Influence of Social Network Integration on the Online Review Helpfulness

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<u>**Short Research Paper**</u>

Influence of Social Network Integration on the Online Review Helpfulness

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Abstract: Online consumer reviews are important for consumers when they make purchasing decisions. However, the large volume of online reviews makes it difficult for consumers to identify those helpful reviews. The influencing factors on online review helpfulness have drawn great attention from different research fields. In recent years, online review websites start to exhibit more features of social media. For example, some websites allow users to integrate with other social media accounts. The influences of such social factors, however, are rarely studied in the literature. Drawing on a dataset from Qunar.com, this paper explores how social network integration and reviewer network centrality influence online review helpfulness through a negative binomial regression model. Our results show that both factors have a positive effect on review helpfulness, and that network centrality positively moderates the effect of social network integration. Our research results provide important implications for reviewers, industry practitioners, and online review websites.

Keywords: online consumer reviews; social network integration; network centrality; online review helpfulness

1. INTRODUCTION

Online consumer review is usually defined as product evaluations published by consumers on e-commerce or third-party websites, mainly in the form of star rating and open review text [1]. According to the research survey provided by Saleh (2015), 90% of consumers read online reviews, and 88% of consumers believe that online reviews are as trustworthy as personal recommendations [2]. This shows that most consumers will read online reviews before making a purchasing decision to reduce their uncertainties. Consequently, online reviews have important influences during consumers' product selection and purchase process.

The rapid increase number and uneven quality of online reviews, however, also pose a great challenge to consumers. They may find it difficult to identify reviews that provide the most truthful and valuable information. Therefore, to address such an issue of information overload, it is crucial to help consumers quickly identify the most "helpful" reviews from tons of reviews. Online review websites usually allow readers to give feedback on reviews by clicking the "useful" vote buttons. The helpfulness of a review thus can be measured by the number of votes it received.

Online review helpfulness has drawn great attention from researchers from different fields. The concept of online review helpfulness was first proposed by Chatterjee (2005) [3], which refers to the influence degree of information use. Mudambi (2010) regards it as the subjective perceived value of whether consumers are helpful to online reviews in the decision-making process [1]. In addition, many scholars have studied how different factors may affect the helpfulness of online reviews, mostly focusing on reviewer characteristics and review characteristics [4-8].

Since online review websites exhibit more and more social media features, a few scholars also established that social factors may influence online review helpfulness as well [9,10]. In recent years, online review websites start to allow users to integrate with their social network accounts (such as Twitter, Facebook, and Weibo). Such a mechanism may have important influences on review helpfulness but has not been well studied in the existing literature. This paper aims to supplement relevant literature by considering social network integration. In particular, based on a dataset drawn from Qunar.com, we explore the influence of social network integration on online review

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helpfulness and how such influence is moderated by reviewer network centrality. Results show that social network integration positively influences online review helpfulness and this relationship is positively moderated by reviewer network centrality.

2.   LITERATURE REVIEW

2.1 Online review helpfulness

As above mentioned, identifying high quality reviews from a large volume of reviews is important to consumers. Thus, online review helpfulness has become a hot topic in different diplomacies, including information systems and marketing. Many scholars studied the influencing factors of online reviews helpfulness. Scholars mainly considered factors from four types. The first type of factors come from reviewer characteristics. Reviewers' identity disclosure, reviewer expertise, and reviewer reputation are all considered to have a significant impact on online review helpfulness [4-7,11]. The second is review characteristics. Review content (including review length, review readability, review pictures, etc.), review emotional tendency, review valence, review time and review response have also been shown to influence online review helpfulness [8-12]. The third type relates to reader characteristics. For example, Laura (2011) points out that readers' prior knowledge has a positive effect on review helpfulness [13]. The last type of factor comes from product characteristics. For example, prior scholars have studied the influence of different product types on review helpfulness [14-15].

2.2 Social network integration

Social network integration refers to the phenomenon in which many online platforms seek to supplement their user communities through integration with well-known social networking sites such as Facebook, Twitter, and Weibo [16]. In other words, social network integration facilitates the creation and login of user accounts and provides a more personalized user experience, but it also weakens the anonymity of users [17].

Several scholars have examined the influence of social network integration during the process of online review generation. For example, Lee (2015) found that, in the presence of social network integration, consumer reviews on products will be influenced by existing reviews through observational learning and peer pressure mechanisms [18]. Huang (2017) pointed out that social network integration would increase the review number and emotional languages, while decrease cognitive languages and negative languages [16]. Pu (2020) examined the influence of social network integration on the generation of online reviews from the perspective of social presence theory [17].

Despite the important role of social network integration in the process of review generation as pointed by these pioneering previous studies, rare research has been done to examine the influence of social network integration on online review helpfulness.

Our paper contributes to the literature by considering how social factors including social network integration and reviewer network centrality will influence online review helpfulness. To the best of our knowledge, we are the first to explore the influence of social network integration on the helpfulness of online reviews and how this effect is moderated by reviewer network centrality.

3.   HYPOTHESES DEVELOPMENT

3.1 Social network integration

Sussman (2003) proposed that argument quality and source credibility are the direct factors that affect information usefulness [19]. Social network integration can increase the readers' perceptiveness of review helpfulness through both argument quality and source credibility. First, reviewers can share their reviews with other social platforms through social network integration, and these reviews may be seen by friends in the reviewer's social circle. Reviewers thus are motived to improve the review quality to establish a positive social

image and to build a reputation. Consequently, consumers will perceive these high-quality reviews as more helpful. Second, social network integration enables consumers to obtain the identity information of the reviewer. When consumers read a review, they can see the source of the information, which improves the credibility of the review. This may also lead to more useful votes for this review.

According to the anonymity effect and social norm theories, the psychological pressure on individuals from group norms or the influence of others will be reduced under the condition of anonymity. As a result, individuals will show greater autonomy and independence to express their opinions more fully [20]. That is, identity anonymity makes reviewers express their evaluation of consumption experiences more truthfully. However, social network integration leads to disclosure of reviewers' identities and thus weakens their anonymities. As a result, in the presence of social network integration, reviewers are more likely to publish reviews that conform to social norms, and readers will consider these reviews as less useful information since they don't represent reviewers' truthful opinions about products or services.

In sum, the influence of social network integration on review helpfulness depends on whether the effect of argument quality and source credibility dominate the anonymity effect and social norm or otherwise. High quality reviews can help readers to make quick purchasing decisions while source credibility can help mitigate readers' uncertainty upon the identity of reviewers. On the contrary, whether the reviewers choose to conform to social norms when writing a review is not observable to readers and thus may play a less important role. Thus, it is reasonable to hypothesize that the former effect dominates the latter effect. That is, social network integration will improve online review helpfulness. Therefore, we propose the following hypothesis:

H1: When reviewers choose social network integration, their reviews will be perceived as more helpful.

3.2 Reviewer network centrality

As above mentioned, online review websites show more and more social media features in recent years. For example, one reviewer can follow another reviewer on a review website. Usually, some reviewers may have relatively more followers while some reviewers might follow a large number of other reviewers. This unevenly distributed follower-followee relationship can be measured by centrality, a key concept in social network analysis. Centrality refers to the degree to which a user in a social network is centered in the whole network and thus can measure the influence of users in social networks [21]. In a social network, centrality can be divided into two types: external network centrality, which refers to the number of followees a user has in a social network, and internal network centrality, indicating the number of followers a user has in a social network [10].

On one hand, reviewers with a high external network centrality thus have more information sources than those with a low external network centrality, since they followed more other reviewers. They may spend more time than others to read followees' reviews and this may make them being more experienced in writing reviews. Consequently, high external network centralities might lead to higher quality reviews. In addition, reviewers with a high external network centrality may be also motivated to write high quality reviews in order to receive returned attention from other reviewers. Therefore, it is reasonable to conjecture that high external network centrality is an indicator of "usefulness".

On the other hand, high internal network centrality can be viewed as an indicator of reputation in a social network [22]. From a social psychology perspective, reputation is essentially a signal of enhanced credibility [23]. To attract a large number of followers on a review website, the reviewer must have provided many trustworthy and high-quality reviews in the past. In addition, reviewers with a high internal network centrality are considered more influential since their activities are immediately observed by a large number of followers. But this also requires these reviewers to provide trustworthy and high-quality reviews to maintain a large number of followers. Therefore, reviews posted by reviewers with a high internal network centrality are more likely to be perceived as more trustworthy.

Base on the above discussions, we propose the following hypothesis:

H2a: Reviews posted by reviewers with high external network centrality will be perceived as more helpful.

H2b: Reviews posted by reviewers with high internal network centrality will be perceived as more helpful.

In addition, reviewer network centrality may also moderate the influence of social network integration on online review helpfulness. First, as abovementioned, social network integration will reveal reviewer identity information and enhance source credibility. A higher reviewer network centrality means a higher influence on review websites. When such a reviewer chooses social network integration, her information will be open to more users compared to a reviewer with low network centrality. Thus, the effect of enhanced source credibility would be more salient. Second, reviewers with a high network centrality usually are active users in social media. When they share their reviews, they might care more about their social images than reviewers with a low network centrality and thus are more motivated to improve review quality.

Therefore, we propose the following hypothesis:

H3a: Reviews' external network centrality positively moderates the impact of social network integration on review helpfulness.

H3b: Reviews' internal network centrality positively moderates the impact of social network integration on review helpfulness.
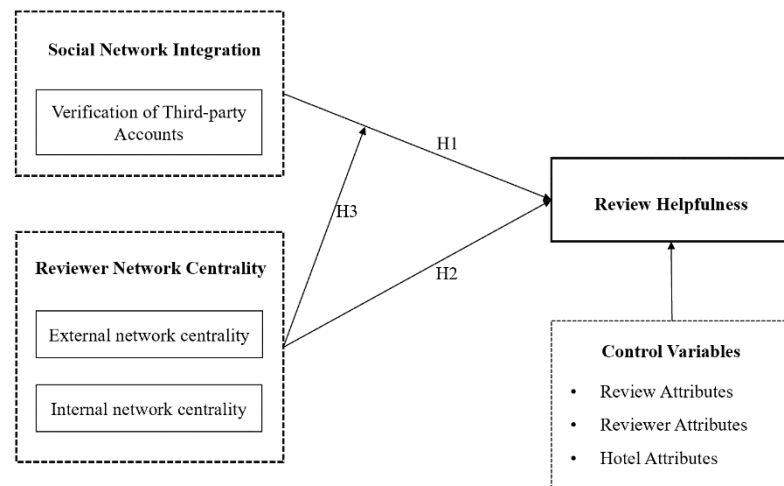

Figure 1.   Research Model

4.   RESEARCH METHODOLOGY

4.1 Data collection

Qunar.com is a leading Chinese online travel agency. It provides consumers with one-stop booking services for travel products and also allows consumers to post reviews for their purchasing. Qunar.com now enables consumers for social network integration, making it an ideal website for our research. We collected all consumer reviews for hotels in the city of Beijing. The dataset includes in total 2,489,626 reviews of 10,459 hotels. In addition, a large number of reviews on Qunar.com are posted by anonymous users. We deleted these reviews since reviewer characteristics cannot be obtained for them. This leaves us a number of 587,661 reviews. Variables used in this research are explained in detail as follows.

4.2 Variable design

To verify all hypotheses proposed in this paper, we designed the following regression model：

$Review\ Helpfulness = \alpha + \beta_1 Social\ Network\ Integration + \beta_2 External\ Network\ Centrality + \beta_3 Internal\ Network\ Centrality + \beta_4 External * Social\ Network\ Integration + \beta_5 Internal * Social\ Network\ Integration + \theta Controls + \varepsilon$ （1）

The dependent variable *Review Helpfulness* is the number of "useful" votes that one review receives. The independent variable *Social Network Integration* is a dummy variable. If the reviewer enables social network integration by verifying a third-party social media account, it equals 1. Otherwise, it takes a value of 0. Therefore, H1 is tested by β_1, which captures the influence of social network integration on review helpfulness. *External Network Centrality* is measured by the number of reviewers' followees. *Internal Network Centrality* is measured by the number of reviewers' followers. The estimation of β_2 *and* β_3 thus are used to test H2a and H2b. β_4 and β_5 are the coefficients of interaction terms of *External Network Centrality* and *Internal Network Centrality* with *Social Network Integration*, which are used to test H3a and H3b, respectively.

The control variables in this paper included the number of reviews posted by the reviewer, hotel level, and rating difference between the current review with the average rating for the same hotel. As mentioned above, Qunar.com offers four hotel levels to choose from, including "two-star or less/ economical", "three-star/comfort", "four-star/premium" and "five-star/luxury". To avoid multicollinearity, three dummy variables – "HotelLevel_2", "HotelLevel_3" and "HotelLevel_4" are set to represent four levels. In addition, existing research points out that a higher number of reviews posted by reviewers can improve their expertise and reputation and their reviews will be perceived as more helpful [11]. We thus include the number of reviews posted by the reviewer to control this effect. Further, the gap between a review rating with the average rating of the hotel may also influence the review's perceived helpfulness [10]. We thus include rating difference as a control variable too.

5. RESULTS AND DISCUSSIONS

5.1 Descriptive statistics

Table 1 reports the descriptive statistics. Review helpfulness is a count variable with a minimum value of 0 and a maximum value of 46. Through further frequency analysis, we also found that its skewness equals 17.55 > 0, indicating a right skewed distribution. The regression models of the count variable should be adopted. As is known to all, Poisson regression fits well when the variance of count dependent variable is equal to its mean. However, the variance (0.1616) of the dependent variable in this study is greater than the mean (0.0663). Therefore, we choose the Negative Binomial regression model. We choose the software Stata 16.0 for regression analysis.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Review helpfulness	587,661	0.0663	0.402	0	46
Social Network Integration	587,661	0.0735	0.261	0	1
External network centrality	587,661	0.0178	1.428	0	322
Internal network centrality	587,661	0.0323	2.834	0	761
Number of reviews posted	587,661	11.52	19.99	0	2,138
Rating difference	587,214	0.696	0.690	0	3.900
HotelLevel_2	426,927	0.396	0.489	0	1
HotelLevel_3	426,927	0.271	0.444	0	1
HotelLevel_4	426,927	0.222	0.416	0	1

5.2 Regression analysis results

Before the regression analysis, we conduct the multicollinearity test of each variable and the results were shown in Table 2. All the variance inflation factors (VIF) are less than 10, indicating that there is no multicollinearity issue among variables.

Table 2.   Test for Multicollinearity

Variable	VIF	1/VIF
Social Network Integration	1.03	0.971564
External network centrality	1.51	0.661173
Internal network centrality	1.54	0.648464
Number of reviews posted	1.06	0.945675
Rating difference	1.03	0.972928
HotelLevel_2	2.79	0.358234
HotelLevel_3	2.52	0.397102
HotelLevel_4	2.35	0.426300
Mean VIF	1.73	

The regression results are shown in Table 3. Model 1 is a regression model involving only control variables. Model 2 adds the variable of social network integration to Model 1. Model 3 adds two variables of reviewer network centrality to Model 1. Model 4 is the regression model of all variables except interaction effects, and Model 5 is the regression model of all variables including interaction effects. As shown in Table 3, the Likelihood ratio test p value for each model is 0.000, indicating a strong fit of the Negative Binomial regression model with our dataset.

The results of Model 2 ($\beta1$=0.379, p=0.000) and Model 4 ($\beta1$=0.374, p=0.000) consistently demonstrate that social network integration has a significant positive effect on review helpfulness. This suggests that social network integration may increase source credibility as we have hypothesized, and reviewers are motived to improve the review quality when their reviews will be shared through other social platforms. Thus, the review helpfulness is increased. H1 is strongly supported.

The results of Model 3 and Model 4 show that both external network centrality ($\beta2$=0.0434, p=0.000; ($\beta2$=0.0346, p=0.000) and internal network centrality ($\beta3$=0.0277, p=0.000; $\beta3$=0.0294, p=0.000) have significant positive effects on the review helpfulness. Higher network centralities of reviewers usually represent their high reputation and high professional skills. Thus, H2a and H2b are also supported.

Model 5 shows that external network centrality ($\beta4$=0.0799, p=0.000) and internal network centrality ($\beta5$=0.0231, p=0.000) can positively moderate the influence of social network integration on review helpfulness. This result indicates that the higher the reviewer's network centrality is, the stronger influence of social network integration on review helpfulness. H3a and H3b are supported.

Table 3. Negative Binomial Regression Analysis Results

	Model 1	Model 2	Model 3	Model 4	Model 5
Social Network Integration		0.379***		0.374***	0.373***
External network centrality			0.0434***	0.0346***	-0.0545***
Internal network centrality			0.0277***	0.0294***	0.0236***
External ×Social Network Integration					0.0799***
Internal ×Social Network Integration					0.0231***
Number of reviews posted	5.90e-0.5	-0.000820**	-0.00425***	-0.00539***	-0.00574***
Rating difference	0.586***	0.586***	0.586***	0.586***	0.586***
HotelLevel_2	-1.130***	-1.120***	-1.122***	-1.112***	-1.111***
HotelLevel_3	-0.539***	-0.533***	-0.533***	-0.527***	-0.526***
HotelLevel_4	-0.152***	-0.146***	-0.146***	-0.141***	-0.140***

	Model 1	Model 2	Model 3	Model 4	Model 5
lnalpha	2.083***	2.074***	2.064***	2.064***	2.052***
Constant	-2.765***	-2.796***	-2.731***	-2.758***	-2.755***
chibar2(01)	1.9e+04	1.9e+04	1.9e+04	1.9e+04	1.9e+04
Prob >= chibar2	0.000	0.000	0.000	0.000	0.000
R-squared	0.0356	0.0366	0.0375	0.0384	0.0385

6. CONCLUSIONS

Online review websites are showing more and more social media features. One notable mechanism that emerged in recent years is social network integration. However, little research has been done to study its implications on online review helpfulness. Based on a dataset drawn from Qunar.com, we show that social network integration and reviewers' network centrality have a positive impact on review helpfulness and network centrality positively moderate the influence of social network integration. The research significance of this study includes the following two folds:

This research has certain theoretical significance. This paper is a supplement to the research in the field of online reviews. It provides new variables for the study of the influencing factors of online reviews helpfulness from the perspective of social networks. Examining the impact of social network integration on online review helpfulness, we also enrich the literature in the field of social media, by adding discussion on the potential value and impact of social media.

This research also has practical implications for consumers, reviewers, industry practitioners, and third-party review sites. The empirical results of our study can help consumers find high quality reviews. Reviewers also have clearer guidance on how to post more helpful reviews. Industry practitioners such as hotel managers can use incentive measures to encourage reviewers to post more useful reviews. Third-party platforms can use our results to update their algorithms to improve the review sorting mechanism.

As with other literature, our study has serval limitations. First, the dataset in this paper is cross-sectional data, so it may not be able to observe the dynamic behaviors of individuals. Future studies may use panel datasets and conduct further studies. Second, this paper uses the hotel review data from Qunar.com. Future studies may extend this research to other industries such as online shopping, entertainment, and online education.

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