it relates new technologies, virtual reality, augmented reality, IoT, artificial intelligence, robotics, drones and autonomous driving (Pillai *et al.*, 2020; Novak and Hoffman, 2019; Kamble *et al.*, 2019). Now, the concept of IoT is regarded as one of the highly rated technological and strategic innovations that are expected to create new business opportunities in the future (Fagerstrøm *et al.*, 2020). IoT expands the omnipresence of the Internet by incorporating interactions via embedded technologies with the aid of highly distributed networking devices, while communicating with humans (Woodside and Sood, 2017). The advancement in technology is also contributing to the diverse ways IoT improves lives through different application areas (Xia *et al.*, 2012).

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Consumer engagement (CE), on the other hand, has attracted considerable attention due to the dynamism in the academic, retail, business (Pansari and Kumar, 2017; Baldus *et al.*, 2015; Brodie *et al.*, 2013; Biro and Loureiro, 2020; Rosado-Pinto and Loureiro, 2020) and practitioners' landscape (Dessart *et al.*, 2016). With the advent of IoT, there has been significant shift from human-to-human interactions to human-to-machine or machine-to-machine interactions (Bulmer *et al.*, 2018; Cebeci *et al.*, 2020; Wang *et al.*, 2012). While some researchers identified that the best consumer experience can be generated through the combination of human and technology-based services (Parasuraman *et al.*, 2005; Reinders *et al.*, 2008, 2015), others call for future studies to empirically examine the implications of IoT for an improved CE (Nguyen and Simkin, 2017).

Hoyer *et al.* (2020) and Rust (2020) have also recently identified the need for further conduct empirical research to evaluate IoT and CE with retailers, service providers and brands considering interactions between machine-to-machine vis-à-vis human-to-human relationships in retail marketing. Recent reviews in marketing field presented by Valdez Cervantes and Franco (2020) analyzed retailing technology and the effects on shoppers' perceptions. Nguyen *et al.* (2018) also focused on consumer behavior and order fulfillment in online retailing. Further, academic research suggests that the phenomenon of CE co-creates services and influences consumer behavior (Deighton and Kornfeld, 2009). Our primary aim in this current paper is to conduct a systematic analysis on IoT and CE, focusing on proposing future research opportunities using the TCCM model.

We intend to achieve this by (1) conducting a critical overview of extant research on this topic; (2) synthesizing our findings into an integrative and multi-disciplinary framework and (3) highlighting some congruence and inconsistencies in previous studies and identify directions for future research. This study contributes to the body of knowledge by providing a better understanding on the relationship between IoT and CE and their importance for practitioners. This detailed and systematic review took into consideration recent publications in this field, as well as current development in the industry. Through this review, we are also able to provide better transparency for future research and by identifying contextual gaps.

The subsequent section of this paper is followed by a definition of IoT and CE to enhance concept clarity. Next, we present a thorough understanding of the systematic review methodology for this research. This is shortly preceded by an analysis of extant research. Following a structured categorization of our findings, we propose an integrative framework for positioning and informing future research agendas on IoT and CE before concluding the paper with limitations and directions for further study.

2. Methodology

IoT as a concept was first published by Kevin Ashton in 2009, where he described it as "adding radio frequency identification and other sensors to everyday objects" (Ashton, 2009, p. 1). This is a technology that enables spread of embedded network of intelligent and autonomous devices with the intention of scaling productivity, profitability and efficiency through the usage of big data (Kamble *et al.*, 2018). IoT is considered as "an open and comprehensive network of intelligent objects that have the capacity to auto-organize, share information, data and resources, reacting and acting in case of situations and changes in the environment" (Madakam *et al.*, 2015, p. 165).

CE is regarded by practitioners as "repeated interactions that strengthen the emotional, psychological or physical investment a customer has in a brand" (Sedley, 2010, p. 7). Academics view it as "intensity of customer participation with both representatives of the organization and with other customers in a collaborative knowledge exchange process" (Wagner and Ann, 2007, p. 20). Thus, it is the mechanism for value creation that improves the development of customer relationships (Brodie *et al.*, 2013). Brodie *et al.* (2011, p. 260) refer to CE as a psychological state that occurs by virtue of interactive, co-creative customer

experiences with a focal agent/object (e.g. a brand) in focal service relationships. CE centers on specific interactive consumer experiences. Based on the above analysis, Vivek *et al.* (2012) suggest CE as a central concept within the marketing system. To unify this approach, we adopted a systematic review methodology with the aim of identifying a comprehensive overview, identifying research gaps and future research direction (Denyer *et al.*, 2008; Macpherson and Jones, 2010; Tranfield *et al.*, 2003).

The systematic review process entails a methodological and comprehensive review of clearly identifying, selecting and appraising relevant research with an evaluation of findings for the study under review (De Menezes and Kelliher, 2011). The approach embodies a rigorous, transparent and replicable manner which leads to a holistic conclusion of discoveries of the topic under review (Tranfield *et al.*, 2003; Denyer and Tranfield, 2009; Atewologun *et al.*, 2017; Christofi *et al.*, 2017). This method applies a multiplicative and systematic procedure which eliminates bias based on rigorous literature searches (Tranfield *et al.*, 2003). All associated procedures and meta-analysis developed over the years currently plays an important role in evidence-based practices (Tranfield *et al.*, 2003).

The method is echoed to have several upsides over other traditional narratives and reviews, which primarily includes provision of collective insights through theoretical synthesis of findings, improving the rigorousness of the research and authenticates the reliability of the research (Tranfield *et al.*, 2003; Macpherson and Holt, 2007). This method is applied as being fully transparent and highly replicable from an academic point of view (Tranfield *et al.*, 2003; Crossan and Apaydin, 2010). For industry experts, this is a strong source of knowledge to generate reliable bank of information based on the assemblage of intelligence from the conducted studies. For practitioners, this method helps generate a reliable understanding station by the assemblage of knowledge from organization of studies. Hence, we consider the systematic review as the most soothing method to achieve holistic well-rounded research on IoT and CE.

3. Search protocol

3.1 Question formulation

One of the criteria for a successful systematic literature review is built on the premise of a clear research question at the commencement of the review process (Nguyen *et al.*, 2018). We took into consideration the interface between IoT and CE in retail in our review (McCausland, 2021). Guided by academic and industry practitioners, we choose to focus on these research questions: (1) How does IoT and new technologies influence CE in retailing sector? and (2) How does IoT and new technologies influence customer experience and customer emotions?

3.2 Inclusion criteria

Following Nguyen *et al.* (2018), we adopted similar techniques by locating references to ensure all available resources are taken into consideration. Electronic databases, peer review journals and applied snowballing methods were used. We restricted our electronic database search to EBSCO, ScienceDirect and Emerald and offline research restricted both to scholarly peer-reviewed articles and to the fields of marketing. The choice of these databases was based on their large coverage and frequency of usage for conducting high quality systematic review. We used Google Scholar to identify further studies (Blut and Wang, 2020a, b). To avoid missing any relevant literature, we decided not to limit the coverage period but opening it up until August 2021 which was the stop point of this study (Vrontis and Christofi, 2021).

3.3 Search strategy

We commenced our search strategy by evaluating the title and abstract of the database in use (Wang and Chugh, 2014). In line with Müller-Seitz (2012), we generated a list of keywords with a

broad coverage. We defined our search parameter into IoT and CE in retail. The search terms identified were the prevalent terms utilized in the literature to capture IoT and CEs in retail sector. We also used truncation to highlight all relevant literature studies that had similar search terms (Dada, 2018). We went as far as using the abbreviations of each of these search terms such as IoT and CE. We adopted the parameters as adopted by Vrontis and Christofi (2021) by using the group strings associated with Boolean and Operator to develop a combined search string. We finally used the search formular of Internet of things (OR IoT) AND consumer engagement in retail (OR CE). We generated a total of 3,835 articles in total in our initial search results.

We adopted the search criteria detailed in Keupp and Gassmann (2009), Keupp *et al.* (2012), by focusing on journals with high impact factors which buttresses the qualities of the articles. IoT and CE literature studies and Social Science Citation Index-listed journals with an annual impact factor of at least 1.0 were considered, while journals with lower impact factors were excluded from our review. This review can be regarded as a good representation of accumulated knowledge on the topic of IoT and CE within the period under review.

3.4 Exclusion criteria

We subjected the above data into further scrutiny to have focus on selected articles. We commenced by deleting duplicated literature studies generated across different database. Second, we limited our studies to only peer-reviewed academic journal that had full text ranked 2–4* in the Association of Business Schools (ABS) ranking 2021 based on quality of research in top tier ABS ranking journals Atewologun *et al.* (2017), Nguyen *et al.* (2018). We also watched out for previously published systematic reviews published in top-ranked and high impact reviews (e.g. Atewologun *et al.*, 2017; Franco-Santos and Otley, 2018). Third, we choose to review only literature studies published in English, despite, we believe it is justified to focus on common scientific knowledge base which the English language largely represent in the scientific field Follmer and Jones (2018). Furthermore, articles not based on IoT and CE, which is the pivot of this study, were excluded (e.g. they include articles on retail algorithm, search regrets and chat group characteristics). Articles with only reference to IoT but without focus on CE were also excluded. Then, we further excluded articles with contents that were not applicable to this current study despite their search terms being present. We finally arrived at a sample of 112 articles after applying all these exclusion criteria for this systematic review.

3.5 Selecting relevant studies

After applying the inclusion and exclusion criteria as referenced by Müller-Seitz (2012), Kauppi *et al.* (2018) and Vrontis and Christofi (2021), we succeeded in limiting the literature studies to 112. After the first rounds of review which consisted mainly of understudying the titles of the articles, examining the abstract and full text in some cases, at this stage, we were inclusive, general and focused less on whether the article was focusing on the topic or not. Our objective here was to identify all relevant literature studies that could discuss this topic. Hence, we only considered articles that improved the understanding of IoT and CE in this context yet included those in which the focus was on another topic, but that still shed light on the phenomenon in question. At the end of this exercise, we arrived at 93 articles.

At the second review stage, we adopted to read all the outstanding articles and implemented the coding method of Kauppi *et al.* (2013), by labeling all articles independently as green (accepted), yellow (possibly accepted) or red (rejected) – codes were then compared to check for inconsistencies. After the second review, we arrived at 76 relevant articles for the literature analysis.

We further consulted Google Scholar to identify any possible literature studies not currently considered under our review (Dada, 2018) to ensure we had considered all relevant literature studies. Additionally, we manually searched through references of some selected literature studies, as well as consulted academic experts to advise on relevant literature

studies for the purpose of having a thorough and representative study (Weibler, 2017; Nofal *et al.*, 2018). After applying the parameters of the inclusive, exclusive and quality criteria against all additional literature studies, we arrived at a total of 58 articles for this review. Figure 1 shows review process in stages.

3.6 Extraction, analysis and synthesis

Due to the high acceptance rate of content analysis as a powerful data reduction technique (Prasad, 2008; Stemler, 2001) for analyzing large bodies of text in academic reviews (Cetindamar *et al.*, 2009; Germain and Cummings, 2010; Sirola-Karvinen and Hyrkäs, 2006), we decided to adopt this approach to be consistent with previous researchers. Data extraction form was used to properly structure and document technical characteristics of each reviewed papers (e.g. type of paper, authors details, sample size and data collection). Subsequently, with the information retrieved through the data extraction form, we focused the rest of this

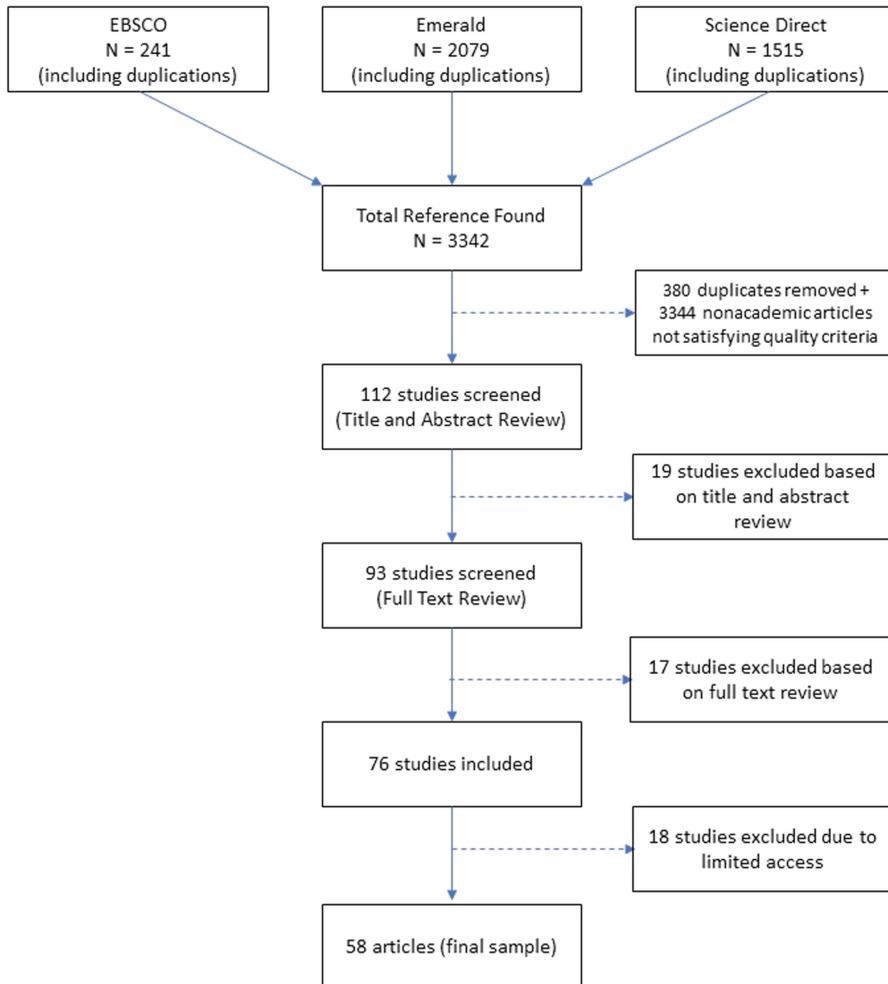


Figure 1.
Literature search
strategy

review to detailing the findings from the systematic analysis (Nguyen *et al.*, 2018). Thus, Section 4 is dedicated to the descriptive review of the literature, and Section 5 adopts the TCCM framework to explore the theoretical foundations, structure the gap analysis and propose future research directions.

4. Descriptive review of the literature

After reviewing the literature falling under the predefined parameters, we identified trends that are relevant to the impact of IoT on CE. This section is dedicated to reporting the findings which are structured based on topics like methods, research areas and recency among others. This will serve as a guide to gap identification for future research.

4.1 Year of publication, type of paper and methods employed

Table 1 shows an overview of selected articles in chronological order. This reflects relevant studies undertaken on this topic in the past 21 years (2000–2021). There was a noticeable increase in the numbers of publication in 2002, that is, 7% ($n = 4$), which was triggered by researchers' prediction on changes in the retail landscape in the next 10 years, with consumer expectations uncertain due to the innovations in the retail industry (Wood, 2002). There was also the need to understand the requirements of satisfying consumer experience due to the introduction of e-retailing (Szymanski and Hise, 2000). Additionally, we identified a further acceleration in the numbers of publications in the last 6 years (2016 and 2021), which accounted for 74% ($n = 43$) of the total publication under review. This is an indication of the transformation in the retail industry spurred by digitalization and IoT and a constant change in consumer requirements (Bhatti *et al.*, 2020).

Figure 2 further reflects the distribution of the publication according to the type of studies conducted. Empirical reviews accounted for the largest share of 57% ($n = 33$) followed by conceptual analysis 21% ($n = 12$). Meta-analysis and systematic reviews have been conducted in the past on similar subject (Blut and Wang, 2020a, b; Lamberton and Stephen, 2016). In our research, they accounted for a total of 4% ($n = 2$ that is, one each).

With reference to the methods used for our studies (Table 2), quantitative methods accounted for the highest share of 36% ($n = 21$), qualitative methods assumed 28% ($n = 16$), while mixed methods were only 7% ($n = 4$). Though the percentage of quantitative research was the largest, the share of descriptive and conceptual reviews from this analysis was quite

Year	No	Weight (%)
2000	1	2%
2002	4	7%
2004	1	2%
2009	1	2%
2010	2	3%
2011	2	3%
2012	2	3%
2013	2	3%
2014	2	3%
2016	2	3%
2017	2	3%
2018	2	3%
2019	2	3%
2020	2	3%
2021	2	3%
Total	58	50%

Table 1.
Weight of reviewed
publications

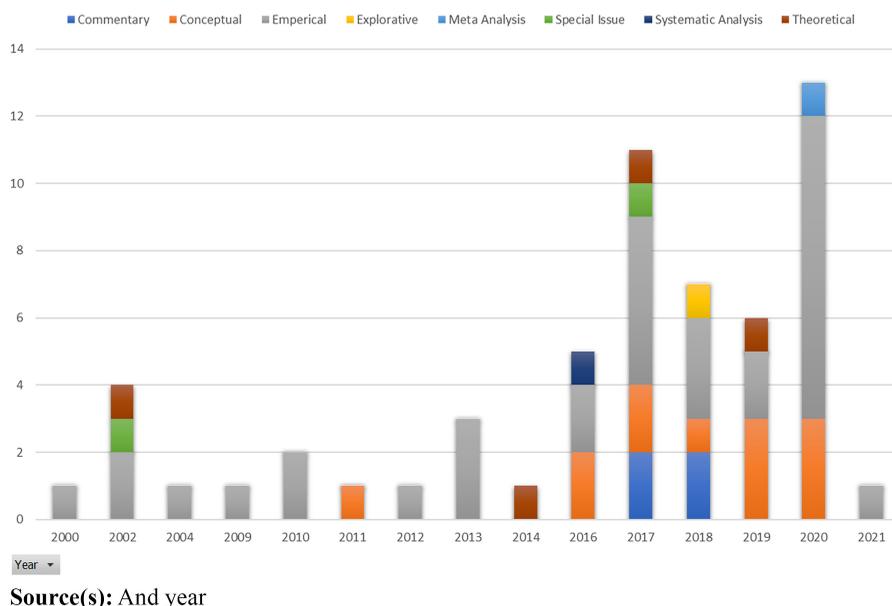


Figure 2.
Article frequency
analysis by type of
source and year

Method	Articles	Total %
Quantitative	21	36%
Case analysis	17	29%
Qualitative	16	28%
Mixed	4	7%
Total	58	100%

Table 2.
Distribution of widely
used research methods
in our sample

significant. This also echoes the position of previous researchers to further expand more research in this direction (Pantano and Gandini, 2017; Pantano and Verteramo, 2017; Nguyen and Simkin, 2017). Table 3 elucidates widely used methods according to the authors.

4.2 Journal outlets, fields of research and citation impact

As part of the exclusion criteria, our focus was to identify journals with highly regarded and relevant content in the fields of retailing, marketing and consumer research. Hence, we referenced high ranking ABS journals which includes (Table 2) International Journal of Research in Marketing, Journal of Consumer Research, Journal of Marketing and Marketing Management, Journal of Retailing, Journal of Retailing and Consumer Science and Journal of Academy of Marketing Science. Most of the articles that have published related subjects on this topic have been referenced majorly from the Journals of Retailing 28% ($n = 16$) and Journal of Marketing Management 17% ($n = 9$) (see Table 4).

4.3 Geographic analysis of authorship origin and study locations

As evidenced from Table 5, there is a strong collaboration from scholars across different geographical orientation and location. We also discovered at least three or more authors, 45%

Mixed method	Qualitative	Quantitative	Case analysis
Tang <i>et al.</i> (2021) Byun <i>et al.</i> (2020)	Siebert <i>et al.</i> (2020) Valdez and Franco (2020)	Fagerström <i>et al.</i> (2020) Liao and Yang (2020)	Sharma <i>et al.</i> (2020) Blut and Wang (2020a, b)
Hult <i>et al.</i> (2019)	Melumad and Pham (2020)	Cheah <i>et al.</i> (2020)	Yadav and Pavlou (2020a, b)
Szymanski and Hise (2000)	Pantano and Vannucci (2019) Pantano <i>et al.</i> (2018a, b) Wu <i>et al.</i> (2017) Grewal <i>et al.</i> (2017) Maslowska <i>et al.</i> (2016) Kumar <i>et al.</i> (2013) Zhu <i>et al.</i> (2013) Shih and Schau (2011) Wood (2002) Kozinets <i>et al.</i> (2002) Ming-Hui and Roland (2017) Roland and Ming-Hui (2014) Shaphali <i>et al.</i> (2018)	Valentini <i>et al.</i> (2020) Huang and Rust (2020, 2021) Henkens <i>et al.</i> (2020) Herhausen <i>et al.</i> (2019) Herrando <i>et al.</i> (2018) Balaji and Roy (2017) Liu <i>et al.</i> (2017) Ng and Wakenshaw (2017) Dessart <i>et al.</i> (2016) White <i>et al.</i> (2012) Reimers and Clulow (2004) Mathwick <i>et al.</i> (2002) Songpol <i>et al.</i> (2013) Geng <i>et al.</i> (2009) Yang (2010) Esther (2010) Kumar and Pansari (2016) Sourabh and Sangeeta (2018)	Flaherty <i>et al.</i> (2019) Hollebeek <i>et al.</i> (2019) Reinartz <i>et al.</i> (2019) Ramaswamy and Ozcan (2018) Kumar (2018) Hoffman and Novak (2018) Nguyen and Simkin (2017) Balmer and Yen (2017) Woodside and Sood (2017) Grewal <i>et al.</i> (2017) Kumar <i>et al.</i> (2017) Lamberton and Stephen (2016) Plouffe <i>et al.</i> (2016) Peterson and Balasubramanian (2002)

Table 3.
Widely used methods
in reviewed studies

Production outlet	ABS ranking	No. of articles
Journal of Consumer Marketing	4*	5
Journal of Marketing	4*	5
Journal of the Academy of Marketing Science	4*	4
Journal of Consumer Research	4*	2
Spanish Journal of Marketing – ESIC	4*	2
Journal of Marketing Research	4*	1
Marketing Science	4*	1
International Journal of Research in Marketing	4	2
Journal of International Marketing	3	1
Journal of Retailing	2	16
Journal of Marketing Management	2	10
Journal of Retailing and Consumer Services	2	9
Grand total		58

Table 4.
Journals included in the
sample

($n = 26$), jointly partnered to come up with their reviews. This indicates similarities in the research field.

A total of 158 authors contributed to the reviewed literature studies, of which authors from the USA and China contributing 27% each ($n = 8$) (Figure 3). From our review of extent

Authorship characteristics	No.	%
One	7	12%
Two	25	43%
Three or more	26	45%
Total	58	100%
<i>Number of countries</i>		
One	20	34%
Two	21	36%
Three or more	17	29%
Total	58	100%
<i>Number of institution</i>		
One	20	34%
Two	21	36%
Three or more	17	29%
Total	58	100%

Table 5.
Authorship analysis of
reviewed articles

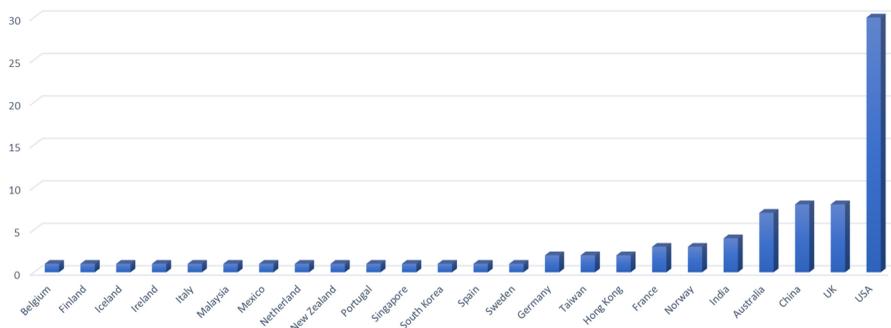


Figure 3.
First author's
geographical location

literature, we could validate a representative geographic coverage area, as we had a total of 25 countries included in this study. Contributions from authors in the USA accounted for 33% ($n = 31$), followed by UK 13% ($n = 11$) and China 8% ($n = 9$). From a regional point of view, studies from 4 continents were observed, that is, North America 35% ($n = 47$), Europe 27% ($n = 26$), Asia 18% ($n = 13$), and Australia 7% ($n = 5$). It was observed that studies from Africa were not included, which also presents a research gap that needs to be identified, especially as the rate of development in this continent is rapid especially in some countries.

This finding corroborates the discoveries and call for future research from other authors including Sharma *et al.* (2020). Only one cross regional/country specific study between Australia and USA (Sharma *et al.*, 2020) was sighted, there has been more craving from researchers to conduct more empirical studies to better compare findings and generalize research outcomes between developed and emerging countries, and countries with different cultural orientations (Fagerström *et al.*, 2020; Gupta *et al.*, 2018).

5. TCCM analysis

In this section, we adopt the TCCM framework (Knight *et al.*, 2004; Paul and Rosado-Serrano, 2019), which helps to further understand the status of the literature, to spot the gaps from previous studies and to offer directions for future studies. (T) stands for theory, (C) for context, (C) for characteristics and (M) for methodology. This framework is aimed at structuring our findings and gap analysis for future research directions and is presented on Tables 6–8.

Table 6.
Theories used by
reviewed studies

Citation details	Theories used
Cheah <i>et al.</i> (2020)	Psychological reactance theory (PRT)
Esther Swilley (2010)	Technology acceptance model (TAM)
Geng <i>et al.</i> (2009)	TAM
Herrando <i>et al.</i> (2018)	Stimulus–Organism–Response
Huang and Rust (2020, 2021)	Construal level theory (CLT)
Hult <i>et al.</i> (2019)	American Customer Satisfaction Index (ACSI) model
Yang (2010)	Unified theory of acceptance and use of technology (UTAUT)
Mathwick <i>et al.</i> (2002)	Cognitive continuum theory (CCT)
Melumad and Pham (2020)	Social exchange theory
Pantano and Vannucci (2019)	Rogers' theory of innovation diffusion
Reinartz <i>et al.</i> (2019)	Assemblage theory
Sharma <i>et al.</i> (2020)	TAM and quality–value–satisfaction (QVS)
Songpol <i>et al.</i> (2013)	Consumer acceptance of technology (CAT) and TAM
Sourabh and Sangeeta (2018)	Theory of planned Behavior (TPB) and TAM
Tang <i>et al.</i> (2021)	Service quality and customer satisfaction
White <i>et al.</i> (2012)	Fairness heuristic theory
Zhu <i>et al.</i> (2013)	Expectancy theory and attribution theory

Table 7.
Frequencies of used
theories

Theories	No	%
ACSI model	1	2%
Assemblage theory	1	2%
CCT	1	2%
CLT	1	2%
CAT and TAM	1	2%
Expectancy theory and attribution theory	1	2%
Fairness heuristic theory	1	2%
NA	38	66%
PRT	1	2%
Rogers' theory of innovation diffusion	1	2%
Service quality and customer satisfaction	1	2%
Social exchange theory	1	2%
Special Issue	2	3%
Stimulus–Organism–Response	1	2%
TAM	3	5%
TAM and QVS	1	2%
TPB and TAM	1	2%
UTAUT	1	2%
Total	58	100%

5.1 Theory development (T)

A detailed overview of the different theories used in the articles are depicted in Tables 6 and 7, with the later offering a perspective of frequency. Interestingly, most of the articles analyzed (61%; $n = 38$) do not clearly point out any theory foundation to support the research. Among remaining ones, the most often used theory was the technology acceptance model (TAM) (10%; $n = 6$). This finding is consistent with previous studies that confirm TAM is the most popular methodology for appraising consumer acceptance intentions (Shin *et al.*, 2018), with perceived usefulness and perceived ease of use being most often used to explain acceptance intentions (Davis, 1989). Attitude is also often present in the TAM studies analyzed and, in some studies, it accounts for negative correlation with intentions (Yousafzai *et al.*, 2007a, b).

Domain	Citation	Avenues for future research
Theory	Plouffe <i>et al.</i> (2016)	Generate a general framework that could be applied to different environments namely consumer-to-consumer, business-to-business and consumer-to-business
Context	Balaji and Roy (2017)	Replicate study in other cultures and countries to aid generalizability
	Blut and Wang (2020a, b)	In which task contexts will direct technology–technology interactions likely replace human-driven interactions (among firms and consumers)? In which contexts is this type of replacement likely to remain partial? Why?
	Esther Swilley (2010)	As this study was limited to one particular technology, the wallet phone, attitudes toward other technological devices, not just the software, should be addressed
	Grewal <i>et al.</i> (2017)	Examine the effect of the interaction style and its implications in real business settings with IoT technologies
	Grewal <i>et al.</i> (2017)	Examine customer satisfaction at different touch points in the customer purchase journey
	Henkens <i>et al.</i> (2020)	Explore the role of haptics in the effect, whether similar psychological effects arise for other electronic devices that consumers have constant tactile contact with, such as “wearable tech” (e.g. Fitbits, Apple watches)
	Herhausen <i>et al.</i> (2019)	Examine post-purchase touchpoints of the customer journey
	Henkens <i>et al.</i> (2020)	Explore the role of haptics in the effect, whether similar psychological effects arise for other electronic devices that consumers have constant tactile contact with, such as “wearable tech” (e.g. Fitbits, Apple watches)
	Hult <i>et al.</i> (2019)	Analyze in more detail the interplay between purchase channels, product categories, and customer demographics
	Kumar <i>et al.</i> (2013)	A systematic analysis of the relationship between satisfaction and loyalty for the different levels of profitability is much needed in the literature
	Kumar <i>et al.</i> (2017)	Examine ways to enhance customers’ sense of engagement and explore whether the IoT will increase CE with retailers, service providers and brands as machines take over all the “talking” to other machines (i.e. the start of machine-to-machine commerce)
	Liu <i>et al.</i> (2017)	Can sellers compensate for concrete consumers’ inability to touch and to increase their PI and WTP for a product sold online for which they cannot touch prior to purchase?
	Maslowska <i>et al.</i> (2016)	Explore the interrelationships between engagement and disengagement over time using a longitudinal sample
	Mathwick <i>et al.</i> (2002)	Replication of this study in mixed gender and male gender populations is warranted
	Liu <i>et al.</i> (2017)	Can sellers compensate for concrete consumers’ inability to touch and to increase their PI and WTP for a product sold online for which they cannot touch prior to purchase?
	Mathwick <i>et al.</i> (2002)	Replication of this study in mixed gender and male gender populations is warranted
	Ng <i>et al.</i> (2017)	Extend research to other social networks hosting OBCs, such as Twitter, Pinterest and Instagram
	Pantano and Vannucci (2019)	Consider other categories to offer a more comprehensive overview of the actual innovation diffusion, and compare and contrast among different retailers operating in different cities or different areas, such the shopping centers and the anchor stores
	Reinartz <i>et al.</i> (2019)	Examine the expectation that self-extension experiences will tend to be defined by direct interactions, while self-expansion experiences will emerge more often from largely ambient interactions
	Siebert <i>et al.</i> (2020)	Examining new and different types of customer journeys
	Songpol <i>et al.</i> (2013)	Future studies should focus on large but distinct demographic groups. College students are ideal for initial studies of technology-driven products due to their confidence and inclination to accept innovations

(continued)

Table 8. Future research direction using the TCCM framework

Table 8.

Domain	Citation	Avenues for future research
	Sourabh and Sangeeta (2018) Valdez Cervantes and Franco (2020) Valentini <i>et al.</i> (2020)	Further research is required to arrive at definitive conclusions in understanding the consumers' showrooming behavior Extend scope beyond supermarket so effects can be generalized to other retailing formats and investigate effects on other forms of in-store technology Understudy channels through which retailers deliver promotions and examine why consumers bifurcate into offline-focused and online-focused deal prone segments
	White <i>et al.</i> (2012) Wood (2002) Yadav and Pavlou (2020a, b)	Studies to examine other types of SST (e.g. bill payment kiosks) would provide additional value to SST migration research Extend research to multiple countries and cultures to enable generalization of our results Future research should elaborate on customer engagement in the context of smart service systems in which more than two actors are involved
Characteristics	Balmer and Yen (2017) Cheah <i>et al.</i> (2020) Fagerström <i>et al.</i> (2020) Geng <i>et al.</i> (2009) Herrando <i>et al.</i> (2018) Herhausen <i>et al.</i> (2019) Herrando <i>et al.</i> (2018) Hoffman and Novak (2018) Hollebeek <i>et al.</i> (2019) Huang and Rust (2020, 2021) Liao and Yang (2020) Melumad and Pham (2020) Ming-Hui and Roland (2017) Ramaswamy and Ozcan (2018) Reimers and Clulow (2004) Shaphali <i>et al.</i> (2018) Kumar and Pansari (2016)	Investigate how IoTCC empowers different stakeholders, impacting on the corporate identity, image and reputation? Explore the effects of privacy concerns specifically by addressing the boundary conditions of cultural values Develop a prototype for smartphone app through an experiment in a physical grocery store. Extend studies to other countries like USA and China and comparisons between developed and developing countries Extend research to multiple countries and cultures to enable generalization of our results Extend research to multiple countries and cultures to enable generalization of our results Examine post-purchase touchpoints of the customer journey Extend research to multiple countries and cultures to enable generalization of our results Extend research to understand connections impact firm performance is important Explore how physical stores can exploit their exclusive value-creation potential in terms of providing experiences and empowerment, enabling them to succeed in an increasingly digital world Replicate and validate their findings as well as explore in different locations in retail stores Investigate mobile payment and implementations on the retail channels Findings suggest the need to examine whether engagement dimensions influence one another in different contexts and the impact that this may have on the individual experience How can a firm determine a customer's needs online, in the quickest and most efficient way? More research needed on interaction orientation Future research must therefore move beyond supply side measures of concentration, and focus on how spatial convenience through retail segregation, is likely to influence consumer patronage behavior Future researchers could do a comparative study of Hoisfede's conceptualization and other conceptualizations to determine the use of the most relevant cultural dimensions in any framework Further research should focus on the time-varying effect of engagement on firm performance because it could provide additional insights into the effect of the engagement framework on performance after implementation of the recommended strategies

(continued)

Domain	Citation	Avenues for future research
	Wu <i>et al.</i> (2017) Zhu <i>et al.</i> (2013)	Examine the effect of the interaction style and its implications in real business settings with IoT technologies Additional studies needed to determine the impact of relational ties between customers and firms. Studies should be corroborated with actual service firms to gather customer-recovery data
Methodology	Byun <i>et al.</i> (2020) Dessart <i>et al.</i> (2016) Flaherty <i>et al.</i> (2019) Yang (2010) Lamberton and Stephen (2016) Maslowska <i>et al.</i> (2016) Nguyen and Simkin (2017) Pantano <i>et al.</i> (2018a, b) Roland and Ming-Hui (2014) Sharma <i>et al.</i> (2020) Shih and Schau (2011) Szymanski and Hise (2000) Tang <i>et al.</i> (2021)	Empirically test the relationships proposed or extend the framework by including other important variables Further research must add to this discourse – both empirically and theoretically Subject CE and S-D logic literature to empirical testing and validation Future researchers should investigate the moderating roles of gender and age in the adoption of mobile shopping services Offer conceptual pieces or single-study observational models on broad topics but to do little to offer comprehensive tests Explore the interrelationships between engagement and disengagement over time using a longitudinal sample What factors affect consumer's engagement with firms? How can firms use the IoT to design and develop a better customer experience? Adopt quantitative methods to reinforce the generalizability of results and a further evaluate the willingness to become smart of the different retail industries IT and the service revolution are creating a wealth of new topics to study and new methods with which to study them Use qualitative studies to provide more explanations to speculate different mediator effect on TR dimensions Future research using field experiments or survey to improve generalizability of situations consumers might face in real retail purchasing contexts An expectancy-disconfirmation analysis should also be carried out with simultaneous comparisons of online retailing to brick-and-mortar retailing, direct marketing and catalog retailing Extend data size by collecting surveys from various target locations such as schools, office buildings and residential areas

Table 8.

This finding is consistent with [Swilley \(2010\)](#), where attitude was pointed out as an antecedent of technology rejection in the context of wallet phone. Moreover, security and privacy concerns have also been evaluated as additional barriers that inhibit the adoption of new technologies ([Malhotra et al., 2013](#); [Cecez-Kecmanovic et al., 2014](#)).

The topic of CE within IoT was explored by means of different theories. For instance, [Yang \(2010\)](#) combined the unified theory of acceptance and use of technology (UTAUT) to determine driving factors of consumer behavioral intention to use mobile shopping services. Using the four constructs (i.e. performance expectancy, effort expectancy, social influences and facilitating conditions), the researchers concluded that the ease of using mobile shopping services is not a major driving factor of attitude and behavioral intention in the usage of mobile shopping services. Applying the theories of consumer acceptance of technology (CAT) and TAM, [Kulviwat et al. \(2013\)](#) tried to provide a framework to understand how external factors influence acceptance or rejection of new technology, building on the central idea of self-efficacy theory – which is based on the assumption that personal beliefs are the basis for the actions ([Barling and Beattie, 1983](#)), findings indicate that individuals with high self-efficacy are more open to adopt technological innovations than others ([Ellen et al., 1991](#)). Thus, the consumers have their own abilities to understand and effectively use the new technology and to further influence others to use them ([Kulviwat et al., 2013](#)). Subsequently, the theories of planned behavior (TPB) ([Blut and Wang, 2020a, b](#)) and quality–value–satisfaction (QVS) ([Arora and Sahney, 2018](#)) have also been applied to provide different perspectives to technological readiness and adoption under different context. Given the insights generated through the combination of different theories, we can argue that certain external factors (e.g. technology experience, system experience, playability) play a crucial role on consumers accepting or rejecting the adoption of new technologies ([Kulviwat et al., 2013](#)). The process of evaluating the impact of technologies on CE can increase the skepticism and distrust attributed to the perceived higher risks of usage compared with benefit ([Blut and Wang, 2020a, b](#)).

The analysis of articles allows to conclude that the current state of the art does not account for theories that juxtaposes consumer satisfaction and commitment – through the usage of new technology and the subjective evaluation of the quality of alternatives ([Brehm, 1985](#)) – and the relationship investment (RI) model ([Rusbult, 1980](#)). The investment model suggests three primary predictors of brand commitment and engagement: satisfaction with the relationship, alternatives to the relationship and investments in the relationship ([Sung and Campbell, 2009](#)). The investment model is an important theory of studies outside the scope of technology and as such could offer sound theoretical ground.

Furthermore, the social exchange theory ([Hollebeek et al., 2019](#)) was highly limited in application at only 2% ($n = 1$). As a key engagement theory, it explains the perceived personal value and personal investment required when engaging with new technologies ([Hollebeek et al., 2019](#)). The perceived value of engagement is important, since a consumer is more likely to continue their relationship if the interaction is considered valuable ([Brodie et al., 2013](#); [Viswanathan et al., 2017](#)).

In sum, despite the considerable applicability and validity attributed to TAM ([Alenezi et al., 2010](#)), we need new theoretical foundations that could further explain this phenomenal from different perspectives, focusing on engagement and social aspect of consumer–brand relationship while adopting new technologies.

5.2 Context (C)

Research in CE and IoT has resulted in the advancement of the knowledge by identifying various features, including relevant characteristics, antecedents and outcomes. However, the existing research is fragmented and diverse, so few consistent and definitive conclusions can be drawn. The challenge associated with this field is that with several studies highlighting

the effect of IoT on marketing strategies and consumer behavior (Capatina *et al.*, 2020; Davenport and Kalakota, 2019; Ting *et al.*, 2019), gaps still exist. Such gaps include the need for research on CE in the context of smart service systems, in which more than two actors are involved, for instance, customers and employees. The reason lies in the suggestions from researchers that a platform to effect consumer well-being can be provided by CE with different actors in smart service systems (David *et al.*, 2018; Horwood and Anglim, 2019; Lee *et al.*, 2017). Reinartz *et al.* (2019) calls for exploring how physical stores can exploit their exclusive value-creation potential, in terms of providing experiences and empowerment, enabling them to succeed in an increasingly digital world. From our analysis, most empirical studies were only conducted with a single location, with only one study, and conducted in two geographical locations, namely United Kingdom and Australia (Sharma *et al.*, 2020). Due to the dynamism of consumer behavior, there are opportunities to conduct research in different context and across different countries. Indeed, diverse studies suggest the opportunity to conduct comparative studies using Hofstede's cultural dimensions on CE and IoT (Gupta *et al.*, 2018).

5.3 Characteristics (C)

Studies on new technologies mostly revolves around disruptive (sophisticated) technology (Inman and Nikolova, 2017), smart technology (Adapa *et al.*, 2020), innovative technology (Renko and Druzijanic, 2014) and self-service technology (Dabholkar and Bagozzi, 2002; Meuter *et al.*, 2005; Parasuraman, 2000). This is because of the disruption in physical retailing due to the accelerated use of online shopping, mobile shopping and social commerce, which has placed institutional retail under significant pressure (Verhoef *et al.*, 2015). Our findings indicate that traditional brick-and-mortar shopping is being threatened. Within the retail value chain, the supremacy of stationary retailing is being structurally challenged, as increasing portions of the retail trade are shifted from store-based formats to Internet-based formats, including pure players, manufacturer online operations and platforms (Reinartz *et al.*, 2019). However, despite the erosion of physical retailing – through rising online and mobile shopping platforms – retail institutions are also under pressure to redefine their omnichannel environment (Verhoef *et al.*, 2015). In contrast, we have also seen some online giants, such as Amazon and Zalando, opening physical and offline stores (Warby, 2018). This exemplifies that stationary retail formats when combined with an integrated online channel foster channel synergy, rather than cannibalization (Herhausen *et al.*, 2015). This can be harmonized with the webrooming effect, as described by Kumar *et al.* (2017), where consumers research online and purchase in physical stores. It is possible that this model enhances consumer experience via an opportunity to have wide options via different online channels. Other concepts can be related to consumer experience, such as perception of authenticity, brand image, brand personality or actual innovation diffusion model.

5.4 Methodology (M)

From our analysis in Table 2, we identified that the most used methodological approach was the quantitative research which accounted for 34% ($n = 20$). This is contrary to previous assertions that there is a relative shortage in the usage of quantitative studies, in examining CE and new technologies (Dessart *et al.*, 2016). Most researchers who adopted the qualitative methods have called for further revalidation of their findings using quantitative methods (Pantano *et al.*, 2018a, b). The share of mixed methods accounted for only 7% ($n = 4$). Thus, we consider the need to develop more mixed-method approach when studying IoT and CE to identify common determinants and outcomes. The following should be taking into consideration to improve the methodological rigor.

5.4.1 Sample and data collection. From the quantitative survey, questionnaires were the most used instrument for data collection at 55% ($n = 32$), within those 10% ($n = 6$) used experimental methods, and 29% ($n = 17$) do not perform any data collection. The usage of multiple case study method employing primary data was quite minimal to none existing. In the studies analyzed, the samples were collected majorly among customers in supermarkets. Consumers in these settings may behave in a similar manner due to comparable level of income. Researchers should focus more on other retail context, where the rate of new technological adoption is equally high, such as department stores, clothing or footwear stores, fashion or jewelry retailers, among others (Sharma *et al.*, 2020). Cross-referencing data collection and studies across different countries and continents will also aid better research outcome.

5.4.2 Analytical tool. Among the empirical studies (Figure 2), we found significant number of articles without any form of analytical tool tagged, mostly falling under conceptual papers (38% $n = 22$, Table 9). We found that the most used method of data analysis was the confirmatory factor analysis (CFA) 9% ($n = 5$), which was employed for factorial validity of scores from the CE scales and to show close fit for the measurement model (Dessart *et al.*, 2016). The structure equation modeling (SEM) equally accounted for 9% ($n = 5$) mostly used to measure consumer purchase satisfaction (Herrando *et al.*, 2018). Other methods of data analysis that have been employed, include conjoint analysis, mediation approach with Bayesian estimation and multivariate regression. Considering the volume of studies without any analytical tool – due to their conceptual nature – we recommend more research using. For instance, SEM to better allow the relations among constructs or fuzzy-set Qualitative Comparative Analysis (FsQCA) to analyze asymmetries between constructs (see Table 10).

6. Theoretical and practical contributions

In what concerns to theoretical contributions, this literature contributions are threefold. First, we identified the main constructs of CE and IoT, and their impact on brand engagement. Although prior studies have advance in the conceptual (Van Doorn *et al.*, 2010) and empirical (Brodie *et al.*, 2013) research on CE, the understanding of this important construct remains

Tools	No	%
ANOVA	3	5%
ANOVA and <i>T</i> -test	1	2%
Bid rent theory	1	2%
Confirmatory factor analysis (CFA)	5	9%
CFA and regression analysis	1	2%
Conjoint analysis	1	2%
Exploratory factor analysis	2	3%
Framework based on Pantano and Timmermans (2014)	1	2%
Inductive thematic analysis	2	3%
Latent class analyses (LCA)	2	3%
Mediation approach with Bayesian estimation	1	2%
Multivariate regression	1	2%
NA	22	38%
Reliability analysis	2	3%
Snowflake schema database	1	2%
Special Issue	2	3%
Story-telling task analysis	1	2%
Structural equation modeling	5	9%
Structural equation modeling (PLS-SEM) and partial least squares	4	7%
Grand total	58	100%

Table 9.
Analytical tools

only partially explored. Hence, this study proposes further empirical research on IoT and CE with clearly defined theoretical foundations and analytical tools to aid general applicability (Dessart *et al.*, 2016). Kumar *et al.* (2017) in their research identified that customer demographics and culture are essential elements of retail outlet patronage. Gupta *et al.* (2018) hinted that CE with the firms – either through direct or indirect purchases – is influenced by the culture and socio-cultural environment of the consumer. Hence, the influence of culture in the adoption of new technologies is equally important. Different countries, for example UK and Australia, can have a similar culture (Sharma *et al.*, 2020). The geographic limitation of studies calls for future research to conduct a comparative study using Hofstede’s cultural dimensions by comparing the effect on developed and developing countries (Fagerström *et al.*, 2020).

Second, we identify a clamor to explore other theoretical models outside the current scope of TAM, such theories include the social exchange theory (Hollebeek *et al.*, 2019) which explains the perceived personal value and personal investment required when engaging with new technologies and the RI model (Rusbult, 1980) that suggests three primary predictors of brand commitment and engagement: satisfaction with the relationship, alternatives to the relationship and investments in the relationship (Sung and Campbell, 2009). Tran *et al.* (2019), from a recently conducted meta-analysis, highlighted the need to extend the investment model – help to explain additional variable in relationship commitment (i.e. going beyond the standard three antecedents of satisfaction, quality of alternatives and investment).

Third, practitioners and researchers should focus on the roles of mobile technology in omni-channel retailing conversion. Especially because most customers now adopt the web rooming effect, where they search online and purchase offline (Kumar *et al.*, 2017). This is also another factor that enhances consumer experience, as consumers benefit from savings on shipping costs.

Regarding practical implications, we present three different perspectives, that is, economic, consumers and research community. Economy: Technological advancement in the economy improves personalized services, deepens consumer relationships and consequently increases the economic output through the service sector (Rust and Huang, 2014). We see a direct effect on the economy and the quality of services as marketing undergoes tremendous transformation due to the impact of IoT.

Consumers: From our analysis, we identified that consumers feel a sense of retail store community when they socially engage with other shoppers and employees (Byuna *et al.*, 2020). Hence, the relevance of bricks and mortar effect is still significant. Even though consumers may not embrace a new product right away, the adopters of an existing product are not technology resisters, but rather willing to explore benefits of the new product before making a final decision (Cui *et al.*, 2009). Digitization positively impacts consumer retail experience, which address long-standing customer needs more effectively than previously possible (Hollebeek *et al.*, 2019).

Row labels	No	%
Comparison	1	2%
Conjoint analysis	1	2%
Interviews	4	7%
Meta-analysis	1	2%
NA	17	29%
Questionnaire	32	55%
Special Issue	2	3%
Total	58	100%

Table 10.
Method of data
analysis

Research community: The need for the research community to properly examine customer satisfaction at different touch points in the customer purchase journey has been highlighted as pivotal (Grewal *et al.*, 2017a, b). Post purchase examination is equally as important, the mechanics of how physical stores can exploit their exclusive value-creation potential in terms of providing experiences and empowerment, enabling them to succeed in an increasingly digital world is becoming more relevant in our present predicament (Hollebeek *et al.*, 2019).

7. Conclusions

Our research contributes to the existing knowledge of IoT and CE through a comprehensive systematic analysis using the TCCM model. Through this research, we could identify crucial knowledge gap that are important to enable a full overview of the subject matter. The study detailed the various developments in this field – in the past two decades – by building on existing scholarly reviews and providing a fresh perspective due to the evolving global phenomenal, yet, identifying cogent areas for future research directions. Our findings suggested that further studies are required (1) to evaluate CEs in our current dynamic retail environment, (2) extend scope of research beyond research supermarket to other retailing formats, (3) investigate the effects on other forms of in-store technology, (4) the need to extend research to multiple countries and (5) cultures to enable generalization of our findings. The literature also revealed some inconsistencies in the reviewed studies, as well as the required justifications in favor of the relevant future directions. It is expected that the research outcomes should give some indications on whether firms should adopt technology–technology interactions (Yadav and Pavlou, 2014) or human-to-human interactions (Aggarwal and McGill, 2012). The importance of this outcome will aid practitioners to identify appropriate angles for investment and strategy formulation in developed and advanced countries.

As technology continues to become very involved in our daily lives, there are tendencies that there will be a natural shift to technology-to-technology interactions (Yadav and Pavlou, 2020a, b) due to our heavy reliance on technological advancement. Advancement in the field of IoT systems, such as smart homes, smart cities, interconnected cars and the smart energy grid further contributes to these assertions. However, there are legitimate concerns as regards trust in the technology-to-technology interaction without any human interactions, followed by limited generalizability of previous research. The role of human in CE cannot be totally substituted by machine-to-machine interactions and vice versa irrespective of the highly computerized environment. Human-to-human interactions play a pivotal role (e.g. when a customer service consults with a customer attempt to offer products demonstration supports) in the consumer user journey. Striking this balance and identifying where to apply either or both is the empirical hypothesis that needs to be validated.

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