How online reviews affect purchase intention: A meta-analysis across contextual and cultural factors

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A B S T R A C T

The proliferation of online reviews has provoked a substantial deal of academic research, providing proof of online reviews' influence on purchase intention in consumer behavior. However, the current empirical research often yields inconsistent and inconclusive results. In order to bridge the gap in our understanding of the relationship between purchase intention and its determinants, a meta-analysis of 156 studies with 214 effect sizes and 69,006 observations was conducted. Additionally, two new factors - review content type and review format - were included in the study. The results showed that all antecedents significantly affect purchase intention, with review valence showing the most potent effect ($r = 0.563$). Furthermore, individualism, product type, and four study characteristics are important moderating factors. In conclusion, this study provides more reliable generalizations, and its findings are beneficial to scholars, managers, retailers, and website owners, for example, to help set the agenda for future research efforts and to provide practical guidance that could boost marketing activities.

1. Introduction

Over the past two decades, with the tremendous growth of social media and online user-generated content (UGC) platforms, electronic Word-of-Mouth (eWOM) has become an indispensable and reliable source of decision-making, reducing uncertainty and transaction costs. Among various forms of eWOM, online reviews become one of the most dominant forms due to their great flexibility, expressiveness, and user-friendliness. In marketing, online reviews are considered a powerful tool of the marketing communications mix and a type of free "sales assistant" for improving market performance (Chen & Xie, 2008). For example, 95% of consumers consider online reviews before purchasing. Previous literature also shows that consumers perceive online reviews as more valuable and trustworthy than commercial advertising (Ismagilova, Dwivedi, Slade, & Williams, 2017). Further, online reviews have a significant impact not only on consumers' decision-making but also on the firms' performance. According to the Spiegel Research Center (Biswas, Sengupta, & Ganguly, 2021), products with at least five reviews are 270% more likely to be purchased than those without available reviews. Realizing the value of online reviews, both firms and platforms strongly encourage customers to share their experiences or opinions.

Notably, online reviews have garnered a remarkable amount of academic research interest. As an essential predictor of actual behavior (Cheong, Muthaly, Kuppusamy, & Han, 2020), purchase intention has become the focal consequence of online reviews. In e-commerce, customer purchase intention is the most crucial customer variable to measure and take action against. Furthermore, there are many benefits to understanding consumer intent, such as improving conversion metrics, protecting brand perception, and driving consumer retention. Following a Web of Science literature search, the number of studies addressing the relationship between online reviews and purchase intention has increased consistently throughout the years. It has hovered around 680 in the past two years (see Fig. 1), signifying that purchase intention is becoming a notable concern in online review research. Extant empirical studies have demonstrated the influence of online reviews on consumers' purchase intention; for instance, on intention to purchase electronic products, such as laptops (Jia & Liu, 2018; Langan, Besharat, & Varki, 2017), cell phones (Jiménez & Mendoza, 2013; Shihab & Putri, 2019), and digital cameras (Bae & Lee, 2010; Brand & Reith, 2022), intention to choose restaurants or tourism destinations (Zhang, Zhao, Cheung, & Lee, 2014; Zhang & Wang, 2021), and intention to book hotels (Hernández-Ortega, 2018; Mauri & Minazzi, 2013; Zhao, Wang, Guo, & Law, 2015), to state a few. However, the literature provides fragmented and inconsistent findings. On the one hand,

findings regarding the role of online reviews on consumer purchase intention are not straightforward. For example, some studies (e.g., Brand & Reith, 2022; Sharifi, 2019) have established that review sidedness positively influences purchase intention, whereas another set of studies (e.g., Cheung, Luo, Sia, & Chen, 2009) posits that the relationship mentioned above as non-significant. On the other hand, existing literature does not offer a robust mechanism for the influence of online reviews.

These contradictions hinder the generalizability of results, causing confusion among researchers and practitioners. The absence of consensus makes it difficult to reach a meaningful conclusion and impacts future research work. In the context of eWOM communication, Many researchers have applied the scientific meta-analysis technique to reconcile the inconsistency resulting from methodological differences or heterogeneity among previous studies related to online reviews or purchase intention (Floyd, Freling, Alhoqail, Cho, & Freling, 2014; Hong, Xu, Wang, & Fan, 2017; Wang, Wang, & Yao, 2019; Li, Chen, & Zhang, 2020; Hu & Yang, 2021; Verma et al., 2023a; Verma et al., 2023b). However, the majority of existing meta-analytic studies focus on how online reviews affect sales or review helpfulness (see Table 1). Apropos of purchase intention, relevant studies concentrate on the eWOM communication research. Moreover, they did not consider the influence of review content type (functional vs. hedonic) and review format (text-based vs. picture-based) on purchase intention. Wang, Du, and Wang (2023) showed that the innate value of online reviews lies in the multiple dimensions of information that transcend the aggregate-level feature, such as review volume and valence. In addition, a picture is worth a thousand words. Picture-based reviews are more effective and could culminate in the highest trust perceptions (Park, Sutherland, & Lee, 2021). Briefly, linguistic features and the format of online reviews deserve attention. Also, the exclusion of relevant moderators (e.g., positivity degree of reviews, platform type, research settings) presents an incomplete picture of purchase intention. Finally, the limited number of studies included in previous meta-analyses suggests that some relevant studies need to be discovered and analyzed. Therefore, we conduct a comprehensive meta-analysis to examine all significant antecedents of purchase intention in the online reviews context. Moderators are selected based on theoretical relevance, prior literature, and data availability from primary studies.

Accordingly, we investigate the following research questions in the context of online reviews: (1)What are the predominant antecedents of purchase intention in the extant literature? (2)What is the associative strength of these factors with purchase intention? (3)Does the culture, product, platform, and study characteristics moderate the relationship between purchase intention and these variables? Response to these research questions will not only elucidate the mechanism behind consumers' assessment of purchase intention but also clarify contradictions in the extant literature. From the managerial perspective, our study could offer platforms several recommendations for effectively managing online reviews.

2. Literature review and hypotheses development

Online reviews contain valuable information for decision-makers. To better understand the effect of online reviews on purchase intention, we dismantle this social communication. Based on the dual processing perspective (Chaiken, 1980; Petty & Cacioppo, 2012), factors related to the review and reviewer directly impact purchase intention, while factors associated with the context (e.g., culture, product type, platform type) act as moderators. The theory and data availability from primary studies drive the inclusion of variables in our model. For example, relationships that appeared in less than three studies were not included (Hong et al., 2017). Similarly, the criteria for selecting moderators include their theoretical relevance, traceability, and availability from the primary studies: (1) Theoretical relevance derived from existing literature on online reviews; (2) Moderators proposed by previous meta-analytic studies; (3) Data availability from previous studies. Based on the above criteria, moderators can be categorized into three groups: contextual (product and platform type), cultural (individualism vs. collectivism), and methodological (scenario, sample, method). WEB APPENDIX A provides the fundamental definition and operationalization of all variables. Following a majority principle (Hong et al., 2017; Li et al., 2020; Purnawirawan et al., 2015), the expected relationships between purchase intention and its determinants are derived from tendencies of the extant literature and enclosed in the last column of WEB APPENDIX A, which are employed to forecast the consequences of the meta-analysis. A brief description of each central element is given below.
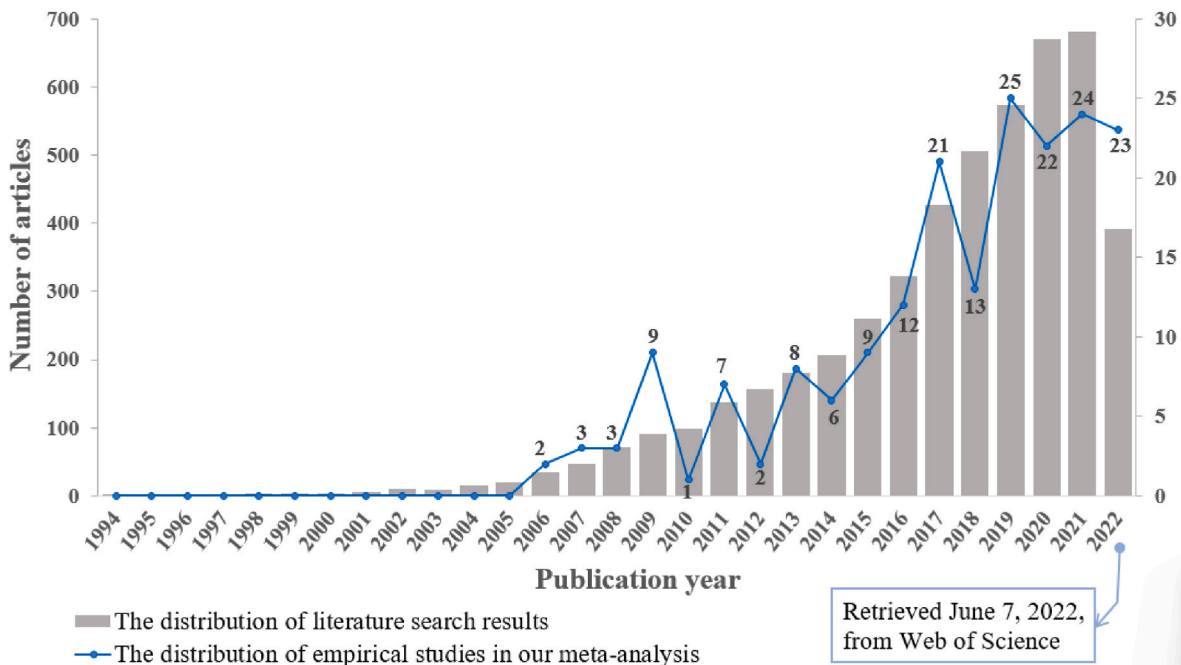

Fig. 1. The distribution of articles regarding the impact on purchase intention.

Table 1
Meta-analytic studies on eWOM related to online reviews or purchase intention.

Study	No. of articles included	Focal Consequences	Focal Antecedents
Floyd et al. (2014)	26	Retail sales	Review valence, Critics' reviews, Third party reviews, Frequency of purchase, and Product benefits
Purnawirawan, Eisend, De Pelsmacker, and Dens (2015)	34	Attitude, Perceived usefulness, Recommendation intention, Credibility, and Purchase intention	Review valence
Hong et al. (2017)	42	Review helpfulness	Review depth, Review readability, Review rating (linear/quadratic), Review age, Reviewer information disclosure, and Reviewer expertise
Wang et al. (2019)	53	Review helpfulness	Review length, Review volume, Readability, Review rating (linear/quadratic), and Review age
Ismagilova, Slade, Rana, and Dwivedi (2020a)	69	Intention to buy	Argument quality, Source credibility, Source expertise, Source trustworthiness, Tie strength, eWOM credibility, and eWOM usefulness
Ismagilova, Slade, Rana, and Dwivedi (2020b)	20	eWOM usefulness, eWOM credibility, eWOM adoption, Intention to buy	Source expertise, Source trustworthiness, and Homophily
Hu and Yang (2021)	27	Review helpfulness	Review valence, Review length, Review readability, Review age, Reviewer expertise, and Profile disclosure
Li et al. (2020)	28	Product sales	Number of reviews, Star rating, Std dev of ratings, Review helpfulness, Review length, Review sentiment, Reviewer's reputation, and Special shipping
Albayrak and Ceylan (2021)	21	Purchase intention	Twenty-one eWOM factors: relevance, timeliness, source credibility, usefulness, eWOM quantity, etc.
Zhu, Liu, and Dong (2021)	51	Perceived usefulness of online reviews and Purchase intention	Argument quality: review time, positive reviews, negative reviews, review depth, review pictures, and review replies. Source credibility: reviewer Information disclosure, reviewer trustworthiness, and reviewer expertise. Personal factor: trust tendency of review readers.
Moradi and Zihagh (2022)	89	Behavioral intention and eWOM adoption	Perceived informativeness, Message quality, Source trustworthiness, Source expertise, Tie strength,

Table 1 (*continued*)

Study	No. of articles included	Focal Consequences	Focal Antecedents
Verma, Dewani, Behl, Pereira, et al. (2023)	51	Responses to eWOM communication: credibility, attitude, adoption, and purchase intention (Credibility is the mediator)	eWOM usefulness, and eWOM credibility Argument Quality, Recommendation consistency, Recommendation valence, Recommendation sidedness, Recommendation rating, Source credibility, Source expertise, Source trustworthiness, Tie Strength, and Homophily
Verma, Dewani, Behl, and Dwivedi (2023)	179	Responses to eWOM communication: credibility, usefulness, attitude, adoption, and purchase intention (Credibility, usefulness, attitude, and adoption are the mediators)	Argument Quality, Recommendation consistency, Recommendation comprehensiveness, Recommendation quantity, Recommendation timeliness, Recommendation valence, Recommendation sidedness, Recommendation rating, Recommendation accuracy, Source credibility, Source expertise, Source trustworthiness, Tie Strength, and Homophily

2.1. Major determinants

2.1.1. Review-related antecedents

Review-related factors focus mainly on variables derived from the content (quality, sidedness, valence, consistency), message volume, and message rating. According to the dual processing perspective, consumers use various heuristics or cues to establish validity assessments and later form decision outcomes. For example, extant studies have used various theoretical perspectives (e.g., Elaboration Likelihood Model, Heuristic Systematic Model) to validate the impact of central cues such as argument quality (Zhang, Zhao, et al., 2014; Park et al., 2007) and review sidedness (Brand & Reith, 2022; Filieri, McLeay, Tsui, & Lin, 2018), and peripheral cues such as review consistency (Byun, Ma, Kim, & Kang, 2021), review valence (Jia et al., 2018), review volume (Park et al., 2007; Zhang, Zhao, et al., 2014), Zhang, Zhao, Cheung, & Lee, 2014nd review rating (Cheung et al., 2009) on responses to online reviews (credibility, usefulness, and purchase intention). With regard to review presentation format (text-based vs. image-based vs. video-based), prior studies showed that pictorial reviews are more informative, diagnostic, and persuasive than reviews without pictures (Le, Ly, Nguyen, & Tran, 2022; Liu, Feng, & Hu, 2022; Xu, Chen, & Santhanam, 2015), minimizing consumers' information overload and reducing uncertainty. In the online reviews context, capturing attention is exceptionally challenging, and visual cues could help (Park et al., 2021).

On the other hand, online reviews are effective narratives of customer experiences, which are essentially multidimensional. For example, affective content can elicit affective reactions from readers and

trigger their inferential processes, affecting their purchase decision (Wang et al., 2023). According to marketing communication literature, we focus on two types of review content: functional and hedonic (Liadeli, Sotgiu, & Verlegh, 2023). Functional content focuses on product-related information, such as product attributes and deals. Jiménez and Mendoza (2013) found that detailed reviews about a product are more credible and persuasive than general reviews, leading to higher purchase intention. Within hedonic content, we distinguish between emotional and social orientations. Ruiz-Mafe et al. (2018) suggested that consumers' emotions, in terms of high pleasure and degree of online review stimulation, constitute core causes that, in combination with online reviews' informativeness, result in high scores for consumers' intention.

Finally, according to the extended Information Adoption Model proposed by Erkan and Evans (2016), information usefulness and credibility strongly connect with consumers' behavioral responses. Perceived usefulness generally refers to the degree to which consumers believe that online reviews would facilitate their decision-making process of online shopping (Park et al., 2007). Similarly, Thomas et al. (2019) noted that review credibility positively affects consumers' purchase intention regarding a Yelp product or service in e-commerce.

Based on the above discussion, it is evident that review-related factors are an essential part of consumers' purchase intention.

2.1.2. Reviewer-related antecedents

Source persuasiveness perspective states that consumers rely on various source-related dimensions to mitigate uncertainty from online reviews. For example, through the attribution theory, Chakraborty (2019) underpinned that source credibility of online reviews affects brand equity dimensions, which ultimately affects consumers' purchase intention. The evaluation of a source is frequently measured in terms of source expertise, source trustworthiness, and source homophily. Source expertise is closely related to source credibility and is regarded as a primary mechanism for reducing uncertainty of online reviews in decision-making (Ketelaar, Willemsen, Sleven, & Kerkhof, 2015; Zhao et al., 2015). Ismagilova et al. (2020b) pointed out that the information seeker perceives less credibility of the source when it is untrustworthy. Further, the extent of the interpersonal relationship and degree of similarity (homophily) between the reviewer (source) and receiver significantly impact their response to eWOM communication (Saleem & Ellahi, 2017). Thus, it is necessary to investigate the effect of the source credibility in the context of online reviews.

2.2. Moderating effects

2.2.1. Culture: individualism versus collectivism

In the field of anthropology, culture refers to "… the interactive aggregate of common characteristics that influence a group's response to its environment" (Hofstede, 1984) and is deemed an influential factor that impacts consumer behavior and international marketing (Park & Lee, 2009a). Glancing at the e-commerce landscape from a global viewpoint will reveal geographical disparities. For example, Amazon, the most predominant online marketplace in the West, accounts for only 0.7 percent of the gross merchandise volume in China's B2C segment. As pertaining to online reviews, intercultural research dealing with purchase intention has received some attention in the literature (Brand & Reith, 2022; Le et al., 2022; Park & Lee, 2009a; Purnawirawan et al., 2015; Tran et al., 2020). For example, Park and Lee (2009a) compared the effect of the perceived usefulness of online reviews on the purchase influence of online reviews between Korean and USA consumers. Another study by Brand and Reith (2022) suggested that intercultural differences between Chinese and German glimpsed in the impact of review credibility on purchase intention. According to the extensive study by Hofstede, Hofstede, and Minkov (2005), national culture comprises five dimensions: power distance, individualism, uncertainty avoidance, masculinity, and long-term orientation. Among the dimensions of

culture, individualism may retain particular relevance to consumers' buying behavior. Consumers in high-collectivity cultures more frequently refer to online reviews for browsing than those in high-individuality cultures (Park & Lee, 2009a). Therefore, we explore the moderating role of national culture.

2.2.2. Product type: search versus experience

According to the product classification method of Peterson, Balasubramanian, and Bronnenberg (1997), products sold online can be classified into two categories: search and experience goods. Search goods, such as electronics, are products consumers can accurately appraise their apparent and functional attributes before purchasing. By contrast, experience goods are intangible and can be evaluated only by experience or consumption (e.g., restaurants and hotels). Due to the different attributes of goods, pre-purchase risk and uncertainty increase along the search-experience product continuum (Purnawirawan et al., 2015). Previous studies have demonstrated that consumers would respond differently to the characteristics of online reviews when encountering an experience rather than a search product. For example, Jiménez and Mendoza (2013) identified that the positive relationship between the credibility of online product reviews and purchase intention is different for search and experience products. Another empirical study conducted by Park and Lee (2009b) with 440 responses from South Korea found that the effects of eWOM direction (positive vs. negative) and a website's reputation on the eWOM effect are more prominent for experience goods than for search goods. Thus, it may be foreseen that antecedents in the online reviews context will exert diverse degrees of influence on search and experience products' purchase intention (Tsao & Hsieh, 2015).

2.2.3. Platform type: e-commerce versus third-party

Consumers use multiple online platforms to seek and share eWOM messages. In the context of online reviews, we concentrate on three main categories: E-commerce Websites (e.g., Amazon.com, Taobao.com, JD.com), Online Review Sites (e.g., Yelp, TripAdvisor), and Online Discussion Forums. Each category is perceived differently by consumers, which impacts the eWOM evaluation and its consequences. For example, e-commerce platforms provide extensive information on products and user experiences, while they provide limited information about the reviewers (Babić Rosario, Sotgiu, De Valck, & Bijmolt, 2016). In contrast, consumers have a greater level of interaction in online forums than on other channels, enhancing the believability and trustworthiness of posted messages (Tsao & Hsieh, 2015). In a nutshell, different platforms provide different degrees of social interaction, source information, and information richness, which can influence consumers' attitudes and subsequent decisions. Further, researchers suggested that the platform's perception and characteristics moderate the impact of eWOM on different outcomes, such as credibility, purchase intention, and sales (Babić Rosario et al., 2016; Floyd et al., 2014). Therefore, we explore the moderating role of product type.

2.2.4. Study characteristics

Several methodological characteristics could moderate the impact of online reviews on purchase intention. Following previous meta-analyses, we identify some variables, including the publication year, the positivity degree of online reviews used in research (positive vs. negative), subject type (student or non-student), and research method (questionnaire or experiment). We also code whether the descriptions of the products or services used in the study are accompanied by pictures. That is a part of the research design. The presentation of the product or service cues (e.g., brand, picture, price, description) or the mock-up website is all about creating a more realistic environment. Visual cues are more intuitive and can help to capture the subjects' attention (Amin, Mahomed, Ab Aziz, & Hashim, 2021; Ketron, 2017), which may influence consumers' subsequent judgment. According to confirmation bias (Nickerson, 1998), people are more likely to consider information consistent with their beliefs or predispositions when forming an

evaluation. Given that people are reading online reviews to assist them in their purchase decisions, it is very likely that people give more weight to positive than negative reviews (Purnawirawan et al., 2015). Therefore, we explore the moderating role of these study characteristics.

3. Method

3.1. Data collection

Our meta-analysis followed guidelines for conducting systematic reviews and conformed to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards (Moher, Liberati, Tetzlaff, & Altman, 2009). In Web Appendix B, we outline the detailed procedure of the database construction, and in Web Appendix G, we report the final list of studies. First, a computerized bibliographic search was executed using high-profile academic electronic databases (e.g., Web of Science, EBSCO, Science Direct, Emerald), followed by an Internet search on Google Scholar and Research Gate. Second, we manually searched relevant journals on information systems, economics and management, and marketing (for a similar approach, see Babić Rosario et al. (2016)). Finally, employing a snowballing procedure, the references of studies identified in the preceding searches were scrutinized. After excluding the duplicate articles, the initial search yielded 6973 unique hits. According to the research goal, we made the following selection criteria when collecting related articles: (1) its research topic is related to online reviews; (2) it is an empirical study; and (3) it must probe the association between online reviews and purchase intention. Titles and abstracts of these hits were reviewed based on the selection criteria, resulting in 532 papers that were selected for in-depth reading. Then, we applied the following inclusion rules to evaluate each study in detail: (1) studies must report sample size; (2) correlational studies have to report the correlation coefficient (r) or the standard regression coefficient (β); and (3) studies of group contrasts have to report related statistics for the relationship between purchase intention and any antecedent. All 532 articles were screened according to the inclusion rules, leading to 149 studies in the present meta-analysis. Based on the snowballing procedure, 7 additional publications are identified. Ultimately, we included 156 articles in our meta-analysis, including 138 peer-reviewed journals, 1 dissertation, and 17 conference papers (see WEB APPENDIX G).

3.2. Data coding

To reduce error when collecting relevant and descriptive information from each study, we specified a coding protocol with agreed-on inclusion criteria, definitions, and guidelines on deriving effect sizes. Two coders reviewed the entire data set, and a third validated 80% independently. The intercoder reliability was achieved at 93% after resolving the disagreements through discussion. Given that the correlation coefficient r is a scale-free measure easier to interpret in the marketing literature (de Matos & Rossi, 2008), we selected r as the primary effect size metric. The correlation coefficient reveals the direction and strength of the relationship between online reviews and purchase intention. If the correlation coefficient was unavailable in the original study, we could transform related statistics, such as beta coefficients, t-tests, and F-ratios, into r-coefficients using standard guidelines (Lipsey & Wilson, 2001; Peterson & Brown, 2005). For studies with missing correlations or effect sizes, we contacted the authors for correlation matrices or raw data. It is noteworthy that some studies broke down constructs and thus reported multiple correlations. In this case, we averaged the correlations between sub-constructs and reported the data as a single study (Blut, Chowdhry, Mittal, & Brock, 2015).

Specifically, for the two types of review content, we mainly operationalized functional as informational content (e.g., level of detail, comprehensive, informativeness). We operationalized hedonic content as (1) emotional (e.g., related to emotions, arousal, sensory) or (2)

related to social content (e.g., social presence). In the moderator coding, we coded each study based on culture (individualism; collectivism), product type (search products; experience products), platform type (e-commerce; others), positivity degree (positive; negative), subject (student; non-student), research method (questionnaire; experiment), and product image (present; non-present). As for culture, we marked studies as individualistic or collectivistic based on a country's score on Hofstede's individualist scales. (Mou, Cohen, Bhattacherjee, & Kim, 2022).

3.3. Integration of effect sizes

As recommended by Schmidt and Hunter (2014), we used the random-effect model to estimate pair-wise correlations in our meta-analysis. The meta-analysis was conducted in the Metafor package in R version 4.1.11. Coefficients were converted into Fisher Z before integrating the effect size. We also conducted Hedges's test for homogeneity and applied a 75% rule-of-thumb to evaluate the heterogeneity of the effect size distribution (Schmidt & Hunter, 2014). Additionally, Orwin's (Orwin, 1983) fail-safe Number (FSN), funnel plot, and Egger's test (Egger, Smith, Schneider, & Minder, 1997) were employed to appraise the robustness of the findings and potential publication bias. Finally, the moderating role of culture, product type, platform type, and study characteristics was undertaken by conducting the meta-regression. Due to limited observations for the degree of positivity, we adopted the subgroup analysis for this moderator. Further, in line with existing literature (Card, 2015), we conducted the subgroup analysis, even when the sample size for a specific subgroup was less than three.

4. Results

We organized our findings into two main sections. First, we provided the results of heterogeneity tests, publication bias tests, and the random-effect model. Second, we reported the results of the moderator analysis.

4.1. Calculation of effect sizes

Table 2 presents the results of the quantitative synthesis of the 15 relationships, and all pair-wise correlations in our meta-analysis are positively significant. As observed, 67, 58, 46, and 41 studies examine the impact of review valence, review volume, argument quality, and source credibility on consumers' purchase intention, respectively, indicating that the four factors are undoubtedly the principal points of interest in online reviews research. Across various studies, the combined effect size is most potent for review valence (r = 0.563), followed by review usefulness (r = 0.481), review credibility (r = 0.460), and source homophily (r = 0.451). Also, there is an intermediate relationship between purchase intention and review rating (r = 0.443), review sidedness (r = 0.3981), review format (r = 0.3976), source trustworthiness (r = 0.391), source expertise (r = 0.374), argument quality (r = 0.354), review volume (r = 0.317), functional review (r = 0.301) based on the Cohen classification (Cohen, 1988). However, source credibility (r = 0.279), review consistency (r = 0.272), and emotional review (r = 0.223) have a small effect on purchase intention.

In addition, we also appraised the extent of heterogeneity using the Q-statistic and the individual I^2 value for each relationship. As depicted in Table 4, Q-estimates for all relationships are significant at $p < 0.001$. The I^2 value ranges from 91.3% to 98.0%, higher than the recommended level of 75%. In turn, the heterogeneity test results confirm our hypothesis of the random effect model. Furthermore, a publication bias test was conducted on 15 pairs of relationships. First, contour-enhanced funnel plots of all variables were generated. Visual inspection of the relationship between effect sizes and their corresponding standard errors reveals roughly symmetrical distributions (see Fig. 2). However, inferences from funnel plots are always somewhat subjective. Therefore, the fail-safe N test and Egger's regression test were performed to

Table 2

Meta-analytic effect sizes of varied factors on purchase intention.

Factor	k	Sample size	Combined ES	95% Confidence interval	Q	I²
Functional review	29	8242	0.301***	[0.2282; 0.3712]	321.26***	91.3%
Emotional review	16	4972	0.223**	[0.0836; 0.3539]	420.73***	96.4%
Review format	26	7364	0.398***	[0.3253; 0.4653]	344.91***	92.8%
Review volume	58	17349	0.317***	[0.2382; 0.3923]	1811.26***	96.9%
Review valence	67	25570	0.563***	[0.4937; 0.6259]	3000.39***	97.8%
Review rating	30	8728	0.443***	[0.3319; 0.5425]	1167.00***	97.5%
Review sidedness	11	5611	0.398***	[0.2504; 0.5277]	370.43***	97.3%
Review consistency	20	8127	0.272***	[0.1783; 0.3600]	383.08***	95.0%
Argument quality	46	15072	0.354***	[0.2641; 0.4372]	1820.30***	97.5%
Review usefulness	36	12025	0.481***	[0.3593; 0.5872]	1899.71***	98.2%
Review credibility	39	15136	0.460***	[0.3727; 0.5395]	1680.79***	97.7%
Source credibility	41	14971	0.279***	[0.1795; 0.3724]	1568.05***	97.4%
Source expertise	18	5626	0.374***	[0.2562; 0.4804]	521.65***	96.7%
Source trustworthiness	11	3432	0.391***	[0.2041; 0.5509]	392.29***	97.5%
Source homophily	7	3448	0.451***	[0.2357; 0.6247]	240.61***	97.5%

Note: * for $p < 0.05$, ** for $p < 0.01$, *** for $p < 0.001$; k: number of studies; ES: effect size.
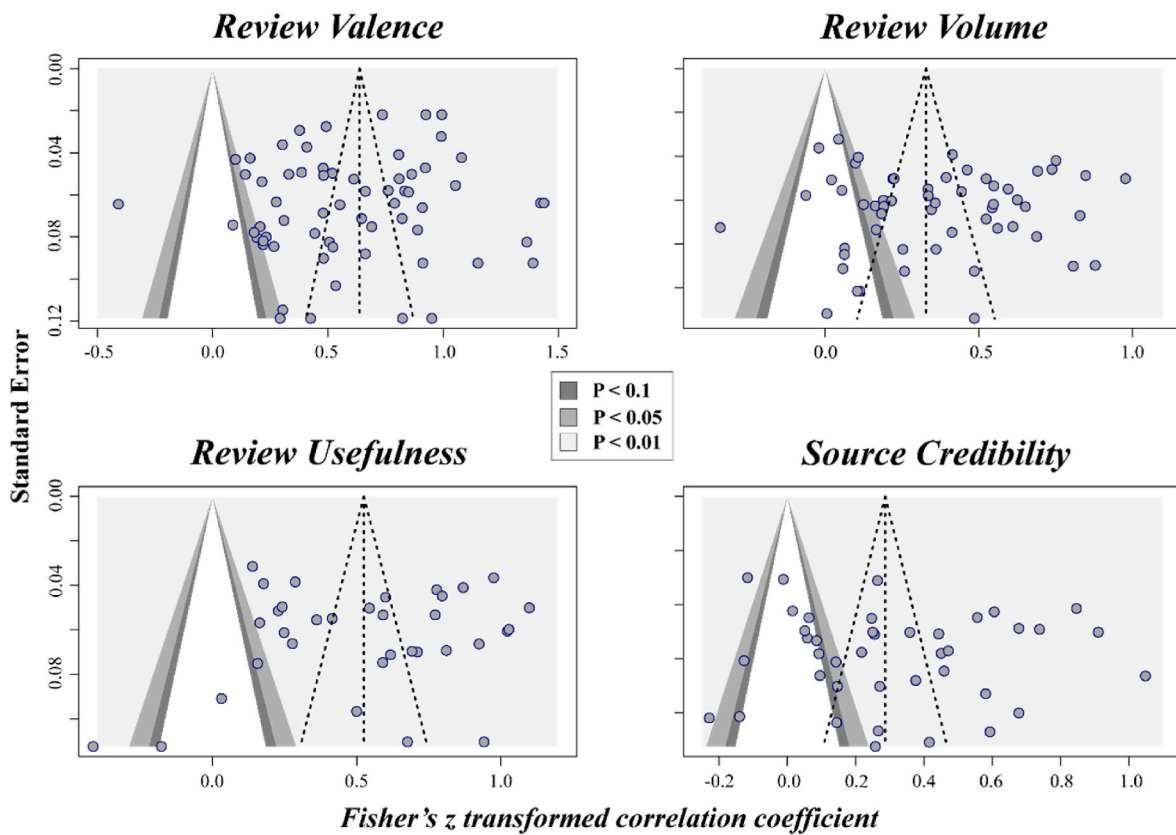

Fig. 2. Contour-enhanced funnel plots of review valence, review volume, review usefulness, and source credibility. Colors signify the significance level of each study in the plot. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

interpret the funnel plot quantitatively (see Table 3). Egger's test for all relationships fails to reach a statistically significant level at $p = 0.05$, representing no significant publication bias. For each pair of relationships, the ratio of the fail-safe N value and the number of observed correlations exceeds the threshold value of 2.0 (Verma et al., 2023a). Therefore, all pair-wise correlations pass the fail-safe N test, verifying the results of Egger's test.

4.2. Analysis of moderator effects

Moderator analysis is necessary when systematic heterogeneity among effect sizes exists. According to Blut et al. (2015), a statistically significant Q-statistic indicates the presence of systematic

heterogeneity. As reported in Table 2, we have high amounts of heterogeneity. Therefore, we have tested the impact of four types of moderators, mainly culture, product type, platform type, and study characteristics. Table 4 shows the significant meta-regression results. Platform type does not significantly impact the relationships' strength. Regarding the culture, it only negatively moderates the relationship between source trustworthiness and purchase intention ($β = −0.581***$). The meta-regression analysis also establishes the moderating role of product type, which can only happen within the relationship between review usefulness and purchase intention ($β = −0.348*$). Unexpectedly, different study characteristics demonstrate diverse moderating effects. In particular, relationships between purchase intention and review valence ($β = 0.037**$) and source trustworthiness

Table 3
Tests for publication bias.

Factors	Fail-Safe N			Egger's test		
	$N_{fs.0.05}$	k	N/k	95% Confidence interval	t-value	p-value
Functional review	148	29	5.10	[-3.92; 5.29]	0.29	0.774
Emotional review	54	16	3.38	[-7.66; 7.69]	0.003	0.998
Review format	188	26	7.23	[-0.96; 9.71]	1.608	0.121
Review volume	314	58	5.41	[-5.09; 5.69]	0.11	0.912
Review valence	767	67	11.45	[-5.66; 1.75]	−1.034	0.305
Review rating	250	30	8.33	[-9.51; 9.12]	−0.041	0.967
Review sidedness	81	11	7.36	[0.41; 18.7]	2.047	0.071
Review consistency	89	20	4.45	[-5.13; 7.51]	0.37	0.715
Argument quality	285	46	6.20	[-6.17; 6.46]	0.044	0.964
Review usefulness	332	36	9.22	[-8.8; 7.4]	−0.169	0.866
Review credibility	340	39	8.72	[-2.67; 11.2]	1.205	0.235
Source credibility	188	41	4.59	[-4.22; 9.04]	0.712	0.481
Source expertise	120	18	6.67	[-12.84; 7.44]	−0.522	0.608
Source trustworthiness	77	11	7.00	[-21.77; 1.45]	−1.715	0.120
Source homophily	60	7	8.57	[-22.92; 13.38]	−0.515	0.628

Note: * for $p < 0.05$, ** for $p < 0.01$, *** for $p < 0.001$.

Table 4
The significant results of meta-regression.

Moderator	Factors	k	β	95% CI
Culture	Source trustworthiness	9	−0.581***	[-0.675; −0.468]
Product type	Review usefulness	30	−0.348*	[-0.562; −0.091]
Publication year	Review valence	67	0.037**	[0.015; 0.06]
	Source trustworthiness	11	0.093*	[0.01; 0.176]
Picture accessibility	Review format	26	−0.262**	[-0.407; −0.104]
Research subject	Argument quality	46	−0.223*	[-0.408; −0.022]
	Source expertise	18	−0.280*	[-0.519; −0.001]
	Source homophily	7	−0.463*	[-0.728; −0.078]
Research method	Emotional review	16	0.373**	[0.13; 0.574]
	Review format	26	0.201*	[0.047; 0.346]
	Review sidedness	11	−0.355*	[-0.63; −0.001]
	Argument quality	46	0.301**	[0.115; 0.467]
	Review usefulness	36	0.313*	[0.011; 0.563]
	Review credibility	39	0.312**	[0.12; 0.481]
	Source credibility	41	0.23*	[0.026; 0.415]
	Source homophily	7	0.463*	[0.078; 0.728]

($β = 0.093^*$) are moderated by publication year. Research method has the widest range of moderating roles, including emotional review, review format, argument quality, review usefulness, review credibility, source credibility, and source homophily. As shown in Table 4, picture accessibility and research subject serve adverse moderating effects. WEB APPENDIX D in the supplementary material presents the comprehensive meta-regression results. According to the subgroup analysis in WEB APPENDIX E, positivity degree significantly moderates the relationship between purchase intention and emotional review (Q = 8.76**), review consistency (Q = 17.93***), review usefulness (Q = 12.77***), source credibility (Q = 6.44*), and source expertise (Q = 4.95*).

In addition, we conducted the permutation test to assess the robustness of our meta-regression model (Higgins & Thompson, 2004). Permutation tests do not require a spare "test" data set on which we can evaluate how our meta-regression performs in predicting unseen effect sizes. WEB APPENDIX F shows that the marginal change in p values from the meta-regression and permutest function demonstrates the robustness of our findings. Due to the small number of included studies, the results of source expertise and source homophily after the permutation test become slightly insignificant.

5. Discussions and implications

5.1. Discussions

Given the critical role of online reviews in current marketing, it is essential to take stock of the research in this field and provide guidance for its further development. Prior studies on the influence of online reviews on consumers' purchase behavior have yielded inconsistent conclusions. In this regard, we adopted a meta-analytic approach to develop and examine a research model of consumers' purchase intention. Guided by the previous literature and PRISMA standards, we can now elaborate on the issues raised in the introduction section.

Our univariate meta-analytic analysis reveals that all the review-related and source-related factors significantly influence consumers' purchase intention. It is consistent with the results we expect in the WEB APPENDIX A. The combined effect size of review valence on purchase intention is 0.563 (n = 25,570), which is numerically much higher than other meta-analysis results, including Purnawirawan et al. (2015) (r = 0.229, n = 4643) and Ismagilova et al. (2020a) (r = 0.241, n = 6777) .[1] According to Cohen and Cohen (1983), the test of the discrepancy between these correlation coefficients is statistically significant (Z-score = 25.323, p < 0.001; Z-value = 28.641, p < 0.001). The number of original studies and social context are important factors that cannot be overlooked. Purnawirawan et al. (2015) collected 11 relevant studies (one in 2008, seven in 2009, two in 2011, and one in 2012) and merely focused on experimental studies. Ismagilova et al. (2020a) draw a "big picture" of eWOM factors influencing consumers' intention to buy and acquire 21 effect sizes related to valence. In contrast, more studies were incorporated into our meta-analysis, and the moderating effect of the publication year on review valence confirms that the effect size of review valence may change over time. A possible reason is confirmation bias—a tendency of humans to overweigh information that confirms their initial beliefs and positions (Nickerson, 1998). In the online reviews context, a great deal of positive reviews flood the web, causing higher purchase intention for positive reviews compared to negative reviews (positivity bias) (Yin, Mitra, & Zhang, 2016).

In addition to the intuitive review rating, the significant impact of reviews with pictures and two-sided information suggests that visual

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[1] Since Purnawirawan et al. (2015) and Ismagilova et al. (2020a) did not report the sample size, we obtained approximate values by inspecting studies included in their meta-analysis.

clues and double-edginess help consumers evaluate comments with little cognitive effort. On the other hand, in the absence of peripheral cues, consumers would consider the central cues (e.g., argument quality, functional and emotional content of the review). Functional and emotional content reflect multiple dimensions of information about user experiences and value perceptions. As for source-related cues, existing studies have already established the essential role of source characteristics in eWOM. Our study wants to emphasize the significance of homophily. The perceived social relationship established even in a virtual environment is an essential cue through which consumers appraise the information's credibility. Further, the usefulness and credibility of online reviews serve as two integral parts of consumers' decision-making, with their effect sizes second only to review valence. They represent the overall perception of a combination of various cues.

The findings of the meta-regression and subgroup analysis partially explain why conflicting findings are found in existing studies. Inconsistent with the extant eWOM literature (Babić Rosario et al., 2016; Verma et al., 2023a), platform type does not show any effect. According to Verma et al. (2023b), the lack of clarity regarding the sample mix is one reason for the insignificant impact. Culture and product type only emerge as significant moderators on source trustworthiness and review usefulness, respectively. Specifically, the impact of source trustworthiness on purchase intention is stronger in the collectivistic culture than in the individualistic culture. Perceived usefulness correlates with purchase intention for experiential products more than search products. The moderator analysis for the study characteristics for the publication year, subject type (student or not), method (experiment or questionnaire), and the existence of visual description capture more significant results. For example, the impact of review format is weaker when visual cues about the product or service are provided. Maybe more is less sometimes. If product-related information conflicts with reviews with pictures, cognitive dissonance may disrupt consumers' judgment (Amin et al., 2021). In terms of research method, all significant relationships are stronger when using the questionnaire. Given that the results are subject to sample randomness and covariates in an experimental context, there is a greater chance of less error variance (de Matos & Rossi, 2008). Further, our study briefly explores the relationship between methodological variables and other moderators using multivariate meta-regression analysis. When controlling for study characteristics, the moderator role of culture, product type, and platform type have no significant changes. In conclusion, study characteristics matter.

5.2. Theoretical implications

Based on the collected literature, we adopt meta-analysis as a statistical tool to not only address the contrasting findings of previous studies but also test the moderating role of culture, product type, platform type, and study characteristics. The theoretical implications are twofold. First, given that online reviews serve as the decision-making compass for the vast majority of travelers and online shoppers, we not only empirically validated the theoretical framework of previous research (e.g., Purnawirawan et al., 2015; Ismagilova et al., 2020a; Ismagilova et al., 2020b; Verma et al., 2023a; Verma et al., 2023b), but also added a few new variables. Based on the dual-processing perspective and source persuasiveness perspective, our paper incorporated almost all the antecedents of purchase intention related to the review and reviewer in one integrative model. With the proliferation of Internet technologies, from text to graphics to short videos and live streaming, the form in which users access information is constantly evolving. Pictures or videos bring value that traditional media do not have. Further, due to the multimodality and accessibility of information, how online content holds consumers' attention has become a critical social issue. Therefore, we also synthesized review content characteristics and formats to understand their real effects. Our findings demonstrated that consumers adopt a multi-cue fusion decision-making process (Petty & Cacioppo, 2012). Thus, we minimize the model specification error by

including or controlling as many pertinent variables as possible (Verma et al., 2023a). In addition, univariate analysis can reveal which antecedents of purchase intention are the worst, best, and most commonly studied. For example, the relationship between purchase intention and source homophily or emotional review has attained less attention from researchers.

Second, we conducted both the meta-regression and subgroup analysis to investigate the role of different moderators. Our results provide a more in-depth and conditional comprehension of purchase intention and help us explain why some predictors are more prominent in a given culture and situation. For example, Hofstede's cultural dimensions (i.e., individualism and collectivism) can clarify why source trustworthiness has a higher impact in collectivistic culture than in individualistic culture. Further, moderating analysis of study characteristics complements the boundary conditions of purchase intention in the context of online reviews. Our findings highlight research method (experiment/survey) and sample type (student/non-student), which capture the heterogeneity in many factors. In terms of research design (picture/non-picture), when the description of a product contains images, the text-based review exerts a greater influence than the review with pictures. Thus, it is important to take cultural, product, and research factors into consideration when researchers build conceptual models.

5.3. Managerial implications

From a practical perspective, this study provides meaningful implications for marketers formulating sales strategies and for platforms making management decisions.

In the past, users' judgment has relied heavily on ratings, helpful votes, and the volume of reviews, among other aggregated factors. However, information overload is intensifying, and online shoppers have become more mature and rational. Relying just on these elements is insufficient. Nowadays, how to manage online reviews has become a meaningful direction. Our study confirms that all review-related factors positively influence consumers' purchase intention. Therefore, platforms or companies should encourage consumers to write and share online reviews. For example, platforms can offer a standard template that can be used by consumers to share the pros and cons of a product in their reviews. Currently, the prevailing thought is that "Content is king". Though not the most influential, functional or emotional content is also crucial. Therefore, companies and platforms should encourage consumers to express their informational (the attributes of the product or service) and emotional (description of emotional states, such as pleasure, fun, enjoyment, or other attractive states) needs in online reviews. With the help of text analysis techniques, platforms can excavate users' motivations, emotions, viewpoints, and intentions from the content they generate. According to the feelings-*as*-information theory (Schwarz, 2012), viewing pictures can evoke affective feelings and further influence consumers' consumption decisions. Marketers and platforms can develop review-generation guidelines and support systems and provide suggestions or tools to refine user-uploaded pictures, which enhance the synergy between image comments and textual content. Incentive is a key enabler. Marketers and platforms should provide financial incentives (e. g., discounts, coupons, cashback, extended warranty, and free delivery) to facilitate consumers sharing online reviews.

In addition to increasing customer participation in review generation, retailers, companies, and platforms should also pay attention to improving the credibility and usefulness of online reviews. Review credibility and usefulness can reduce uncertainty, which results in higher persuasive effects. Furthermore, a growing problem of fake reviews has increased consumers' skepticism towards online reviews. Therefore, organizations should focus on those attributes that increase credibility and usefulness. For example, aside from helpfulness ratings, platforms could display credibility ratings, which help consumers locate credible reviews quickly. In terms of source-related attributes, platforms

should disclose as much information as possible about the reviewer so that consumers can judge the reviewer's reliability. Special badges or tags could be effective. It is noteworthy that a few social connections between consumers (source homophily) can make huge waves. Companies and platforms should also encourage the reviewer to display their social media profile.

Further, our work finds that product-related information can attenuate the impact of reviews with pictures, arising from a discrepancy between the product information and the users' actual expectations. Also, our results show that negative reviews have a huge detrimental effect on consumers' purchase intention. Therefore, platforms should continuously monitor online content and respond promptly to negative comments, especially those containing pictures. Likewise, companies and platforms should focus more on maintaining good consumer relationships. For example, quick resolution of consumer complaints on e-commerce platforms will help retailers reduce the negative impact of online reviews. More importantly, any negative reviews penned by the expert reviewers should be addressed on an urgent basis.

Finally, our findings show that several moderators may affect our conclusions. Considering online review platforms are often international, our results show that managers or marketers should adapt different strategies to account for differences in country characteristics. Similarly, online reviews for experience products are more valuable for consumers than search goods. Furthermore, practitioners need to be careful when comparing the impact of review valence and source trustworthiness across time, indicating that a more sophisticated and integrated marketing strategy is required.

6. Limitations and future work

Although most findings can be understood as statistically significant, our study is not without limitations. First, this meta-analysis is restricted by the comprehensiveness of literature retrieval and the quality of data described in the selected literature, revealing an intrinsic limitation of electronic databases and retrieval terms. For example, we did not search for unpublished studies, working papers, and dissertations examining online reviews. Second, the classification of review type is constrained to emotional and informational due to data constraints. Other types than just traditional broad-stroke content dimensions (Berger et al., 2020; Wang et al., 2023) remain unknown. Regarding review format, the video-based format of online reviews has recently earned the attention of researchers. Previous research showed that video reviews have conflicting effects on purchase decision. Therefore, it will be an excellent venue for future research to synthesize the effects of online reviews attached to videos uploaded by reviewers. Third, our meta-analysis focuses on first-hand data collected using surveys or experiments. Second-hand data scraped from online review systems is seldom employed in this field owing to a lack of actual metrics of purchase intention. Drawing on Chevalier and Mayzlin (2006), which regarded sales rank as a proxy of product sales, a potential proxy variable for purchase intention may be used in future studies.

Fourth, due to the insufficient data, our study is constrained to investigate the moderating influence of culture, product type, platform type, and study characteristics. It is noteworthy that platform type has no moderating influence. Given data constraints, our study's categorization of platform type (e-commerce and third-party) is a little crude. Each platform provides a different level of social interaction, information presentation, and information richness. Thus, more granular platform categorization deserves further exploration (Verma et al., 2023b). On the other hand, additional research is needed to explore how other moderators (e.g., type of website, reviewer characteristics, brand) may affect the influence of online reviews on purchase intention. By conducting a single-paper meta-analysis of the six experimental studies, Grewal and Stephen (2019) showed that mobile reviews, compared to nonmobile reviews, positively influenced purchase intentions. On the other hand, this study considered individualism as categorical

moderators based on the midpoint of Hofstede's cultural scales. According to the regression approach to analyzing continuous moderators, future studies can directly examine the interaction of online review variables and cultural index (Tang, 2017).

Finally, all variables in this meta-analysis are evaluated separately. Given the diversification of research theories in online reviews research, our present meta-analysis may have intrinsic multi-level structures. For example, following the theory of reasoned action, trust exhibits the mediating role between online reviews and consumers' purchase intention. (Ventre & Kolbe, 2020; Zhang, Cheung, & Lee, 2014). Future research should test various theories to advance the knowledge of this field based on the meta-analysis structural equation modeling technique.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dim.2023.100058.

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