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Looking Back to Move Forward: A Bibliometric Analysis of Consumer Privacy Research

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Abstract: Information privacy has attracted considerable attention in the information system research field. However, little effort has been made to review its latest developments from a marketing perspective. As research on consumer privacy advances rapidly, a comprehensive evaluation of the field is required. In this paper, two bibliographic databases retrieved from Web of Science were used to perform a series of bibliometric analyses consisting of co-citation analysis, co-occurring keyword analysis, and structural variation analysis. To facilitate these analyses, we use the software CiteSpace. Our results present the existing literature's publication performance, thematic concentration, intellectual turning points and influential studies, and identify emerging trends in the literature. We found that a number of landmark studies has greatly affected the development of the consumer privacy research. Most importantly, this study proposes a research agenda for the field. Recent emerging topics focusing on privacy calculus, privacy ethic, privacy enhancing technologies, privacy-related coping strategies, and new contemporary privacy contexts should be further discussed in the future research.

Keywords: consumer privacy; bibliometric analysis; literature review; citespace; emerging trend

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1. Introduction

In recent decades, numerous commercial and information techniques have emerged that aim to help firms obtain access to consumers' information data more easily [1,2]. Such unprecedented technological innovation has brought consumers greater convenience while confronting them with privacy data vulnerability and unfair information practices [3–8]. A plethora of scholars and policy makers have sought legal, commercial, and technological solutions to protect consumers from privacy violations, but the misuse and abuse of information continue to emerge.

Against this backdrop, marketing scholars have contributed various ideas and investigations. For example, in the 1990s, there were many notable academic contributors, such as Goodwin [9], Jones [10], Smith, Milberg, and Burke [11], Wang, Lee, and Wang [12], and Culnan and Armstrong [13]. These researchers provided an early discussion of privacy-related conceptualizations, theoretical developments, taxonomies, constructs and principles for protecting consumer privacy. Notably, Goodwin's [9] influential study systemically elaborated the definition of consumer privacy. He argued that consumer privacy is consumers' ability to control their personal information in the transaction and consumption process. In contrast, Wang, Lee and Wang [12] underscored the aspect of an individual's right to privacy with regard to the use of personal information. However, the complexity and ambiguity of the concept of consumer privacy has led to very diverse outcomes that lack consensus [14]. A proliferation of subsequent publications has investigated consumer-related attitudes, perceptions, behavioral consequences and coping strategies as well as the implications of their implementation in the marketing field. Despite this rapidly growing attention, the development of privacy research in the marketing domain is still in a rela-

tively early stage. We thus provide a literature analysis of consumer privacy research and take a prospective look at the field.

Given the flourishing development of privacy research in the information system field, prior studies have conducted literature reviews [14–17]. However, there are a few limitations that have been overlooked. First, to the best of our knowledge, these literature reviews predominately adopted an information system perspective, making it difficult to evaluate the overall contribution of marketing to information privacy research. Second, all of these reviews overemphasize the systematic delineation of privacy concepts and the relationships among consumer privacy-related constructs such as privacy perception, beliefs, behavioral consequences, and remedies. For example, Smith, Dinev, and Xu [17] provide an interdisciplinary review of recent developments in the domain, and systematically compare and discuss the conceptualization of information privacy, the relationship between information privacy and other constructs, and the contextual nature of these relationships. Third, peer review represents the principal procedure of quality judgment, but it also has deficiencies, such as vulnerability to subjective cognitive limitations [18]. By contrast, the bibliometric approach works well in the general assessment of fields that involve a diverse range of relevant topics [19]. In existing studies, there is an apparent dearth of investigation of the structure and dynamics of consumer privacy research. Fourth, despite the sporadic studies on the review of privacy-specific issues such as the privacy paradox [20], privacy concerns and their measurement [21,22] in recent years, a comprehensive review of information privacy ended in 2011. Although new research themes have emerged since then, there have been no updates. Finally, extant reviews have a relatively ambiguous time window and literature selection. Thus, this article is devoted to filling these research gaps. Specifically, the goal of this research includes four aspects: (1) to portray the co-citation network (e.g., co-citation cluster) in the consumer privacy field; (2) to capture the fundamental transitions and research evolution of the consumer privacy knowledge domain; (3) to identify the landmark articles that have a traction effect on consumer privacy research as a whole; (4) to detect emerging topics of consumer privacy and further suggest opportunities for future research.

The structure of this study is arranged as follows. First, we perform a state-of-the-art review related to consumer privacy through the core dataset. In addition, 2496 publications are investigated in an attempt to clearly see the intellectual landscape of the consumer privacy research domain and the newest research fronts. Specifically, we not only focus on the journal co-citation network, contributing authors and affiliations to obtain a descriptive analysis but also investigate the document co-citation networks, co-occurring keywords, and references with large citation bursts to obtain more detailed information on the intellectual structure, research dynamics, and emerging trends in the domain. Furthermore, we expand our dataset collection by using the expanded citations to acquire a broader landscape, in which 23,171 retrieval results are analyzed. In this section, we mainly extend our understanding of the emerging trends in the consumer privacy field.

2. Methodology

2.1. Data Collection

When conducting data retrieval, a dilemma arises regarding the trade-off between "recall rate" and "precision rate" [23]. Generally, a higher precision rate is accompanied by a lower recall rate and vice versa. To ensure better retrieval performance, we followed previous research and adopted a strategy of combining "topic term retrieval" and "citation index-based expansion" [24], through which we can fully capture more information. As the world's largest academic information platform, ISI (Institute for Scientific Information) Web of Science has a rich collection of citation indexes representing the citation connections between scholarly research articles, which makes it particularly suitable for our data collection. For the core dataset, the data collection procedure includes several steps as follows (as shown in Figure 1): (1) Database selection. Our datasets were primarily retrieved from the Web of Science (Core Collection), which incorporates a series of citation

indexes. Given the research theme of our study, we chose three citation indexes, "SCI-EXPANDED/SSCI/A&HCI" databases, which have a collection of more than 12,000 high-quality scholarly journals and numerous articles published worldwide. (2) Research topics and time window. Through reviewing substantial literature in the domain, we believe that keywords "consumer privacy" and "customer privacy" are more representative search terms since these two keywords appeared in the early influential works, such as Smith, Milberg, and Burke [11], Wang, Lee, and Wang [12], etc. Therefore, we used the keywords "consumer privacy" or "customer privacy" as the search terms and covered the timespan "all year (1985 to 2019)" to retrieve sample records in the core collection. In addition, only original research articles published in English-language journals were considered. We thus obtained 2690 retrieval results. (3) Additional filters. Less representative record types (e.g., book reviews, research notes, and book chapters) were excluded, and the results were reduced to 2532 articles. (4) Irrelevant record elimination. To validate the data more precisely, we manually reviewed each article to eliminate less relevant sources. Twenty-eight irrelevant references were removed, and the retrieval results yielded 2496 records.

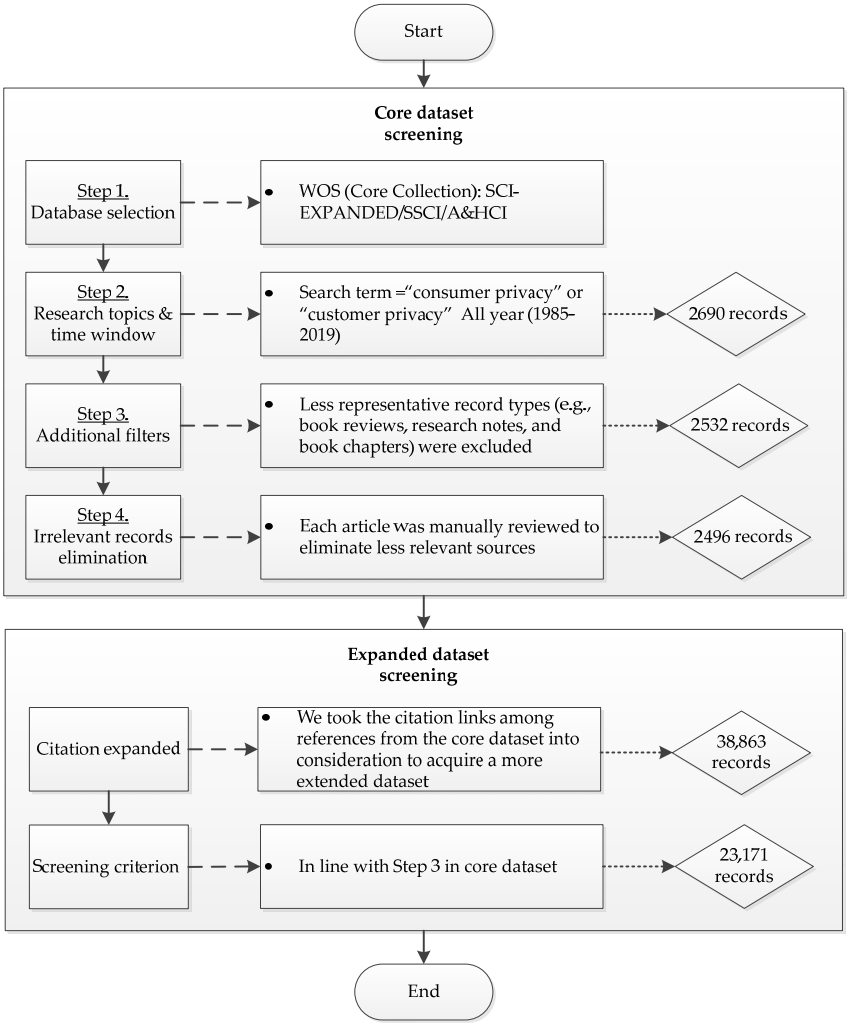

Figure 1. Data collection process.

For the expanded dataset, we took the citation links among references from the core dataset into consideration to acquire a more extended dataset. The screening criteria remained almost consistent with that applied to the core dataset screening. The expanded dataset resulted in 38,863 records, and 23,171 records were used for analysis.

2.2. CiteSpace

This paper adopts bibliometric tool CiteSpace to examine the literature for the following three reasons. First, previous literature reviews applying bibliographic data have proven to be extremely cost- and labor-intensive [25]. CiteSpace has the potential to simplify our review process, and thus improve the quality of reviews. Second, according to Chen [26], CiteSpace innovatively uses citing papers as the intellectual base and cited papers as the research front to build a time-variant mapping network. This tool can help visualize intellectual structures and capture abrupt changes in scientific literature [26]. Third, despite the powerful function of CiteSpace, to the best of our knowledge no investigation has been done to use CiteSpace to analyze consumer privacy literature.

For this research, each bibliographic record result from the search included the article's title, abstract, term, keyword, author, country, institution, journal, cited authors, and cited references. These records enabled us to build an integrated network relation of these articles based on CiteSpace, including author co-citation, regional collaboration, co-occurring keywords, document co-citation, and geospatial visualizations via a set of tools such as pruning (e.g., pathfinder, pruning sliced networks, minimum spanning tree), burst detection, and clusters. Moreover, CiteSpace allows evaluation of a broader knowledge network of this domain rather than the literature per se.

2.3. Statistical Methods

Using CiteSpace to carry out the bibliometric analysis is deemed a useful aid in scientific analysis of literature. Due to the advantage of revealing the structural and dynamic patterns and trends of the scientific field [26], this analytic method has received considerable attention in scientometrics, as well as in various other disciplines such as computer science, sociology, and management science. Specifically, the analytic method has three main techniques: co-citation analysis, co-occurring analysis, and structural variation analysis.

Co-citation analysis is a literature-based technique that is often used to explore the intellectual structure of academic fields and the characteristics of academic communities [27]. Small [28] conceptualized co-citation as the frequency with which a pair of publications were cited together by a latter study. In other words, co-citation counts are the numbers of papers that cite the pair. Subsequently, some scholars (e.g., [29,30]) found that highly co-cited pairs of studies can be clustered in a group through co-citation links and that such groups correspond with major research areas. The clustering of co-cited articles formed aggregates representing the size of scientific fields or disciplines. In this study, we mainly use co-citation cluster analysis to display the intensity of connectivity among the topics for which measures of centrality, clustering, and modularity were used [31].

Co-occurring keyword analysis is primarily based on the citation burst algorithm to detect the keyword's statistically significant fluctuations within the corresponding period [32]. The citation burst algorithm was developed to use a two-stage weighted automation model to compute a weight associated with each burst. Specifically, a burst [t_1, t_2] can be calculated as $\sum_{t=t_1}^{t_2} (\varphi(o, r_t, d_t) - \varphi(1, r_t, d_t))$, where r_t is the number of terms at the t_n that contain the word u, and d_t is the total number of terms at the t_n [32]. These co-occurring keywords represent the network of conceptual relations from the viewpoint of scholars active in the field. When some keywords were found to have an upsurge of use from others at a particular moment in time, we regarded these keywords as receiving increased attention in the research network.

Structural variation analysis measures a research field's structural change, which plays an overarching role in bridging previously disjoint bodies of knowledge [26,33]. More specifically, the structural variation reflects two dimensions: betweenness centrality and sigma. Betweenness centrality reflects the degree to which a point dominates the communication path between other points on the minimal path [34]. In this article, betweenness centrality allows us to accurately and easily identify potential pivotal points of

paradigm shift in evolving scientific networks [19,31]. In other words, we use the betweenness centrality of a node to identify pathways between different thematic clusters, which implies that an article with the highest centrality value reflects its importance in connecting the preceding clusters with the following clusters, namely, the intellectual turning points. Sigma is used to measure scientific novelty, which is a combined measure of citation burst and structural centrality and is calculated as (centrality + 1)$^{\text{burstness}}$ [26].

3. Results

3.1. The Landscape from the Core Dataset

3.1.1. The Number of Publications per Year

Figure 2 illustrates the time trends and distribution of consumer privacy articles published from 1997 to 2019. Three results can be derived. First, there has been a steady increase in consumer privacy research over the past two decades. Second, only a small number of studies on this topic were published before 2000, while there appears to be a slow growth trend in the annual numbers of published articles from 2001 to 2010. We can see sharp growth during the years 2010 to 2019. This trend is closely related to changes in the public's demand for personal information privacy and security.

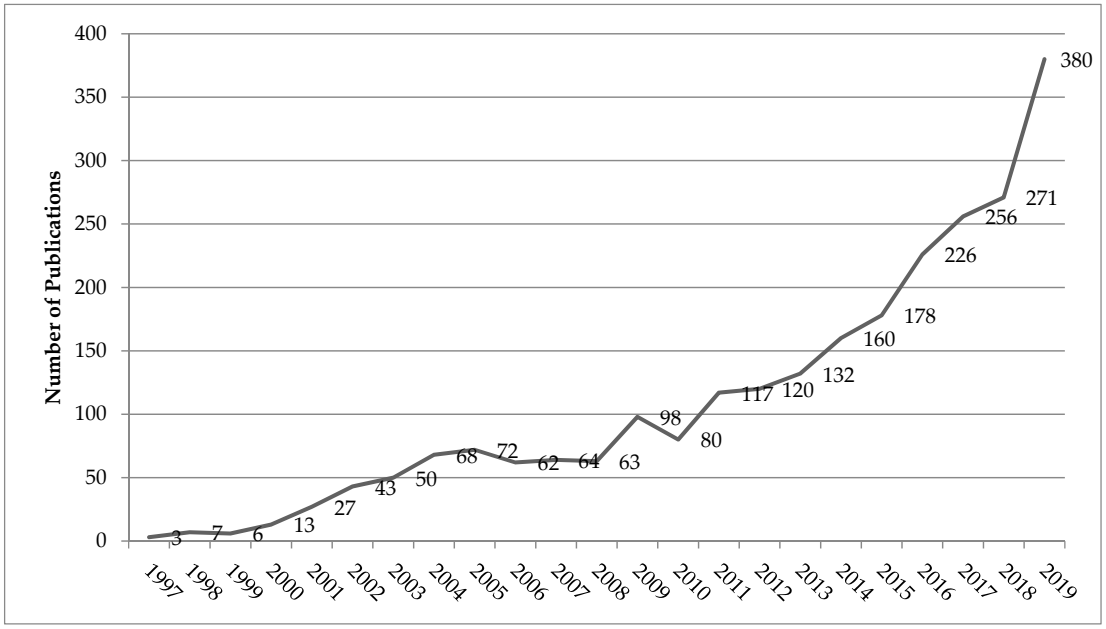

Figure 2. Annual distribution of the number of articles across the period studied (1997–2019).

3.1.2. Distribution across Journals and Disciplines

As Leydesdorff and Rafols [35] noted, we should regard the decomposition of disciplinary structures as the first effort to gain insight into a research field. In order to identify journal and disciplinary categories, we used the Analyze Results tool, which is one of the features that sets Web of Science apart from other comparable databases. This tool allows us to segment and examine search results by categories such as journals, disciplines, and more. We first start with the most contributing journals within the domain of consumer research between 1997 and 2019. 334 journals were included in our dataset only if they had at least 10 co-citations. The top 10 journals, ranked by frequency involving consumer privacy, were as follows: Computers in Human Behavior (55 articles) was the main peer-reviewed journal to publish works about consumer privacy, followed by Lecture Notes in Computer Science (49 articles), IEEE Transactions on Smart Grid (38 articles), IEEE Access (30 articles), Computer Law Security Review (29 articles), Journal of Business Research (26 articles), Journal of Consumer Affairs (25 articles), Electronic Commerce Research

and Applications (23 articles), Internet Research (23 articles), and International Journal of Mobile Communications (22 articles). We can thus conclude that: First, this list reveals the multidisciplinary characteristics in the field of consumer privacy research; second, from the perspective of the distribution of disciplines, Computer Science Information Systems (accounting for 24.29% of the total articles), Business (18.68%), and Management (10.78%) made the greatest contributions to this field. These characteristics represent that research on consumer privacy could provide a broader perspective on the development of privacy.

3.1.3. The Most Prolific Regions, Institutions and Authors

Table 1 lists the most prolific regions, institutions, and authors in consumer privacy research. It shows that the USA was the most prolific region with 1149 publications, followed by China with 271 publications and the UK with 185 publications. With regard to institutions, Purdue University and University of Massachusetts are the most productive institutions with 26 publications. In terms of the most prolific authors, George R Milne from University of Massachusetts Amherst and Xu Heng from Kogod School of Business at American University are the top two most published authors in the field of consumer privacy, while Alessandro Acquisti, Rainu Kaushal, and Paul Benjamin Lowry tied for third place. Interestingly, a highly consistent correlation can be observed among regions, institutions and authors.

Table 1. Most prolific regions, institutions and authors in consumer privacy research.

Region	Freq.	Institution	Freq.	Author	Freq.
USA	1126	Purdue Univ	26	George R Milne	11
Peoples' Republic of China	268	Univ Massachusetts	26	Xu Heng	10
UK	182	Univ Sydney	25	Alessandro Acquisti	9
Australia	160	Univ Michigan	21	Rainu Kaushal	9
Germany	148	Penn State Univ	21	Paul Benjamin Lowry	9
South Korea	137	Natl Univ Singapore	21	Dan J Kim	8
Canada	120	Harvard Univ	20	Pouyan Esmaeilzadeh	7
Taiwan, China	106	Univ Wisconsin	20	Younghoon Chang	7
Spain	93	Florida int Univ	20	Cristian Morosan	7
Italy	72	Univ Calif Berkeley	19	May O Lwin	7

3.1.4. Co-Occurring Keyword in Consumer Privacy Research

Table 2 presents a list of the top 30 keywords with the strongest bursts in consumer privacy. Strength denotes the degree of connectivity and centrality in the complete relationship among keywords. In other words, it can be deemed an indicator of the active use of keywords. The red bar represents how long the relevant keywords' burst status lasts. For example, the keyword "Internet privacy" shows the characteristics of high-frequency usage during the years 2001–2009. In essence, the bursts of certain keywords within a certain period of time highlight the evolution of consumer privacy research and uncover recent research trends.

In an earlier stage, the emergence of online technologies such as the Internet and e-commerce awakened consumers and academia to the potential threat of personal privacy. This is not surprising because some keywords, including "internet privacy", "cryptography", "trustworthiness", and "TAM (technology acceptance model)", present the strongest citation bursts. With the arrival of the web 2.0 era, which was characterized by greater user interactivity in the late 2000s, firms faced a situation in which consumers were more willing to interact with them by participating and collaborating in the network system. To manage the customer relationship, numerous firms have further commercially explored consumer behavior. Thus, keywords such as "website", "usability" "commitment", "consumer trust", and the like have elicited much interest in the academic field. More recently, keywords such as "privacy calculus", "willingness", "access control", "Internet banking", "social media", "algorithm", "electronic health record", "smartphone", "big data", and "perceived

value" have shown a significant presence. Such trends might be attributed to the development of information technology, especially its widespread application in a variety of consumer-related service sectors. In summary, we can clearly notice several major shifts of research focus in consumer privacy literature.

Table 2. Summary of the top 30 keywords based on citation burst strength.

Keywords	Strength	Begin	End	1997–2019
Internet privacy	4.37	2001	2009	
Cryptography	3.35	2001	2008	
Trustworthiness	4.71	2003	2007	
TAM	3.6	2003	2009	
RFID	5.75	2006	2012	
Website	4.81	2008	2013	
Usability	3.84	2009	2013	
Commitment	3.55	2009	2011	
Consumer trust	4.16	2010	2014	
Privacy calculus	4.57	2011	2015	
Willingness	3.62	2011	2015	
Access control	3.4	2011	2014	
Cloud computing	7.57	2012	2017	
Personal information	5.04	2012	2017	
Internet banking	3.34	2012	2017	
Social media	5.39	2013	2019	
Market	3.59	2013	2019	
Algorithm	4.9	2014	2019	
Power	4.39	2014	2017	
Law	3.58	2014	2016	
Electronic health record	3.5	2014	2017	
Smartphone	3.39	2014	2016	
Secure	3.19	2014	2019	
Big data	11.04	2015	2019	
Social networking site	6.06	2015	2017	
Facebook	4.88	2015	2019	
Perceived value	3.93	2015	2019	
Intention	8.15	2016	2019	
Word of mouth	6.22	2016	2019	
Challenge	3.7	2016	2019	

Note: Strength denotes the degree of connectivity and centrality in the complete relationship among keywords.

3.1.5. Thematic Clusters in Consumer Privacy Research

Table 3 presents a detailed overview of co-citation clusters by the size of the references included. Every cluster's label was algorithmically chosen from the citing articles' title and abstract by the log-likelihood ratio weighting algorithm (LLR), which is a measure that calculates the weighting coefficients of references in the cluster [36]. The silhouette metric is used to estimate the uncertainty involved in identifying the nature of a cluster [36]. The score ranges from -1 to 1. A score close to 1 suggests a cluster that is more separated from other clusters. The average year shows the recentness of these clusters, and the coverage value indicates the proportion of cited members of a cluster that the citing article has cited. The citing articles are regarded as the intellectual base [26]. These characteristics together further reflect the research evolution of consumer privacy. Given that small clusters are less representative due to the few citing behaviors, we list only those clusters with sizes greater than 50 references, namely, a total of 12 clusters. Clusters #0, #1, #2, #3, and #4 can be identified as the largest clusters and are very widely accepted research themes within the corresponding period. In contrast, Clusters #0, #1, #3, and #6 are deemed to be the most recently formed clusters with citation bursts. Then, we select representative citing papers with coverage beyond 10% as our critical research focus. For example, Karimov's [37] article in cluster #0 cited 14% of the references of all 285 citations in the cluster, which makes it the most relevant citing document associated with the cluster.

It is evident that the representative terms "initial trust", "electronic banking", and "user acceptance" dominate the largest cluster #0. A total of 285 references with an average year of 2011 are included in this cluster. A great proportion of the studies in this cluster explore the mechanism of the inherent influence of privacy and security perception on consumer adoption or user acceptance of digital services, involving e-banks [38], smart home services [39], and smart glasses [40]. This finding indicates that the commercial application of technology elicits the concern for privacy security among consumers.

As the second largest and recently formed cluster, Cluster #1, labeled "data privacy", "digital market manipulation", and "information technology", contains 263 members with an average year of 2012. The research with the largest coverage in this cluster is by Peppet SR [41], Calo R [42], and Porat A [43]. These authors attempt to incorporate the idea of digital market manipulation and propose that the development of digital technologies offers companies more digital means to approach their consumers anytime and anywhere instead of waiting passively for the market response. Accordingly, social impact and ethical issues (e.g., social welfare, discrimination) were generated due to unforeseen actions or unauthorized use by companies to target consumers more precisely than in the past. The issue of how to manage a balance between social-economic welfare and the interests of consumers appears to be a great challenge for future regulators and legislators [44,45] and has emerged as a prominent area of research interest.

Cluster #3 is the third recently formed cluster with an average year of 2010. Labeled "integrated framework" and "online information privacy research", this cluster has 128 references. This cluster primarily provides the theoretical basis for this field and may shed light on further research. For example, many studies propose an integrated theoretical framework to understand context-specific antecedents and outcomes of privacy concerns (e.g., [46–52]). An implication for further research is thus to exploit context and contextual differences in managing consumer privacy.

Table 3. Representative papers of main clusters.

Cluster #	Size	Silhouette	Mean Year	Citing Papers	Coverage %
#0 Initial trust; Electronic banking; User adoption	285	0.927	2011	Karimov FP (2014). The effect of website design dimensions on initial trust: A synthesis of the empirical literature.	14
				Xu H (2011). Information privacy concerns: Linking individual perception with institutional privacy assurances.	14
				Zhao T (2011). The impact of privacy concern on user adoption of location-based services.	13
				Liao CC (2011). Examining the impact of privacy, trust and risk perceptions beyond monetary transactions: An integrated model.	12
				Martin KE (2012). Diminished or just different? A factorial vignette study of privacy as a social contact.	11
				Treiblmaier H (2011). Trust and perceived risk of personal information as antecedents of online information disclosure: Results from three countries.	11
#1 Data privacy; Digital market manipulation; Information technology	263	0.967	2012	Peppet SR (2014). Regulating the internet of things: First steps toward managing discrimination, privacy, security, and consent.	19
				Calo R (2013). Digital market manipulation.	17
				Porat A (2014). Personalizing default rules and disclosure with big data.	11
#2 Intention to transact online; Seller trust; Future direction	147	0.916	2000	Belanger F (2002). Trustworthiness in electronic commerce: the role of privacy, security, and site attributes.	23
				Shankar V (2002). Online trust: a stakeholder perspective, concepts, implications, and future directions.	18
				George JF (2004). The theory of planned behavior and internet purchasing.	15
				Taylor DG (2010). Has e-marketing come of age? Modeling historical influences on post-adoption era Internet consumer behaviors.	10
#3 Integrated framework; Online information privacy research;	128	0.913	2010	Liao CC (2011). Examining the impact of privacy, trust and risk perceptions beyond monetary transactions: An integrated model.	14
				Ozdemir ZD (2017). Antecedents and outcomes of information privacy concerns in a peer context: An exploratory study	12
				Li Y (2012). Theories in online information privacy research: A critical review and an integrated framework	10
#4 Digital marketing; Interactive media; Privacy concern	110	0.98	2003	Andrejevic M (2002). The work of being watched: Interactive media and the exploitation of self-disclosure.	22
				Ashworth L (2006). Marketing dataveillance and digital privacy: Using theories of justice to understand consumers' online privacy concerns.	18
				Luo XM (2002). Trust production and privacy concerns on the Internet: A framework based on relationship marketing and social exchange theory.	10

Table 3. *Cont.*

Cluster #	Size	Silhouette	Mean Year	Citing Papers	Coverage %
#5 Predicting etail quality; Online information; Online service	102	0.924	2005	Wolfinbarger (2003). EtailQ: Dimensionalizing, measuring and predicting etail quality.	25
				Lwin MO (2003). A model integrating the multidimensional developmental theory of privacy and theory of planned behavior to examine fabrication of information online.	24
				Liu CT (2010). Measuring user perceived service quality of online auction sites	20
				Xu B (2010). Factors affecting consumer behaviors in online buy-it-now auctions	11
#6 Health information; E-medicine; Personal health records	100	0.98	2010	Brann M (2002). E-medicine and health care consumers: Recognizing current problems and possible resolutions for a safer environment.	28
				Vodicka E (2013). Online access to doctors' notes: Patient concern about privacy.	19
				Zarcadoolas C (2013). Consumers' perceptions of patient-accessible electronic medical records	11
#7 Security risk; Consumer perception; Online privacy policies	98	0.949	1999	Miyazaki AD (2001). Consumer perceptions of privacy and security risks for online shopping.	25
				Anton AI (2004). A requirements taxonomy for reducing web site privacy vulnerabilities.	20
				Hoy MG (2003). Consumer privacy and security protection on church web sites: Reasons for concern.	15
				Earp JB (2005). Examining Internet privacy policies within the context of user privacy values.	10
#8 Literature review; Security challenge; Empirical study	91	0.961	2005	Beldad A (2010). How shall I trust the faceless and the intangible? A literature review on the antecedents of online trust.	16
				Karimov FP (2014). An examination of trust assurances adopted by top Internet retailer: Unveiling some critical determinants.	14
				Simth HJ (2011). Information privacy research: An interdisciplinary review.	12
				Lee SM (2007). Rfid based ubiquitous commerce and consumer trust.	10
				Ozdemir ZD (2017). Antecedents and outcomes of information privacy concerns in a peer context: An exploratory study.	10
#9 Privacy calculus; Information disclosure;	80	0.948	2009	Dinev T (2006). An extended privacy calculus model for e-commerce transactions.	15
				Xu H (2009). The role of push-pull technology in privacy calculus: The case of location-based services.	12
				Mai B (2010). No free lunch: Price premium for privacy seal-bearing vendors.	10
#10 Building consumer trust; Trust building model;	79	0.968	2004	Mcknight DH (2002). The impact of initial consumer trust on intentions to transact with a web site: A trust building model.	28
				Mukherjee A (2007). Role of electronic trust in online retailing: A re-examination of the commitment-trust theory.	20
				Aguirre E (2015). Unraveling the Personalization Paradox: The Effect of Information Collection and Trust-Building Strategies on Online Advertisement Effectiveness.	13

Table 3. *Cont.*

Cluster #	Size	Silhouette	Mean Year	Citing Papers	Coverage %
#11 Online privacy protection; Policy initiative; Privacy regulation	66	0.96	2009	Metzger MJ (2010). Public opinion and policy initiatives for online privacy protection.	28
				Goldfarb A (2011). Privacy regulation and online advertising.	10

Notes: Size: the number of members in each cluster; Silhouette: a metric of a cluster measures the uncertainty involved in identifying the nature of a cluster, and a score (from −1 to 1) close to 1 suggests a cluster that is more separated from other clusters; Mean Year: the recentness of these clusters; Citing articles: the intellectual base; Coverage: the proportion of cited members of a cluster that the citing article has cited 3.1.5. Thematic variation in the landscape.

Cluster #6 is labeled "health information", "e-medicine" and "personal health records". This cluster explores issues related to consumers' or patients' perceptions of their health information or their records being exchanged [53,54] and how they respond to the underlying risk of the loss of their privacy [55]. This cluster highlights the trend of data usage and privacy concerns in the medical field.

Cluster #2 makes an inquiry into the impact of the information privacy attitude taken by the service provider on the consumer's behavioral intentions (e.g., [56,57]). Cluster #4 focuses on consumer privacy concerns and the merits of the application of information technology, such as making markets more efficient. Cluster #5 studies the measure of electronic service quality (e.g., B2C platform, ATM, etc.), users' perceptions, and the resulting user behavior. Cluster #7 mainly explores the relationship between various individual-level and firm-level factors and their impacts on consumers' privacy perception. Cluster 8 concentrates on the analysis of the literature review. Cluster #9 focuses on consumer privacy calculus. The literature shows that a privacy calculus (risk-benefit evaluation) exists when consumers decide to proceed with information disclosure [47,58], purchase behavior [48,59], and user adoption of new digital services [52,60–62]. Cluster #10 addresses how to reduce privacy concerns by building consumer trust. Cluster #11 emphasizes the importance of government or public organizations' policies on regulating privacy security.

To sum up, each cluster reflects a thematic concentration, which can help us to further understand the thematic trends associated with consumer privacy. More importantly, these clustering results revealed in our study suggests that research on consumer privacy has a long way to go to comprehend consumers' complicated decision-making process when it comes to personal privacy.

Table 4 shows top ten structurally variational references in the synthesized network. These works are characterized by their traction effect on the entire consumer privacy research field since they can be considered landmark studies connecting the different aggregated groups. The descending order parameter is used to sort these references. The article with the highest betweenness centrality in our dataset is Reagle J [63], followed by Earp JB [64]. The third is the article by Bansal G [65]. The articles in the fourth to tenth positions are Brandimarte L [66], Moores T [67], Tang Z [68], John LK [69], Pavlou PA [70], Norberg PA [71], and Acquisti A [72]. Additionally, we list the 10 cited articles with the highest sigma. The top three highest sigma values are for the articles by Smith HJ [17], Dinev T [59], and Bansal G [65]. These works are identified as being more likely to represent novel ideas due to their transformative potential. For example, Bansal G [65]'s research opened up a new prospect for studying health information privacy by taking personal dispositions into consideration.

Table 4. Top 10 betweenness centrality and sigma references.

References	Betweenness Centrality	References	Sigma
Reagle J, 1999, Commun ACM	0.09	Smith HJ, 2011, MIS Quart	1.69
Earp JB, 2005, Commun ACM	0.08	Dinev T, 2006, Infor Sys Res	1.56
Bansal G, 2010, Decis Sup Syst	0.06	Bansal G, 2010, Decis Supp Syst	1.49
Brandimarte L, 2013, Soc Psy Pers Sc	0.06	Tang ZL, 2008, J Manage Info S	1.44
Moores T, 2005, Commun ACM	0.05	Brandimarte L, 2013, Soc Psy Pers Sc	1.42
Tang Z, 2008, J Manag Infor Syst	0.04	Hui KL, 2007, MIS Quart	1.38
John LK, 2011, J Consum Res	0.04	John LK, 2011, J Consum Res	1.37
Pavlou PA, 2003, Int J Elec Com	0.04	Earp JB, 2003, Commun ACM	1.35
Norberg PA, 2007, J Consum Aff	0.04	Malhotra NK, 2004, Info Syst Res	1.31
Acquisti A, 2013, J Legal Stud	0.04	Acquisti A, 2013, J Legal Stud	1.23

3.1.6. Emerging Trend Identification

Citation bursts have been successfully applied to capture the sharp increase in a relevant research interest. An upsurge in the frequency of a study's citation over a period of time is seen as a mark of academic focus, which implies an underlying research trend [24]. Therefore, we adopt citation burst detection to perform emerging trend identification. Table 5 provides a list of the top 45 references that have the strongest citation bursts. The dark blue bar represents the years in which articles received slight increases in citations, while the red bar shows that citations rise sharply. In order to provide insight into these references, we discuss only those papers with the greatest link strength that start to burst in the same year.

Table 5. Top 45 references with the strongest citation bursts.

References	Str.	Begin	End	1997–2019
Culnan MJ. 1999, Organ Sci	3.76	2001	2005	
Caudill EM. 2000, J Pub Poli Mark	3.69	2001	2004	
Federal Trade Com. 2000, Priv Onl	3.45	2001	2005	
Sheehan KB. 1999, J Advertising	14.56	2002	2005	
Hoffman DL. 1999, Commu ACM	13.75	2002	2005	
Urban GL. 2000, Sloan Manag Rev	10.14	2002	2005	
Miyazaki AD. 2002, J Consum Aff	5.92	2005	2008	
Luo XM. 2002, Ind Market Manag	4.34	2005	2008	
Milne GR. 2004, J Consum Aff	10.75	2006	2009	
Milne GR. 2004, J Interact Mark	10.18	2006	2009	
Malhotra NK. 2004, Info Syst Res	8.84	2006	2009	
Dinev T. 2006, Info Syst Res	15	2007	2011	
Awad NF. 2006, MIS Quart	8.77	2007	2011	
Chellappa RK. 2005, Info Tech Ma	8.58	2007	2009	
Dinev T. 2005, Int J Electron Com	7.39	2007	2011	
Flavian C. 2006, Ind Man Data Sys	7.22	2007	2011	
Bart Y. 2005, J Marketing	6.82	2007	2010	

Table 5. *Cont.*

References	Str.	Begin	End	1997–2019
Pan Y. 2006, J Retailing	10.02	2008	2011	
Kim DJ. 2008, Decis Support Syst	9.34	2008	2013	
Schlosser AE. 2006, J Marketing	8.22	2008	2011	
Pavlou PA. 2007, MIS Quart	4.93	2009	2012	
Tang ZL, 2008, J Manag Info Syst	4.21	2009	2014	
Son JY. 2008, MIS Quart	4.01	2009	2012	
Goldfarb A. 2011, Manage Sci	7.41	2011	2016	
Xu H. 2009, J Manage Info Syst	7.12	2011	2014	
Bansal G. 2010, Decis Support Syst	6.5	2011	2015	
Smith HJ. 2011, MIS Quart	18.65	2012	2016	
John LK. 2011, J Consum Res	7.43	2012	2015	
Ohm P, 2010, UCLA Law Rev	6.71	2012	2015	
Hair JF, 2010, Multivariate Data An	4.65	2012	2015	
Tsai JY. 2011, Info Syst Res	14.64	2013	2016	
Pavlou PA. 2011, MIS Quart	11.1	2013	2016	
Belanger F. 2011, MIS Quart	10.59	2013	2016	
Xu H, 2011, Decis Support Syst	10.08	2013	2016	
Garcia FD. 2011, Lect Note Compu Sc	6.55	2013	2016	
Kursawe K. 2011, Lect Note Compu Sc	5.03	2013	2016	
Youn S. 2009, J Consum Aff	8.17	2014	2017	
Mothersbaugh DL. 2012, J Serv Res	7.14	2014	2019	
Brandimarte L. 2013, Soc Psyc Per	5.64	2014	2019	
Li Y. 2012, Decis Supp Syst	5.59	2014	2019	
Tucker CE. 2014, J Marketing Res	15.8	2015	2019	
Dinev T. 2013, Eur J Info Syst	9.4	2015	2019	
Hann IH. 2007, J Manage Info Sys	7.83	2015	2019	
Keith MJ. 2013, Int J Hum-Comput St	5.74	2015	2019	
Acquisti A. 2006, Lect Not Comp S	5.74	2015	2019	

From 2002 to 2019, researchers focused on considering the issue of consumers' online trust building [73,74]; exploring the role that privacy regulation plays in raising online firms' privacy-related practices and affecting consumers' judgment [75,76]; examining the extent to which consumers are willing to control their personal information and whether privacy attitudes, offline data behaviors, online experience and consumer background predict the tendency to protect privacy [77]; demonstrating consumers' complicated decision-making process when involving personal privacy [59]; offering an interdisciplinary review of privacy-related research [17]; proposing the major driving factors for the uncertainty perception of B2C e-commerce adoption [78]; understanding whether the explicit display

of privacy information will affect consumers' consideration on their privacy and resultant behavior [79]; studying the theoretical correlation between privacy concerns and behavioral reactions in the online environment [13,80,81].

In light of the above discussion, the collection of these studies reveals distinct trends. First, early studies examined the theoretical relationship between diverse constructs and privacy-related proxies (e.g., trust, perceptions, beliefs, and attitudes) to shed light on what matters to consumers. Representative articles by Hoffman, Novak, and Peralta [82], Phelps, Nowak and Ferrell [50], Milne, Rohm and Bahl [77], Dinev and Hart [59], and Pan and Zinkhan [74] were thus identified as having the greatest citation bursts, which indicates that there is no adequate exploration of these relationships and their contextual nature. As Bélanger and Crossler [15] and Smith, Dinev, and Xu [17] suggested, the issue of how various contexts may influence privacy and privacy-related proxies still needs to be fully investigated. Second, some firms view consumers' data collection as an opportunity to improve marketing returns [83]. However, we know very little about the ramifications of firms' customer data management, let alone consumers' behavioral responses that might follow. Any privacy-related misconduct by firms may give rise to consumers' negative responses, which ultimately exert adverse effects on firm performance [5]. Hence, the differentiated impact of privacy-related practices on consumers' behaviors and consumer behavioral variability from the perspective of information privacy could be considered important topics for future research. Third, recent literature has produced few insights regarding the issue of what coping strategy to adopt under what conditions. An important management issue for marketers and researchers is to determine the appropriate policies or regulations firms should adopt to mitigate the adverse effects of consumers' resistant behaviors due to unreasonable access to consumers' information. In addition, we may underestimate consumers' initiative to share their personal information due to the existence of consumers' privacy calculus. Most previous studies have not clearly discussed how to manage the delicate balance between privacy risks and benefits. Works by Zeithaml, Parasuraman, and Malhotra [84], Wolfinbarger and Gilly [85], Angst and Agarwal [86], and Youn [80] mention this issue.

3.2. The Landscape from the Expanded Dataset

To test the robustness of our identification of emerging trends in the landscape from a core dataset, the citation index-based expansion was used to re-construct a new dataset. Through expanding the core dataset, we can capture more information as much as possible. Table 6 presents 43 references that have the strongest citation bursts. Identical to the rules in the core dataset investigation, we review only those papers with the greatest link strength that start to burst in the same year. From 1999 to 2018, researchers focused on introducing the concept of consumer privacy and outline a taxonomy that explicitly describes specific privacy concerns for consumers [12]; combining existing literature and deployment requirements in a real-world environment of commercial user modeling servers for e-commerce to offer a requirement catalog [87]; investigating what makes a business-to-consumer (B2C) website effective [88]; investigating what drives online shoppers' intended use of an e-vendor [89]; exploring online service quality and providing theoretical and practical implications [85,90]; presenting a recent technical literature review to investigate a series of problems regarding the relevance between radio frequency identification (RFID) and privacy and security [91]. examining the inherent links among variables including website usability perception, trust, satisfaction, and loyalty [92]. conceptualizing a trust-based consumer decision-making model in which they explore how trust and perceived risk may operate in combination to affect electronic purchase decisions [93]; investigating the determining factors affecting consumer acceptance of e-shopping [94]; extending the privacy calculus model to examine the personalization-privacy paradox in location-aware marketing [95].

Table 6. Top 43 references with the strongest citation bursts.

References	Str.	Begin	End	1997–2019
Wang HQ.1998, Commun ACM	3.41	1999	2002	
Fink J. 2000, User Mod User-Adap	11.22	2000	2005	
Culnan MJ. 1999, Organ Sci	22.04	2002	2006	
Hoffman DL. 1999, Commun ACM	21.65	2002	2006	
Ben Schafer J. 2001, Dat Min Know	20.74	2002	2006	
Ranganathan C. 2002, Info Manage	25.33	2003	2007	
Miyazaki AD. 2001, J Consum Aff	24.05	2003	2007	
Ba SL. 2002, MIS Quart	12.65	2003	2007	
Gefen D. 2003, MIS Quart	32.13	2004	2008	
Ben SJ. 2001, Data Min Know Disc	29.52	2004	2009	
Mcknight DH. 2001, Int J Electr C	28.58	2004	2009	
Pavlou PA. 2003, Int J Electro Com	27.19	2004	2008	
Suh B. 2003, Int J Res Mark	15.44	2004	2008	
Shankar V. 2003, Int J Res Mark	5.5	2004	2008	
Wolfinbarger M. 2003, J Retailing	17.92	2005	2011	
Koufaris M. 2004, Info Manage	16.88	2005	2009	
Weis SA. 2004, Lect Note Compu Sc	15.67	2005	2009	
Rust RT. 2004, J Marketing	6.62	2005	2010	
Parasuraman A. 2005, J Serv Res	56.91	2006	2010	
Pavlou PA. 2004, Info Syst Res	31.78	2006	2010	
Suh B. 2003, Intj Electr Comm	28.82	2006	2010	
Schroeder SA. 2005, Jama-J Am Med	22.17	2006	2010	
Malhotra NK. 2004, Info Syst Res	16.65	2006	2011	
Vijayasarathy LR. 2004, Info Man	16.18	2006	2011	
Juels A. 2006, J Sel Area Comm	44.06	2007	2011	
Schlosser AE. 2006, J Marketing	14.7	2007	2011	
Flavian C. 2006, Ind Manag Dat Syst	12.44	2007	2011	
Flavian C. 2006, Info Manage	36.75	2008	2012	
Safran C. 2007, J Am Med Info Assn	22.43	2008	2012	
Loiacono ET. 2007, Int J Electro Com	21.88	2008	2012	
Cyr D. 2008, J Manage Info Syst	20.79	2008	2013	
Chen YH. 2007, Ind Manage Dat Sys	18.05	2008	2012	
Hwang YJ. 2007, Decis Supp Syst	12.57	2008	2012	
Kim DJ. 2008, Decis Support Syst	51.79	2009	2013	
Hossain MM. 2008, IEE T En Manag	7.9	2009	2013	

Table 6. *Cont.*

References	Str.	Begin	End	1997–2019
Ha S. 2009, J Bus Res	32.12	2010	2014	
Lee MC. 2009, Electr Commer R A	27.6	2010	2014	
Pavlou PA. 2007, MIS Quart	20.56	2010	2014	
Kim DJ. 2009, Info Syst Res	17.55	2010	2014	
Goldfarb A. 2011, Manage Sci	13.22	2011	2016	
Li YM. 2011, Comput Hum Behav	10.91	2011	2015	
Xu H. 2011, Decis Supp Syst	15.81	2012	2018	
Lin HF. 2011, Int J Info Manage	14.31	2012	2018	

Some conclusions can thus be drawn. First, some articles with the strongest citation bursts, such as Culnan and Armstrong [13], Hoffman, Novak, and Peralta [82], Miyazaki and Krishnamurthy [75], Flavián and Guinalíu [92], Kim, Ferrin, and Rao [93], Goldfarb and Tucker [76], and Pavlou, Liang, and Xue [78] were identified again within a broader dataset scope, which underlines the importance of these influential studies. Second, it must be noted that some studies may exhibit emerging trends that have not yet been reflected within the landscape from the core dataset. For instance, there has been an apparent dearth of investigation on technical research in this domain. Despite the important contributions made by Ohkubo, Suzuki, and Kinoshita [96], Eckfeldt [97], and Juels [91], it is imperative to bridge the gaps between technical application and consumer privacy, which proves to be a great challenge. Third, some earlier basic research, such as Hoffman, Novak and Peralta [82], Jones [10], Wang, Lee, and Wang [12], Phelps, Nowak, and Ferrell [50], Miyazaki and Krishnamurthy [75], Culnan and Armstrong [13], and Pavlou [70] have contributed the most to this domain thus far. These research trends cohere with what we found in the landscape from the core dataset.

4. Discussion and Conclusions

In this paper, we used CiteSpace software and examined bibliographic records to provide state-of-the-art consumer privacy research as well as a glimpse of how this field may evolve in the future. To obtain a deep look into the whole picture of consumer privacy research, two datasets (core dataset and citation expanded dataset) were retrieved for analysis. Based on the analysis of the core dataset, we presented intellectual landscapes, including contributing journals, institutions, countries, and authors, as well as the evolution of research attention, emergent research clusters, and influential studies. Most importantly, emerging research trends were identified that may be useful for future research opportunities in the field of consumer privacy. We further investigated the expanded dataset to elucidate the emerging trends from a broader landscape. There are some notable findings with regard to the existing literature. First, the results show that consumer privacy has become an extremely valuable research area in the marketing field, as evidenced by advances in worldwide research output, theoretical development, and empirical investigation over the past decade. Second, the chronological distribution of keywords, network clusters, and the results of structural variation facilitated our understanding of the entire evolution of consumer privacy research. In other words, we identified not only previously popular topics but also some recent research trends. Taking recent topics as an example, studies have reflected the emergence of various research contexts (e.g., healthcare, financial, e-banking, and online payment). In addition, a transitional research trend was identified, such as Reagle J [63], Earp JB [64], Bansal G [65], Brandimarte L [66], Moores

T [67], Tang Z [68], John LK [69], Pavlou PA [70], Norberg PA, [71] and Acquisti A [72]. Third, earlier influential works in the field were identified, including Hoffman, Novak and Peralta [82], Jones [10], Wang, Lee, and Wang [12], Phelps, Nowak, and Ferrell [50], Miyazaki and Krishnamurthy [75], Culnan and Armstrong [13], and Pavlou [70]. These studies are important in terms of not only how they connect previously disparate patches of knowledge in a synthesized network but also their ground-breaking contributions to drive transformative changes of the knowledge in the consumer privacy domain. Therefore, they should be given adequate attention in the near future.

Our study also reveals some emerging topics that remain a challenge for future research in the domain. First, topics on consumer behavior have obviously dominated privacy research in the past few years. More empirical studies are needed to shed further light on the privacy-related influence mechanism, especially in contemporary research contexts such as healthcare, digital payment, online purchase, and mobile application. In these contemporary contexts, future studies are recommended on how firms' personal data use affects consumers' attitude, cognition, perception, trust, and subsequent behaviors; how tailored measures are developed; how specific firms' data management practices affect customer behaviors, and how any new relationship dimensions can benefit from marketing theorists and practitioners. Analyzing the relationship between privacy and consumer behavior in different contexts enables marketers to effectively meet consumer expectations. Second, only a handful of studies highlight the impact of data privacy on organizations. It is necessary to conduct in-depth explorations of the effects of consumers' privacy awareness on organizations' performance and practices. We believe that there are still some interesting research questions worthy of investigation regarding how specific consumer privacy concerns or awareness impact firms' performance and business strategies (e.g., marketing mix, product or service innovation) and how competitors will react in terms of marketing actions in personal data use. Third, though most of the articles we reviewed discuss consumers' willingness to trade their personal information for benefits, there is room for exploring what type of privacy content might be voluntarily traded by consumers for benefits, what the acceptance threshold is for consumers to agree to the implicit collection of information, particularly when it involves different contexts, and what this acceptance depends on. Fourth, as the public becomes aware of their rights to data privacy, consumers' trust and loyalty show more vulnerabilities once they recognize that their rights being violated [5]. Further studies could examine firm's recovery strategies to make amends or restore their customer relationships following events such as privacy leaks. Academicians and practitioners should give greater attention to appropriate marketing strategies that firms could take to mitigate the adverse effects of consumers' resistant behaviors. Fifth, firms might face ethical questions about the use of consumer data and analytics because less sophisticated consumers are more likely to be targeted by the sellers through quality or price discrimination. Therefore, it is imperative to promote social equity and protect public welfare via relevant laws and regulations. Further research might address what appropriate policies or regulations can be used to constrain firms' discrimination (e.g., pricing, racial, economic) against consumers due to the deployment of usage-enforcing technologies. Moreover, some thoughts must be considered with regard to how to synthesize organization, consumer, and ethical perspectives under an overall framework to understand privacy in marketing. Finally, these research trends call for the need to pinpoint the technical solution to privacy issues. As a double-edged sword, the advance of information technology has brought both positive and negative effects. Further researchers can design research on the relationship between legitimate technical applications and consumer privacy from a marketing perspective. For example, researchers need to know how the impact of privacy-enhancing technologies (e.g., RFID, user microtargeting technologies, sensor-based technologies) leads to consumer privacy concerns and behavior. Conversely, when firms deploy usage-enforcing technologies that ultimately jeopardize consumer welfare and benefits, more focus should be placed on

what kinds of technological solutions can be leveraged to minimize or even avoid negative reactions to the use of personal data and benefit both firms and consumers.

From the results presented, we may also find some implications for practitioners in the marketing field. Privacy-related consideration is becoming one of the most important factors affecting consumer attitude, judgment, and behavior, which implies that firms' privacy practice is closely related to their ultimate performance. Although more convenient services such as personalized service offerings and recommendations can be provided by many firms using consumer data, firms that prioritize data privacy protection are bound to be more highly valued by consumer. Marketers, as decision makers implementing marketing strategies, need to be aware of such changes among consumers regarding privacy concerns and their impact on consumer decisions. More training should be carried out in order to adapt to the new business environment.

Undoubtedly, this study has certain limitations. First, although we attempted to perform an extensive literature search, it is likely that we did not capture all records for analysis due to the limitations of our database. The edition of the Web of Science (Core Collection) we searched only supports retrospective research from the year 1985 to the present. However, this limitation does not affect our analysis results because the theoretical study of consumer privacy did not begin until the 1990s [10]. Second, in this study, we focused on only information privacy from a marketing perspective. Future studies could concentrate on a wider range of search terms, because our study's limited keywords and search parameters might lead to missed items. Third, CiteSpace supports bibliographic and citation data retrieved from a variety of sources, such as Scopus, Google Scholar, and more. Thus, future research can extend the sample of research records by using these sources to reach more robust conclusions. Finally, authors' production analysis could be further analyzed. It would be interesting for future research to explore topics such as influential authors' publishing activity and their impact on this field, as well as authors' collaboration network in terms of a subset of topics.

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