The role of cognitive complexity and risk aversion in online herd behavior

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Abstract

This paper investigated the role of information related, social and customer characteristics in public information adoption tendencies of online customers to result in herding in e-commerce. E-commerce platforms contains numerous online reviews about products which have the potential to influence customers. We applied structural equation modeling and a 2×2 scenario experiment to empirically verify the effect of a few factors in creating online herding. Two levels of cognitive complexity (simple, complex) and risk aversion (risk averse, risk taker) formed the 2×2 factorial design. The study's primary finding was that a person with simple cognitive structure and risk avoidance tendency may exhibit higher intention to adopt public information and engage in herding. Information specific attributes contributed maximum towards information adoption and herding. Among sociological variables, only reputation concern significantly predicted both information adoption and herding. Theoretically, the study offered a framework to explore herding intentions online and augmented the observations from the information adoption model. The quality of concise information from credible sources significantly instigates adoption of public information contained in online reviews. From the perspective of marketers, having a better understanding of herding behaviors and its mechanisms can enable the e-commerce platform to reduce herding's erosion on the wisdom of the crowd by optimizing its information structures (i.e., public information, private information, etc.).

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1 Introduction

E-commerce applications have eased customer lives by offering a plethora of comforts [1]; however, they are not free from complexities affecting overall customer experience [2]. The factors critical to online purchase decisions are continually intriguing marketers and remain the cynosure of academic research. The lack of face-to-face salesperson consultation, inability to physically examine products, quality uncertainties, logistic concerns, and confusions due to information overload are a few challenges which make online purchase decisions complicated and different from traditional ones [3], necessitating a need for marketers to understand the dynamics involved in online purchase behavior [4]. The protection motivation theory [5] posits that consumer's exhibit risk aversion behavior when they are uncertain of outcomes and tend to follow peer and social influences for decision-making. When this trend to follow others' information for decision making continues unabated, it results in an information cascades [6, 7] facilitating dependence on others' actions in the decision-making process [6]. This tendency is documented in literature as 'herd behavior' and explains individuals' preference to follow others' decisions, despite considering the merit of their own/private information [7, 8]. The 'Bandwagon Effect' wherein, higher demand for commodities is felt due to excess consumption by others [4] and the 'Neighborhood effect,' referring to the effect of 'neighbor' on an individual's behavior demonstrates herding tendencies in conventional purchase decisions [9]. However, herding in online purchase behavior though having many practical implications, is a less discussed topic.

1.1 Motivations behind the study

Human behavior is an outcome of many psychological and sociological factors and hence is very complex. It evolves through learning processes that involve observing behaviors of others and frequently updating self-beliefs based on the merits of others' actions [10]. Social learning helps shape human behavior, and herding is a special case where individual decisions to perform a behavior are solely an outcome of adopting others' decisions. Literature offers limited compelling insights about herding behavior in the decision-making process. First, it posits that to induce herding intentions [12–15], individuals should rely more on public information [11] rather than personal. Therefore, diffusion of public information is essential for herding, and information quality parameters such as source credibility, correctness, peer acceptance [16–18], etc. are decisive — also, the information acquisition practices of individuals and preference of information sources [19] are important.

Second, the need for social equality is prominent among individuals, and therefore, in every action, people attempt to achieve a feeling of equivalence with others in society. Such a desire to remain on the same social platform with others motivates individuals to follow others' actions [20, 21]. Thus, social considerations referred as structural equivalence [22] perceptions of individuals and their preference for conformity [23] are instrumental in developing herding. Third, individuals

are reputation conscious [24–26] and therefore adopt others' decisions to reduce reputation harms due to likely unpleasant outcomes from deviant behaviors. Fourth, due to the inability to cope with unforeseen risks, people exhibit a risk avoidance tendency [27] and adopt herding, which offers better confidence in decisions under uncertainty. Fifth, individuals with high cognitive complexity may prefer the careful evaluation of all the relevant perspectives for decisions [28] rather than blindly following others' decisions. In the same manner, individuals with high levels of risk appetite may prefer personalized evaluations for decisions. Lastly, online herding potential is higher due to free information flow [29, 30]. The above observations indicate that herding as a phenomenon is an outcome of many sociological and psychological factors, and its intensity is high under free information flow. Therefore, in e-commerce platforms where information about others decisions is easily available, the formation of consumer behavior based on others' decisions is high.

Even though the literature upholds the role of information in customer decision-making, information overload impact due to an abundance of online information affects customer cognitions and may disrupt their evaluations. Additionally, the individuals' cognitive limitations and the time constraints [31] in making the right decisions prevent the optimum use of information in many purchase decisions. In such scenarios, customers may tend to believe others' information as more reliable and adopt the same for minimizing the uncertainties. This predominantly happens when the cognitive effort to evaluate the possibility of risk is high. Thus, the informational type of social influence [32] that considers others' information as an indicator of authenticity impacts online buying decisions, and customers perceive popular products as the ones with superior quality [33]. This tendency is more rampant in online platforms, offering ample opportunities to freely share customer opinions, product reviews, and user experience. Extant research concludes that online decision-making involves many heuristics and socio-psychological aspects and reviews significantly influencing customers' attitudes and purchase decisions [34–36]. Also, herding due to positive Word-of-Mouth (WOM) is one such heuristic which is beneficial in attracting new customers. Therefore, understanding mental models instrumental in herding is useful for developing digital strategies to address issues like customer hesitation and cart abandonment rampant in the e-commerce space.

The above deliberations highlight the importance of online information adoption in herding. A prominent theory explaining individuals' information adoption tendency is the 'Information Adoption Model' [40], which posits that attributes such as argument quality and source credibility determine the usefulness of the information and its adoption for decision-making. Similarly, many studies establish that online consumer behavior depends on e-commerce attributes like website quality, user-generated content, utilitarian aspects, and its potential to evoke hedonic outcomes. Online social interactions, including sharing product reviews [37], provide customers with cognitive and emotional confidence to justify their purchase decisions. Even in such decision-making styles, differences in customer characteristics, and their sociological beliefs, influence online adoption-intention behavior.

Customer characteristics refer to a broad set of aspects including demographic and psychological traits such as personality, motivations, beliefs etc., that differentiate one customer from another. But sociological factors explain the pertinent beliefs

of individuals that are part of norms of the society and create positive or negative influences on individuals by defining their roles, status, reference groups etc. Customer characteristics referring to their complexity in cognitive evaluations due to information overload and risk avoidance tendencies under the decision-making dilemma have importance in understanding the phenomenon of online herding. The customer characteristics refereed above are intrinsic to customers whereas, extrinsic factors develop sociological beliefs among customers. Therefore, extending the information adoption model by including customer characteristics like cognitive complexity and risk aversion tendencies along with sociological beliefs like conformity preference, structural equivalence, and reputation concerns have many theoretical and practical contributions. Therefore, our research attempts to answer the following research questions.

1. What is the role of information attributes such as argument quality and source credibility in online public information adoption tendencies and herding intentions of online customers?
2. What is the role of sociological factors like conformity preference, structural equivalence, and reputation concern in online public information adoption tendencies and herding intentions of online customers?
3. How customer characteristics like cognitive complexity and risk aversion influence online public information adoption tendencies and herding intentions of online customers?

2 Literature review

The basic premise postulated in the herd behavior theory is that the popularity of the predecessor's actions influences an individual's decision-making style [7]. Commonly, for decision making, individuals diligently use both private and public information. The private information is personal and reflects individual preferences, whereas public information contains a history of actions taken by predecessors for the same decision problem. When public information becomes popularized due to social learning [38], individuals tend to disregard private information and adopt public information. When society relies more on public information, an information cascade that refers to many people sequentially taking the same decision [6] occurs, and the use of private information in decision-making decreases [39]. Information cascades offer a strong signal for people to adopt others' actions.

The information adoption model [40] explains how individuals adopt information and transform their intentions in a connected environment. The information adoption model is rooted in the Elaboration Likelihood Model (ELM) [41], which proposes two information processing routes, such as the central route that scrutinizes the information cognitively and the peripheral route that uses environmental cues to decide on information adoption. The two antecedents referred to in the information adoption model to perceive the usefulness of information are argument quality and source credibility. The argument quality is the central route referring to the completeness, consistency, and accuracy of the information, and the source credibility

is the peripheral route referring to the credibility of information source [41]. The perceived information usefulness is the mediator linking the antecedents and the information adoption intentions. Similar to ELM, the Heuristic–Systematic Model (HSM) [42], proposes two modes of information processing by individuals. First, a systematic one involving considerable cognitive effort in evaluating the content of the message and second, a heuristic style in which the individuals rely upon simple decision rules to evaluate the message content. In both the above models, the argument quality confirmation requires higher cognitive effort, and in estimating the quality of the message, individual heuristics used to evaluate the credibility of the source is imperative.

Extant literature reports many studies on herd behavior in the domains of psychology [43], economics [44, 45], financial markets [46–48], mob psychology [49], political science [50], and marketing [51, 52]. Similarly, investigations on herding phenomena in digital auctions [53], software downloading [54], book buying online [55], online product buying [56], peer to peer lending [57], e-learning [58], and social commerce [59] are available. In technology contexts, two antecedents of herding intentions are 'uncertainty attached to decisions' and the 'learning from observing actions of others' [60]. Other factors developing herding behavior are fear [61], the shared identity of decision-makers [62], and information asymmetry [63]. Also, when the individual has no access to public information or has to bear a cost to access public information [39], dependence on private information is more, and herding is unlikely. Table 1 summarizes few studies on herd behavior in the online context.

Literature, in general, concludes that imitating others' acts is prominent among individuals in many situations. Primary logic motivating individuals to embrace herding is information availability and feeling of uncertainty about outcomes from a decision. In such a scenario, for confidence and emotional comfort, people adopt public information and follow the herd. From the literature, it appears that themes related to social identity, customer ability to engage in cognitive evaluations, fear of risk, and, most importantly, information attributes have significant role in herding. The grounded theories on above themes offered a rationale for various hypotheses proposed in this study. The next section explains such theories and presents the theoretical framework developed.

3 Research hypotheses and theoretical framework

The theoretical framework for this research develops from two prominent theories, the 'Information cascade theory' and the 'Information adoption model.' The theory of informational cascades [6] is applicable in every situation where multiple option for selection exist in the decision-making process. In online purchase decisions, to ensure ideal selection from multiple choices, the customers seek the support from two types of information. First, the personal information containing knowledge about the products acquired through own cognitive evaluations, and second is the public information containing the opinions shared by others about the reasons behind their adoption decisions. However, the quality of personal information

Table 1 List of studies on herd behavior in the online context

No.	Author	Year	Context	Antecedents	Key observations
1	Kang et al. [64]	2020	Luxury consumption	Emotional needs (hedonic and symbolic), social identity needs (self-esteem and recognition), brand involvement, fear of missing out	Antecedents develop both informational and normative herding through brand involvement. The higher levels of fear of missing out develops significantly higher herding due to social identity needs
2	Sunder et al. [65]	2019	ONLINE rating environment	RATER experience, divergent opinions of reference group, product portfolio	As experience level of rater increases herding tendency decreases
3	Wang et al. [66]	2019	E-learning	COURSE difficulty and leaner experience	Herding can be rational or irrational and as difficulty of the course and experience of the learner increases, rational herding follows
4	Munawar et al. [59]	2018	Social commerce	Perceived homophile, herd size, trust in herd's action, sense of community	Antecedents reduce the uncertainty and induces decision confidence in social commerce
5	Li and Wu [67]	2018	Online retailing	Social media WOM, nature of goods	Herding is more prominent on experience goods due to uncertainty in quality than in the case of search goods
6	Liu and Yang [68]	2018	Sharing economy	Imitating others, subjective norm, trust, usefulness, ease of use	Herding tendency directly develops favourable behavioral intentions. Whereas, subjective norm develops behavioral intentions mediated through trust, usefulness, and ease of use
7	Liu et al. [69]	2017	Online retailing	Online reviews, past sales volume information	Both antecedents influence herding and firm's pricing decisions, but product characteristics and quality perceptions of customers decides the level of impact
8	Tseng et al. [70]	2017	Online retailing	Review valence, review extremity, review length, review expertise, signal valence	Intention to vote for a review becomes strong when clear and strong signals of previous voters are good enough to discount own information

Table 1 (continued)

No.	Author	Year	Context	Antecedents	Key observations
9	Xu et al. [71]	2017	Online retailing	Promotional information, review information, endorsement influence, peer imitation	Informational incentives (higher dimensions of first two antecedents) and social influence (higher dimension of last two antecedents) develops online shopping carnival behavior to herd defined by participation, interaction, and pleasure,
10	Liu et al. [72]	2016	Online retailing	Online product sales information, product rankings, online review volume, user ratings, product price, product type	Effect of antecedents to create an information cascade is more for low ranking and experience products compared to high ranking and search products
11	Lee et al. [73]	2015	Online movie rating	Volume of user rating, friend's rating, number of friends, crowd ratings	Friends' ratings have higher potential to induce herding and the number of friends ("audience size") who view user's rating influence ratings
12	Cheung et al. [74]	2014	Online retailing	Peer customer review, peer customer purchase, customer engagement, customer expertise	Action-based social information (purchase) is more influential than opinion-based social information(review). consumer engagement has a positive moderating effect on herding but, consumer expertise has a negative moderating effect
13	Langley et al. [56]	2014	Online retailing	Speed of contagion (the degree at which spreading happens), the number of individuals (share of population engages in spreading), and the uniformity of direction (similarity in behavior)	There eight patterns in herding depending on level of each dimension. The faster one named as stampeding increase first on the speed of contagion to increase in the size and becomes uniformly directed
14	Sun [60]	2013	Technology adoption	Level of uncertainty in decisions, observational learning	Antecedents develop an intention to discount own beliefs and impart a behavior to imitate others leading to technology adoptions

Table 1 (continued)

No.	Author	Year	Context	Antecedents	Key observations
15	Shang et al. [75]	2013	Virtual investment communities	Information consistency, information credibility, social comparison orientation (a higher order one formed from ability comparison and opinion comparison), decision usefulness	Information credibility, consistency, and opinion comparison orientation lead to perceived decision usefulness. herding tendency moderates the effect of opinion comparison orientation on decision usefulness and the effect of ability comparison orientation on overall satisfaction
16	Chen [55]	2008	Online book buying	Star rating, sales volume, customer recommendations	Antecedents developed herding and recommendations of customer had higher effect than expert. Consumers use online herd cues to gain product information and suggestions about best option
17	Huang and Chen [35]	2006	Online buying	Sales volume information, number of customer reviews, customer recommendations	Sales volume and the number of positive vis-à-vis negative customer comments influence customer choices. recommendations of other consumers influence more than expert recommendations

depends on individual cognitive capabilities and hence may sometimes be deficient. The comparative strength of each type of information is critical in its usage in the decision-making process and depends on individuals' relative strength and cognitive capabilities. A cognitively sound decision-maker assigns more importance to personal evaluations, while others count on public information more. Additionally, the possibility of two sources of information offering conflicting signals to the decision-maker is likely. Decisions under the strength of public information disregarding own information result in information cascades leading to herding [76].

Two crucial factors developing information cascades are uncertainty concerns about the outcomes from a decision and the easiness in observing others' actions in a similar decision problem. In e-commerce, online customer reviews describing others' evaluations about products are easily available [54], and have the potential to develop authentic feeling to override the private signals of customers. The extent to which online customers adopts such public information and decides to neglect private information helps to understand the magnitude of herding intentions. Also, the estimation of the effect of online customers' information adoption tendencies on their herding intentions helps digital marketers develop customer review management strategies for the diffusion of positive WOM. Therefore, we propose the hypothesis,

H1 The online public information adoption (IA) tendencies of online customers have a significant positive effect on their herding intentions (HI).

3.1 Information attributes

The information adoption process explains the internalization of knowledge in the public domain for decision making by individuals. As per the 'Information Adoption Model,' the argument quality (AQ) and source credibility (SC) are two significant antecedents causing information adoptions leading to changes in individual attitudes and behaviors. In e-commerce, information attributes such as relevance, accuracy, understandability, comprehensiveness, and personalization related to online reviews imparts AQ perceptions. Similarly, for SC perceptions, authenticity, competence, and reliability of the information source is imperative. Therefore, to better understand the herding phenomenon in e-commerce, the estimation of the effect of AQ and SC on IA and HI is essential. Hence, we propose that.

H2a The AQ perceptions about online reviews have a significant positive effect on IA among online customers.

H2b The AQ perceptions about online reviews have a significant positive effect on HI among online customers.

H3a The SC perceptions about online reviews have a significant positive effect on IA among online customers.

H3b The SC perceptions about online reviews have a significant positive effect on HI among online customers.

3.2 Social factors

Numerous external variables have a role in an individual's information adoption tendencies, the most important being their social identity beliefs [77]. There is a general inclination among people to follow others in order to create a sense of social identity. Similarly, a real, implicit, or imaginary presence of others' actions influences every individual's feelings, thoughts, and behavior [78]. Social cognition and emotions play an adaptive role in the formation of automatic and unconscious procedures [55] that popularize information within the social group. The need for 'structural equivalence' (group identity) [79] referring to the similarity in social status, increases information adoption by individuals to establish a sense of identity in social groups [80]. In online contexts, the possibility of an intention to join a group that shares common views in purchase decisions is conspicuous among customers. Hence, we propose to test the hypotheses.

H4a The structural equivalence (SE) perceptions of online customers through usage of public information have a significant positive effect on their IA.

H4b The structural equivalence (SE) perceptions of online customers through usage of public information have a significant positive effect on their HI.

From time immemorial, the concept of localized conformity preference for consistent social behavior is rampant in cultures. For 'conformity preference,' individuals display an inclination towards others' behavior [81] and prefer a 'consensus' with society. Therefore, public information significantly influences their aspirations. The consensus search may be either to align with others' positive expectations (normative social influence) or to accept information from others' as a proof of reality (informational social influence) [82]. From the marketer's perspective, the conformity preference tends to set a norm in the group behavior for the members to comply with [83]. Conformity preferences of customers can alter their purchase behavior as an outcome of their exposure to information about other's evaluations [84]. Therefore, the likelihood of following others' information for seeking conformity with them is justifiable. Accordingly, we propose the hypotheses.

H5a The conformity preference (CP) perceptions of online customers through usage of public information have a significant positive effect on their IA.

H5b The conformity preference (CP) perceptions of online customers through usage of public information have a significant positive effect on their HI.

In investment decisions, the fear of possible reputation harm in the event of an adverse outcome [85]is a prevalent skepticism among investors to use private

information. When the outcome is uncertain, people are skeptical about following a contrarian behavior. Therefore, 'follow the herd' has become a doctrine to elude from fear of public criticisms about the investor skills [86]. Similarly, purchase decisions in e-commerce have many uncertainty components related to security, privacy, and risks in product quality, damage in transit, financial loss, etc. Therefore, online customers strive their best to minimize uncertainties in decisions and protect their reputation as intelligent decision-makers by following group behavior [87]. Thus, it is logical to conclude that reputation concerns create social pressures to adopt others' views by discounting their own information when certainty of a clear outcome is dubious. The above observation justified the following hypotheses.

H6a The reputation concerns (RC) of online customers from uncertainties related to online purchases have a significant positive effect on their IA.

H6b The reputation concerns (RC) of online customers from uncertainties related to online purchases have a significant positive effect on their HI.

3.3 Customer characteristics

Customers develop rational expectations about outcomes from a decision by intelligently using the available information [11]; however, cognitive limitations and time constraints [31] affect their ability to make rational decisions. Individuals active in the digital world interact with large volumes of information without engaging in cognitive evaluations. The perceptual skill of a person referred to in psychology as the cognitive complexity significantly determines how an individual evaluates the available information for decision making. Cognitive complexity represents the mental ability of an individual to differentiate understated contents in communications or information [88]. Thus, individuals with high cognitive complexity tend to notice nuances and indirect implications in information, while persons with a less complex cognitive structure fail to do so. The individual's inability to engage in a cognitive exercise that distinguishes various constituent elements involved in decision-making may induce an intention to adopt others' decisions. Cognitive complexity is a psychological characteristic that describes cognitions along a simplicity-complexity axis [88]. The decision making under abundant choices though complicated, individuals with complex cognitive structures prefer to use their own evaluations in decision making and may not blindly follow others [89]. Therefore, we propose that.

H7a The more cognitive complex an individual, IA tendencies will be less in the online context.

H7b The more cognitive complex an individual, HI will be less in the online context.

In decision-making, the perception of risk occupies a significant role in customer evaluations. Risk refers to an unpleasant outcome of a decision resulting in the loss

of some value [90], either emotional or financial, to an individual. The perception of risk significantly varies among individuals and, therefore, is highly subjective [91] and depends on individual personality traits [92]. The calculation of risk potential depends on the possibility of undesirable consequences and its impact on individuals materially, physically, and emotionally [93]. Usually, individuals are risk-conscious, mainly when a decision has to be taken under uncertainty [94]. In investment decisions, risk aversion explains the tendency of an investor to opt for lower returns to minimize risk. In purchases, similar to risk aversion, customers' exhibit risk avoidance tendencies when the outcome of a decision is uncertain. In general, risk avoidance is a stable trait in an individual's personality, but the degree of prevalence varies. Taking excessive precautions is a human trait to escape from risk [94]. In online contexts, the individuals' tendency to depend on others' views appearing in reviews is an indication of risk avoidance. In this study, to capture the risk avoidance tendencies of online customers, we used the construct of 'risk aversion' (RA). We thus proposed the following hypotheses to understand the effect of RA on IA and HI.

H8a The customers with higher levels of risk aversion will have higher IA tendencies in the online context.

H8b The customers with higher levels of risk aversion will have higher HI tendencies in the online context.

4 Research model

The key theme underpinning this research is the conclusion from extant literature that for herding to occur, one of the primary pre-requisites is information adoption. Carrying forward this insight, we concluded that many factors like information attributes, sociological factors, and customer characteristics have a role in IA and HI in e-commerce. Therefore, the research model incorporated (1) information characteristics such as source credibility (SC) and argument quality (AQ); (2) sociological factors such as structural equivalence (SE), Reputation concern (RC), and conformity preferences (CP); and (3) customer characteristics such as cognitive complexity (CC) and risk aversion (RA). The various paths in the research model depicted in Fig. 1 represent the hypotheses proposed in the study.

5 Research methodology

In this research, the empirical investigations were to examine the direct effects of six independent variables on IA and HI. In the framework, except for CC and RA, all other variables were perceptions, inhibitions, predispositions, or expectations that a customer holds in developing a behavior. CC and RA are personality-related traits; hence its measurement using multiple indicators that capture different facets in the nomological domain [95] may suffer validity challenges due to the absence of pre-validated scales specific to the context of the study. CC characterizes the degree of
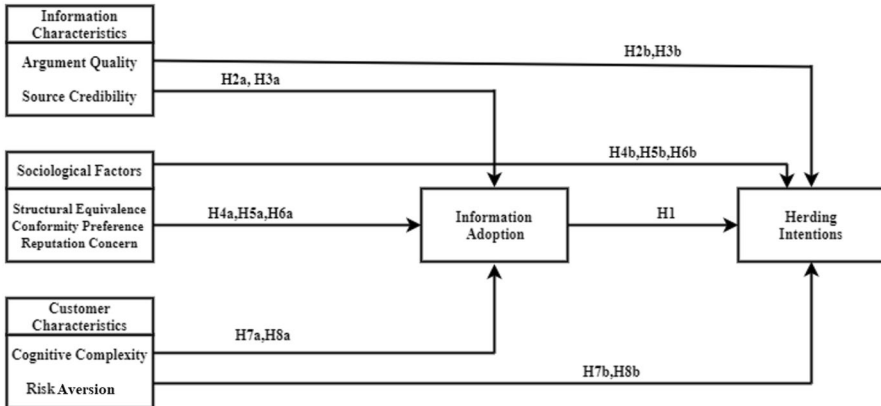
Fig. 1 Research model

'differentiation in an individual's construct system' [96], and hence, its measurement should utilize the dimensions an individual considers in making judgments. However, ambiguity still exists on the dimensions and hence, in the measurement [97]. The most popular measurement paradigms of cognitive complexity, namely the Repertory Grid Technique [98] and Role Category Questionnaire [99], face many criticisms about its generalizability and context irrespective applications [100, 101]. Similarly, even though many scales available to measure perceived risk, they are mostly multi-dimensional and context specific, and doesn't perfectly match with the definition offered to RA in this study. Additionally, due to many methodological issues related to measurement of CC and RA, we have limited the scope of this research to the examination of the effect of them on IA and HI. Therefore, we preferred to use a scenario-based experiment with higher internal validity levels for empirical investigations [102] to estimate the effect of CC and RA in the proposed framework.

5.1 Scenario description

A scenario-based approach is useful in verifying the causality assumptions about the constructs referred to in the scenario by manipulating their levels of effect [103, 104]. Therefore, we developed different scenarios to aid the participant's ability to visualize situations that depict different levels of CC and RA. Two levels of cognitive complexity (simple, complex) and two levels of risk aversion (risk averse, risk-taking) formed a 2×2 between-subjects factorial design. The scenario narrated an online buying decision-making process with suitable manipulations for CC and RA levels. A typical scenario was.

"You spend time on social media and other online platforms to gather information from reviews to make a purchase decision. Mostly, you find *reviews helpful and accept such information to make decisions without much evaluations about*

correctness and *avoid the risk of committing mistakes by taking decisions against the majority"*.

The manipulation for the text in italics for CC was 'easy adoption of public information without much evaluations' (simple) and 'preference for private information for own evaluations' (complex). Similarly, for manipulation of risk aversion was 'going with the majority' (risk averse) and 'preference to make a decision based on own judgments' (risk taker). The research design included a survey among online customers to capture their perceptions about constructs other than CC and RA under the influence of the stimulus narrated in the scenario. Appendix 1 provides all the scenarios used in the experiment. We have ensured the quality of scenarios to aid visualization by multiple rounds of refining in terms of content and face validity with help of experts including academicians and experienced online customers.

5.2 Measures

The scenario captured the effect of CC and RA. The other constructs were latent in nature, and hence for its measurement, suitable indicators from previous studies were identified. The rationale behind selecting the indicators was that the items should capture the theoretical interest manifested in the definition assigned to the construct. Table 2 presents the construct definitions and measurement items. Since correlations among items are likely, we conceptualized the constructs as reflective. The responses to statements including the items reflecting the constructs were collected on a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree.' Appendix 2 provides the survey instrument used for the study.

5.3 The population and sample

This study endeavored to validate a theory on herding intentions in the online context. Since herding is a social phenomenon, the factors influencing social equality has a role in the formation of herding intentions. Therefore, to effectively probe the phenomenon, the population should have two essential characteristics (1) a similar socio-economic profile and (2) experience in online purchases. Inhabitants of a housing colony are elements of same social system likely to have similar social beliefs, and hence deemed ideal for the experiment. The sampling unit was an individual who is having adequate experience in online purchasing. Thus, we chose 240 participants from a middle-class housing colony. Purposive sampling method was used since a carefully controlled non-probability sampling approach offer valid insights enough for theory generalizations [105].Nevertheless, many statistical estimations, warrant the use of probability sampling methods over non-probability methods for meeting the underlying assumptions on data quality for statistical estimations, such as randomness, data independence, absence of common method bias, and normality [106]. Hence, meeting such assumptions justifies the use of data obtained from a non-probability sampling procedure appropriate for parametric estimations. Consequently, in this research, we have conducted such explorations to verify data quality for theory generalizations.

Table 2 Definition of constructs and scale items used for measurement

Constructs	Definition	Scale items
Reputation concern	The social reputation harm threat perceived by an online customer from deviant decision making behavior	Fear of respect loss, distrust by colleagues, loss of expert status, integrity challenge [109]
Conformity preference	The need for conformance with others Sought by an online customer in adopting a decision for remaining in the group	Acquiescence, flexible, compliant beliefs, accommodating [110]
Structural equivalence	The feeling of social equality perceived by an online customer in engaging in activities that majority in the society are doing	Feeling of contributing to social capital [111]; feeling of similar position in society as others, feeling of social significance [112]; ability to apply social influence [113]
Argument quality	The degree to which an online customer perceives the received information as complete, consistent, and accurate to adopt and use	Information completeness, information correctness, information objective, information believability [40, 114]
Source credibility	The degree to which an online customer perceives in the credibility of the source of information to adopt and use	Belief is predecessor's knowledge, expertise, trustworthiness, reliability [40]
Information adoption	The degree of willingness of an online customer to receive and use online public information for decisions	Intent to follow decision, intent share information to others, intent to trust information, intent to use information [37]
Herding intentions	The tendency exhibited by online customers to follows other's decisions discounting own information	Decide as others do, following others is good, following others is safe, following others is beneficial [115]
Cognitive complexity	The psychological characteristics of customers representing their willingness to engage in complex mental evaluations for decision making by diligently evaluating public information	
Risk aversion	The psychological characteristic of online customers representing their aversion to face risks from uncertainties attached to online purchases and hence motivated to use public information for decision making	

5.4 Sample size

Structural equation modeling was used to test the several hypotheses, and therefore, to arrive at the sample size, we used 'a priori sample size calculator' available at https://www.danielsoper.com/statcalc/calculator.aspx?id=89. The minimum sample size required for parameter values of anticipated effect size = 0.3 and desired statistical power of 0.8 was 170 for seven latent variables and 28 indicators at 0.05 levels of significance. Hence, we concluded that a sample size of 240 as acceptable.

5.5 Data collection

Participants were randomly assigned a particular scenario from among the four combinations and requested to visualize the same and respond to the scale items. Sixty participants comprising of an equal gender ratio responded to each scenario. The method helped in understanding the underlying attitudes of respondents and reduced social desirability bias [107]. We have included two single-item measures to check the manipulation of CC and RE and two items proposed by Dabholkar [108] for realism check to ensure that the experimental manipulations were successful and the respondents accurately apprehended the described situation.

5.6 Analysis approach

The study needed structural equation modeling (SEM) estimations to test hypotheses under H1 to H6b, and MANOVA for testing the hypotheses under H7a–H8b. Also, a principal component analysis is required to verify whether the data has the same number of distinct underlying constructs as in the research model. Similarly, a pooled confirmatory factor analysis to assess the psychometric soundness of scales used for measurement. Among two complementary approaches in SEM, namely the covariance-based and variance-based, we opted for the covariance-based approach, since it is more preferred in theory testing, theory confirmation, and theory comparisons [116]. The covariance SEM requires the adherence of various data quality assumptions like the absence of missing values, linearity, normality, randomness, data independence, and residuals following normal distribution, etc.

6 Data analysis

6.1 Data quality for SEM

The portion of the research model with paths linking AQ, SC, SE, RC, CP, IA and HI formed the structural model for verifying hypotheses presented under H1 to H6b. In performing a major pre-requisite about data quality is the assumption related to univariate and multivariate normality. The collected data had no missing values, but the variables were non-normal. The absolute values of univariate skewness and

kurtosis indices were less than 2.0 to conclude the deviations from normality as non-problematic in parametric estimations [117–120]. Further, the 'Runs' test performed using SPSS20.0 confirmed the randomness in the sample. Similarly, Durbin–Watson statistics within 1.5–2.5 [121] confirmed the proof of independent observations. Also, the linearity test using curve estimation procedures in the regression menu of SPSS confirmed that linearity existed between relationships among constructs. The variance inflation factors less than 3.3 confirmed the absence of multicollinearity [122].

We found that the common method bias was absent since the post-hoc Harman's single factor test produced less than 50% variance [123]. As expected, data had issues related to multivariate normality. The Mardia's normalized estimate of multivariate kurtosis was above the threshold of 5 [120]. Many researchers have categorically concluded that most data in social sciences studies has non-normal distribution [120, 124] and that maximum likelihood estimation is relatively robust in cases of violations of normality assumptions [122, 125]. We considered Bollen-Stein bootstrap procedure [126], which attempts to correct the standard error and fit criteria variation emerging from normality challenges and produces stable parameters. In this study, 5000 bootstrap samples produced a Bollen–Stein bootstrap p value > 0.05 to conclude an adequate fit.

To verify the factor composition of the data structure, we used factor analysis with maximum likelihood estimation and varimax rotation. The Kaiser–Meyer–Olkin measure of sampling adequacy was 0.833, and the Bartlett Test of Sphericity was significant to assume the goodness of data for factor extraction. The analysis resulted in seven factors having an Eigenvalue greater than 1, and together explaining 80.505 percent of the total variance. Thus, we could confirm that all the constructs used in the SEM estimations were distinct and valid. Table 3 provides item-level statistics and corresponding conformed factor loadings.

6.2 Validity/reliability

The pooled confirmatory factor analysis in AMOS 22.0 tested the psychometric assessment of all the scales used to measure constructs included in the SEM. The estimated model had an acceptable fit (Normed Chi-square $= 1.43$; CFI $= 0.974$; SRMR $= 0.046$; RMSEA $= 0.043$; Pclose $= 0.921$) with fit indices better than their cut-off values (CFI < 0.95; SRMR < 0.08; RMSEA < 0.06; Pclose > 0.05) [127] after establishing covariance links between error terms of few indicators as suggested by modification indices. All the factor loadings were significant and above 0.60, with no major cross-factor loadings above 0.3. The validity checking using Gaskin's 'Master validity' plugin reported 'No validity concerns.' Table 4 shows the psychometric properties of all the scales. The composite reliably and average variance extracted (AVE) values above 0.7 and 0.5 respectively for all constructs and discriminant validity existed since the square root of AVE was higher than its correlation with the other constructs [128]. We further examined the standardized residual covariances to verify whether the error variances follow a normal distribution. If the standardized residual covariances are less than 2.58, it follows

Table 3 Descriptive statistics of items and their loadings

Constructs and indicators	Loading	Mean	Std.Error	Skewness	Kurtosis
Source credibility					
I feel online information that imparts knowledge are credible	0.9	4.092	0.068	−0.933	−0.061
I feel online information shared out of expertise on the matter are credible	0.911	4.117	0.067	−0.971	−0.022
I feel that to adopt online information, its contents should be trustworthy	0.917	4.146	0.07	−1.014	−0.115
I think online Information is credible if many others share the same feeling	0.904	4.142	0.066	−0.794	−0.669
Argument quality					
I feel online information should be complete to consider adopting it	0.903	4.454	0.049	−1.257	0.863
I feel online information should meet the objective of information search	0.877	4.421	0.053	−1.361	1.32
I feel online information should be believable to consider adopting it	0.841	4.35	0.053	−1.128	0.743
I feel online information should be complete to consider adopting it	0.806	4.317	0.052	−0.877	−0.126
Reputation concern					
Others will not respect me if I commit a mistake	0.822	3.55	0.063	−0.402	−0.335
My colleagues will not trust me if I commit mistakes	0.918	3.742	0.064	−0.728	0.24
Others will not consider me an expert in quality decisions if I commit mistakes	0.95	3.742	0.064	−0.79	0.378
others will challenge my integrity if I commit mistakes	0.813	3.85	0.056	−0.893	1.191
Structural equivalence					
I will be contributing to society by accepting the majority opinion	0.91	4.283	0.057	−0.879	−0.391
I will enjoy equal social status by accepting views of majority	0.874	4.25	0.058	−0.893	−0.286
My importance in society will increase by accepting majority views	0.835	4.25	0.054	−0.793	−0.343
I can influence others by accepting their opinions	0.913	4.346	0.054	−0.976	−0.161
Conformity preference					
I feel everyone will agree to my decisions if I follow majority	0.857	3.979	0.071	−0.802	−0.366
I am flexible to adopt other's views in my decisions	0.803	3.992	0.067	−0.881	0.152
If I go with the majority, chances of complaints are less	0.749	3.938	0.072	−0.753	−0.242
I feel more confidence by accommodating other's views	0.851	4.004	0.065	−0.688	−0.321

Table 3 (continued)

Constructs and indicators	Loading	Mean	Std.Error	Skewness	Kurtosis
Information adoption					
I consider other's views in my decisions	0.671	4.079	0.066	− 1.257	1.246
I will be motivated to share information that I find useful	0.749	4.204	0.053	− 0.992	0.928
I generally trust information if many people share it	0.913	4.008	0.059	− 0.884	0.595
I like to use popular online reviews in my decision-making	0.926	4.004	0.062	− 0.929	0.467
Herding intentions					
I will follow the majority in my decisions	0.861	3.688	0.061	− 0.507	− 0.202
I feel that accepting views of the majority is riskless	0.74	3.25	0.068	− 0.107	− 0.634
I feel that accepting views of the majority is safe	0.77	3.521	0.063	− 0.302	− 0.634
I feel that accepting views of the majority is beneficial	0.891	3.558	0.062	− 0.293	− 0.537

Table 4 Quality criteria for constructs

Construct	CR	AVE	MSV	SC	SE	AQ	RC	CP	IA	HI	Mean	SD
SC	0.949	0.825	0.039	**0.908**							4.12	0.97
RC	0.93	0.771	0.326	0.075			**0.858**				3.72	0.86
SE	0.934	0.781	0.033	−0.148*	**0.878**		−0.092				4.28	0.79
AQ	0.917	0.736	0.185	−0.023	0.300***	**0.884**	0.182*				4.38	0.72
CP	0.888	0.666	0.038	−0.03	0.151*	−0.15*	−0.194**	**0.816**			3.98	0.92
HI	0.889	0.669	0.326	−0.029	0.530***	−0.045	0.371***	0.01	0.465***	**0.822**	3.5	.84
IA	0.891	0.676	0.254	0.199**	0.454***	0.041	0.426***	0.105	**0.818**		4.07	0.80

CR composite reliability, *AVE* average variance extracted, *MSV* mean shared variance

Diagonal elements shown in bold are the square root of AVE between the construct and indicators

For reliability, CR > 0.7; for construct validity, AVE > 0.5; for discriminant validity, MSV < AVE &square root of AVE > inter-construct correlations

*$p < 0.050$; **$p < 0.010$; ***$p < 0.001$

a standard normal distribution, and since the output had most of the values below 2.58, we concluded that the model is correct [127] for predictions.

6.3 Structural equation modeling

After adding covariance links between error variance of few items as per the modification indices' information available in the AMOS output, the overall model fit chi-square got reduced. The resultant model emerged as a well fit one without any validity concerns. AMOS reports squared multiple correlation coefficient or R^2, which indicates the proportion of variance in the dependent variable accounted by the independent variables in the model. The estimated model reported R^2 value of 0.33 and 0.45 for IA and HI respectively to suggest acceptable levels of predictive validity. Figure 2 presents the estimated research model.

6.4 Results of hypotheses tested using SEM estimation

The output of the estimated model provided evidence to support the hypotheses H1a—H6b. Among the antecedents considered AQ ($\beta = 0.37$) followed by RC ($\beta = 0.28$), SC ($\beta = 0.19$) and CP ($\beta = 0.15$) positively developed IA. The IA had a positive relationship with HI ($\beta = 0.32$). Also, we found that only RC ($\beta = 0.41$) had positive direct effect on HI at 0.5 levels. Table 5 summarizes the results of hypotheses tested.
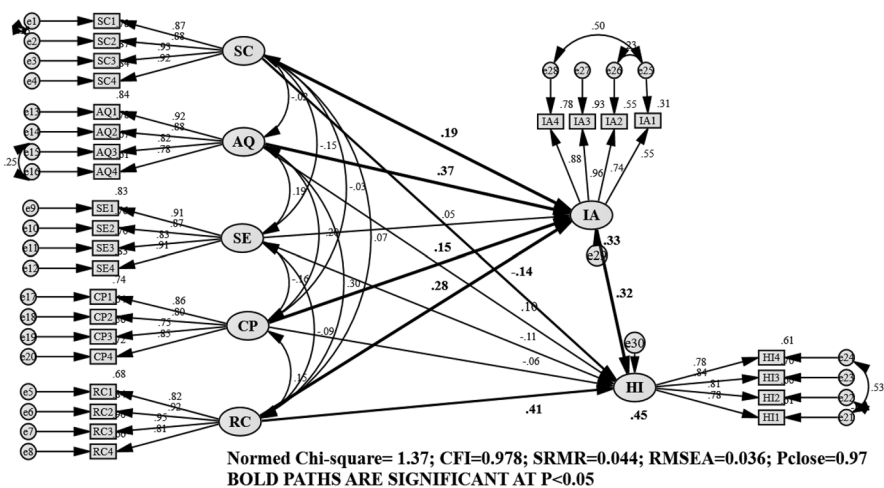

Fig. 2 Estimated SEM model

Table 5 Results of hypotheses testing

IV	DV	Hypothesis	'β' Value	Std. error	'p' value	Result
IA	HI	H1	0.323	0.104	<0.05	Supported
SC	IA	H2a	0.192	0.038	<0.05	Supported
SC	HI	H2b	−0.14	0.047	<0.05	Significant in opposite direction
AQ	IA	H3a	0.371	0.062	<0.05	Supported
AQ	HI	H3b	0.101	0.074	0.151	Not supported
SE	IA	H4a	0.049	0.043	0.419	Not supported
SE	HI	H4b	−0.114	0.055	0.096	Not supported
CP	IA	H5a	0.153	0.039	<0.05	Supported
CP	HI	H5b	−0.057	0.049	0.361	Not supported
RC	IA	H6a	0.283	0.05	<0.05	Supported
RC	HI	H6b	0.411	0.065	<0.001	Supported

6.5 Multivariate analysis of variance (MANOVA)

The experimental design helped to test H7a to H8b. To ensure experimental manipulations were positive, we performed the manipulation checks with one measurement item each for CC and RA. The statement for measuring CC was "I prefer to make decisions by trusting public information available online," and for RA, "I prefer to avoid risk by accepting majority decision rather than going independently." The statements used for manipulation check and realism had acceptable levels of reliability since Cronbach alpha values were above 0.7 to confirm the quality of items. The manipulation checks confirmed that the mean differences between two levels of CC and RA were both significant. Mean scores for each group were consistent with the intended manipulation grouping ($M_{simple} = 3.96 > M_{complex} = 3.02$, $p < 0.05$; $M_{risk\ averse} = 3.69 > M_{risk\ taker} = 2.83$, $p < 0.05$). Similarly, realism check performed using two-items were positive, with an average score of 3.6 on 5.

The two-way Multivariate Analysis of Variance (MANOVA), examined online customer's IA and HI at different levels of CC and RA with gender as a covariate using the GLM analysis in SPSS.20. The Bartlett's test of sphericity was significant ($\chi 2 = 62.112$, df = 2, $p < 0.001$) to confirm the intercorrelation to justify MANOVA. We used Pillai's trace to examine the statistical significance of effects, since it is more robust [106]. The MANOVA results verified the hypotheses H7a to H8b. The two main effects; CC level (Pillai's trace = 0.666, $p < .001$), RA level (Pillai's trace = 0.803, $p < .001$), and, the interaction effect CC * RA (Pillai's trace = 0.125, $p < .001$) were significant. The covariate(gender) had significant direct effect (Pillai's trace = 0.593, $p < .001$). A univariate analysis performed to determine the sources of the effects revealed that CC has a significant and strong positive relationship with IA (Partial eta squared = 0.665; $p < 0.01$) and had a significant but, weak effect on HI (Partial eta squared = 0.029; $p < 0.01$). The information adoption tendencies are more prominent among cognitively simpler persons than complex ones,

as evident from the mean scores reported in Table 6. Thus, we got support for H7a and H7b.

Similarly, RA was positively related to IA (Partial eta squared $= 0.803$; $p < 0.01$) and HI (Partial eta squared $= 0.065$; $p < 0.01$). Thus, both H8a and H8b got empirical support. Among two-way interactions, the effect of RA * CC on IA (Partial eta squared $= 0.105$; $p < 0.01$) and on HI (Partial eta squared $= 0.015$; $p = 0.058$) were significant at 0.1 level. Gender significantly influenced HI (Partial eta squared $= 0.571$; $p < 0.01$) but not IA. The comparison of means for significant effects validated the hypotheses further.

6.6 Examination of mediating effect of IA

We have conducted the mediation analysis to verify whether IA acts as a significant mediator between various antecedents and HI in online**.** The enquiry was justifiable**,** Since the SEM output insignificant direct effects from few antecedents to suggesting a possibility of full mediation of IA in causation of HI. Conventionally, for mediation checking, we assess the significance of indirect effect or mediated effect and depending on the changes in the direct effect conclude the full (if direct effect becomes insignificant), partial (if the direct effect is still significant) or no mediation (if the indirect effect is insignificant). To overcome the confusion regarding the one-dimensional idea of mediation, Zaho et al. [129] has coined a typology that classifies mediation into five categories. These types are (1) complementary mediation in which both direct effect and indirect effect exit in the same direction; (2) competitive mediation both direct effect and indirect effect exit in the opposite direction; (3) indirect-only mediation in which no direct effect; (4) direct-only non-mediation with no indirect effect; and (5) no-effect non-mediation in which neither direct effect nor indirect effect exists.

Table 6 Results of MANOVA analysis

Tests of between-subjects effects				
Source		Mean comparisons	Sig	Partial eta squared
RA	HI	Risk Taker $= 3.365$; Risk Averse $= 3.64$ (*H8b supported*)	.001	.065
	IA	Risk Taker $= 3.461$; Risk Averse $= 4.687$ (*H8a supported*)	.000	.803
CC	HI	Complex $= 3.417$; Simple $= 3.591$ (*H7b supported*)	.008	.029
	IA	Complex $= 3.67$; Simple $= 4.484$ (*H7a supported*)	.000	.665
RA * CC	HI	Simple* risk averse $= 3.79 >$ complex* risk averse $= 3.52 >$ simple* risk taker $= 3.39 >$ complex*risk taker $= 3.17$	.058	.015
	IA	Simple* risk averse $= 4.98 >$ complex* risk averse $= 4.38 >$ simple* risk taker $= 3.96 >$ complex*risk taker $= 2.96$	.000	.105
R squared (HI) $= .66$ (adjusted R Squared $= .655$)				
R squared (IA) $= .87$ (adjusted R Squared $= .868$)				

To examine mediating effects, we used model no.4 of the SPSS process macro V 3.4 [130]. To test the indirect effects, we have adopted bias-corrected bootstrapping with 10,000 samples [131] and included gender as a covariate. The indirect effects were treated significant in all cases where the 95% confidence interval (CI) does not include zero. The estimates produced in the output were unstandardized estimates. Table 7 summarizes the results of the mediation analysis.

We found that two antecedents, namely SC and AQ, have significant indirect effects mediated through IA on HI.RC, CC and IA have a significant direct and indirect effect on HI. The highest significant mediated effect was from RA (β = 0.203), followed by CC (β = 0.157).

7 Discussions

This study examined the effect of specific factors behind public information adoption and herding tendencies of online customers. Many consumer behavior models like Howard and Sheth and Engel–Kollat–Blackwell [132] denotes the role of information in shaping consumer behavior. Purchase decisions originate from a favorable attitude formed on receipt of an information about a product's appropriateness in meeting customer requirements. Also, until the formation of a strong attitude toward a decision, information search will continue to avoid post-purchase dissonances. The information search and usage behaviors have undergone drastic shifts in the digital environment because receiving and sharing real-time information is easy. The tendency to modify existing beliefs on receipt of new information and changing purchase decisions accordingly [133] is more rampant in online formats.

Due to availability of excess information in digital platforms, customer confusions affecting cognitive evaluations that guides decisions are widespread in e-commerce settings [134]. Therefore, customers perceive a pseudo value gain, and tend to adopt others' decisions, resulting in herding. Herding is a natural instinct, and by joining a herd, individuals feel safe and tend to believe that possibility of risk is minimum. From the marketer's perspective, herding creates new opportunities as it develops an informal communication system in which existing customers become influencers to new customers [135]. Digital platforms accelerate herding, since information diffusion is fast, and marketing cues such as referral bonuses, offers, or stock depleting messages, etc., get an extensive reach. Such marketer induced herding is part of a firm's strategy for favorable outcomes. Hence, understanding the dynamics behind herding intentions is beneficial marketers.

In light of reported facts in literature and based on logical considerations, we conceptualized that an individual's intention to follow the herd depends on (1) online information attributes, (2) sociological factors, and (3) customer characteristics. The empirical investigation to verify the linkages among such constructs offered many valuable observations. First, e-commerce customers adopt online public information available in the form of customer reviews and exhibit a herding tendency (β = 0.32; $p < 0.1$). Second, the stepwise regression analysis revealed that information attributes has maximum role in predicting information adoption behavior ($R^2 = 0.21$). Third, both information attributes (AQ and SC) have a significant direct and indirect

Table 7 Results of mediation analysis

IV	Direct effect[a]	'p' value	Indirect effect	Boot LLCI	Boot ULCI	Type of mediation
SC	− 0.035	0.37	0.0385	0.0132	0.071	Indirect only mediation
AQ	0.0366	0.383	0.0576	0.0229	0.098	Indirect only mediation
SE	− 0.067	0.078	0.0083	− 0.016	0.036	Direct only non-mediation at 0.1 level
RC	0.178	<0.01	0.048	0.0141	0.088	Complementary mediation
CP	0.0104	0.78	0.0186	− 0.0654	0.086	No-effect non-mediation
CC	0.7510	<0.01	0.157	0.075	0.2377	Complementary mediation
RA	1.17	<0.01	0.2030	0.0356	0.360	Complementary mediation

[a] In all cases mediator is IA and dependent variable is HI

effect on HI. However**,** the impact of AQ was more in developing IA compared to SC, corroborating with the Elaboration Likelihood Model, which proposes that AQ is the central cue in information adoptions [136].

Fourth, among the sociological constructs, the maximum effect was from RC compared to other antecedents in this category. RC had a significant direct and indirect effect on HI. The observation implies that adopting popular reviews imparts a sense of safeguarding social image [137] in social commerce. Fifth, findings from our study indicate that an intention to adopt others' views is not a reflection of social equality needs [138] as documented in the social identity theory [139] and self-concept maintenance theory [140]. However, empirical findings from this study corroborate the observation in the extant research that social connectivity and peer acceptance motivate individuals to accept shared reviews available in online platforms [141, 142].

Sixth, SE was not significant in developing IA or HI (H4a & H4b). Theoretical perspectives mooted in the social cognitive theory [143], the expectation states theory [144], and the social exchange theory [145] justified inclusion of SE in the framework for the study assuming that status beliefs [146] and social equality [147] concepts are relevant in explaining HI in e-commerce. However, it appears that equivalence perceptions in the digital environment are conceptually different**,** and customers do not form a part of the herd just for an equality feeling. Seventh, CP had no direct effect on HI but had a significant effect on IA. The findings imply that there is an urge to establish conformity with other members in a group for IA. Eight, RC influences customer decisions in online. Lastly, constructs representing customer characteristics in the study significantly influenced IA and HI. Mean comparisons revealed that customers with a simple cognitive structure and risk avoidance nature have significantly higher levels of IA and HI.

From the above observations, it emerges that rather than sociological factors, information attributes**,** and customer characteristics decide public information adoption tendencies of e-commerce customers. Therefore, attributes such as information quality and source credibility of readily available user-generated content influence their herding intentions of e-commerce customers. In general, customers utilize the information to obtain adequate knowledge to evaluate the benefits from purchase decisions. Evaluations create both objective and subjective knowledge [148], of which the objective knowledge is more scientific compared to subjective knowledge having individual biases. Subjective knowledge includes more personal information and contains evidence of individual expertise gained by applying higher cognitive effort [149]. Individuals with complex cognitive structure are likely to cherish decisions based on their subjective evaluations.

The volume of information available online often creates confusion in the minds of the customer [150], decision making becomes difficult. Literature refers to three dimensions of customer confusion, namely similarity confusion, overload confusion, and unclarity confusion [151]. Similarity confusion originates when the customer fails to differentiate products, while large volumes of information about products confuse cognition resulting in overload confusion. Unclarity confusion appears when the customer attempts to revise their existing beliefs for decision making. In e-commerce, many reasons exist for customer confusions [152, 153], and

under confusions, the customer may opt for majority decisions. Based on our findings, public information adoption and herding are minimum among customers with high levels of CC and risk-taking tendency. Thus, it appears that there exists a clear divide in the behavior of online customers, depending on their cognitive complexity and risk adoption tendencies. A cognitive simple and risk averse customer may opt for public information and herding under confusions, whereas customers with complex cognitive structure and risk-taking ability may search for more private information to enable decision making [154].

7.1 Theoretical contributions

The theoretical underpinnings behind herding have evoked researchers' interest in different contexts, and our study extended this exploration to the rapidly growing e-commerce context. The pattern in which the diffusion of information happens via virtual media remains an ongoing domain of interest to both academics and practitioners. Our research contributes to the body of knowledge concerning consumer decision-making models in virtual marketplaces. Herding in online is a collective behavior, which can be positively directed to address the challenges linked to ambiguity in consumer behavior in the e-commerce market place. The framework empirically validated through our research integrates aspects of customer psychographics, which involves various hidden heuristics and common beliefs that intervene in customer decision making. Theoretically, our study extended the 'Information Adoption Model' by incorporating few constructs related to sociological considerations and customer characteristics. We attempted to apply the extended information adoption model for predicting herding intentions among e-commerce customers. The findings explicated that social equality beliefs are not prominent predictors of information adoption or herding in online settings. However, we could authenticate the role of customers' cognitive structure and risk avoidance tendencies in online herding.

Many studies validated the fact that customers get confused to take decisions under the supply of too much information. Also, in such confusions two types of decision-making styles like; (1) trying to cognitively evaluate the correctness of information, or (2) accepting popular views of others, are likely. Theoretically, we found that the customer choice among these decision-making styles depends on their cognitive structure and risk aversion. Thus, we could extend the personal construct theory [155] and cognitive complexity theory [96] by extending them beyond information processing to online purchase decision making. This study contributes to literature on cognitive complexity, since we could analyze its effect using a scenario-based experiment without attempting to measure the same, as difficultly in measuring was a significant barrier in theoretical explorations of the construct [156]

Research on minimizing cart abandonment and customer hesitation in online by managing the e-environment stimuli to develop favorable customer behavior have theoretical implications. The focus of extant research to address these challenges mostly examined the scope of technological, webscape-related, marketing mix aspects, customer beliefs, their motivations and attitudes. This study contributes to such attempts by theorizing the possibility of online herding as solution to lift

online purchase completions. Our investigations corroborated the tenets of the classic S–O–R paradigm [157], which posits that many external stimuli have the potential create a response in the organism. We could establish that information attributes, social beliefs of the customers, and their cognitive structure and risk aversion tendencies forms strong stimuli for customer to adopt online information to create responses favoring majority views.

7.2 Managerial implications

Besides the above conceptual contributions, the study has several managerial implications that help e-commerce managers understand the determinants of public information adoption in an online context. Marketers need to generate favorable herding in retailing, and hence they should aim to conceive and direct communications for the voluntary adoption of information contents by customers, which, in turn, encourages them to share product reviews. Cognitive simple and risk averse customers are likely to adopt customer reviews if the reviews create a positive effect in the public domain; hence firms should put out all-out efforts to publicize positive reviews. However, cognitive complex and risk-taking customers prefer to validate the information in the public domain with their private information before decision making. Such customers require more cues to develop their private information. Thus, firms should ensure a continued supply of reinforcing information from credible sources to reduce hesitation/ dissonances at pre/post stages of purchase decisions. In e-commerce, cart abandonment is predominant, and based on extant research; it is logical to conclude that cognitive complexity and risk avoidance tendencies significantly moot such intentions. Hence, we propose more attempts to understand the cognitive structure and risk-taking tendencies of online shoppers by analyzing their decision-making process.

Even though the contribution of platform quality in developing information adoption was beyond the scope of this research, prior empirical evidence confirms the role of website attributes. As an essential information channel to reduce information asymmetry, online reviews rely on assumption of crowd wisdom, under which the aggregated information takes effect. However, without careful design, studies affirm that herding could undermine the wisdom of the crowd, which serves as the backbone to support consumers to make better decisions. Therefore, having a better understanding of herding behaviors and its mechanisms can enable the e-commerce platform to reduce herding's erosion on the wisdom of the crowd by optimizing its information structures (i.e., public information, private information, etc.). Since the platform has more information and historical transaction records, it has the potential to infer the consumer's cognitive structure and risk attitude. Thus, the platform could provide different information structures to different consumers and facilitate better decision making.

Our research established that for information adoption to occur, argument quality and source credibility are the decisive elements. Therefore, e-commerce firms should identify reviews containing strong arguments in favor of the firm's offer,

reinforce the contents with details regarding the credibility of the source of review, and use such reviews in their communications with customers.

7.3 Limitations

Although our study examined the role of sociological and psychographic variables on IA and HI in the online context, it has a few limitations. No attempt was made to develop a context-specific scale to assess CC or RA. Further, the interplay of other psychographic factors like impulsiveness, loyalty seeking, etc., on CC and RA to predict IA and HI was not probed. Future research on scale development of CC and RA, the role of social media attributes on HI, servicescape design for herding, etc. can contribute to the literature on herding in e-commerce.

Compliance with ethical stadards

Conflict of interest No conflict of interest exists.

Appendix 1

Scenario-1 (cognitive Simple vs risk averse)

"You spend time on social media and other online platforms to gather information from reviews to make an online purchase decision. Mostly, you find *reviews helpful and accept such information to make decisions without much evaluations about correctness* and *avoid the risk of committing mistakes by taking decisions against the majority*".

Scenario-2 (cognitive simple vs risk taking)

"You spend time on social media and other online platforms to gather information from reviews to make an online purchase decision. Mostly, you find *reviews helpful and accept such information to make decisions without much evaluations about correctness* but prefer to make decisions based on own judgments".

Scenario-3 (cognitive complex vs risk averse)

"You spend time on social media and other online platforms to gather information from reviews to make an online purchase decision. Mostly, you find *reviews helpful* but search for more private information for detailed evaluations but ultimately *avoid the risk of committing mistakes by taking decisions against the majority*".

Scenario-4 (cognitive complex vs risk taking)

"You spend time on social media and other online platforms to gather information from reviews to make an online purchase decision. Mostly, you find *reviews helpful but search for more private information for detailed evaluations* and *will prefer to make decision based on own judgments.*

Appendix 2 (survey instrument)

Dear Respondent,

The scenario provided below narrates an online buying decision-making process. You may kindly visualize yourself in the scenario and cast your position on following questions on a scale varying from "strongly disagree" to "strongly agree." (Tick in the appropriate box).

"You spend time on social media and other online platforms to gather information from reviews to make an online purchase decision. Mostly, you find *reviews helpful and accept such information to make decisions without much evaluations about correctness* and *avoid the risk of committing mistakes by taking decisions against the majority*".

No.	Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	I feel online information that imparts knowledge are credible					
2	I feel online information shared out of expertise on the matter are credible					
3	I feel that to adopt online information, its contents should be trustworthy					
4	I think online Information is credible if many others share the same feeling					
5	I feel online information should be complete to consider adopting it					
6	I feel online information should meet the objective of information search					
7	I feel online information should be believable to consider adopting it					
8	I feel online information should be complete to consider adopting it					
9	Others will not respect me if I commit a mistake					
10	My colleagues will not trust me if I commit mistakes					
11	Others will not consider me an expert in quality decisions if I commit mistakes					
12	others will challenge my integrity if I commit mistakes					

No.	Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
13	I will be contributing to society by accepting the majority opinion					
14	I will enjoy equal social status by accepting views of majority					
15	My importance in society will increase by accepting majority views					
16	I can influence others by accepting their opinions					
17	I feel everyone will agree to my decisions if I follow majority					
18	I am flexible to adopt other's views in my decisions					
19	If I go with the majority, chances of complaints are less					
20	I feel more confidence by accommodating other's views					
21	I consider other's views in my decisions					
22	I will be motivated to share information that I find useful					
23	I generally trust information if many people share it					
24	I like to use popular online reviews in my decision-making					
25	I will follow the majority in my decisions					
26	I feel that accepting views of the majority is riskless					
27	I feel that accepting views of the majority is safe					
28	I feel that accepting views of the majority is beneficial					
29	I felt the situation described in scenario as realistic					
30	I had no difficulty imagining myself in this situation described in the scenario					
31	I prefer to make decisions by trusting public information available online					
32	I prefer to avoid risk by accepting majority decision rather than going independently					

Name:
Gender:

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