# The role of online product reviews on information adoption of new product development professionals

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## Abstract

**Purpose** – The purpose of this paper is to investigate the impact of features involving online product reviews (OPRs) on information adoption by new product developers (NPDs).

**Design/methodology/approach** – In total, 143 OPRs on a specific product on Amazon.com were collected as the sample of this study. Using content analysis ratings and observed data in OPRs, the research model was analyzed with the partial least squares (PLS) method.

**Findings** – Results suggest that helpfulness rating and the degree of referencing are positively associated with NPDs' information adoption, while the extremeness of product rating is negatively associated. Moreover, title attractiveness mitigates the negative relationship between the extremeness of product rating and information adoption.

**Practical implications** – The findings provide interesting insight for NPDs who visit e-commerce sites to learn through electronic word-of-mouth (eWOM) communication. OPRs with a higher degree of referencing, higher helpfulness rating, moderate level of product rating, and higher degree of title attractiveness are better adopted by NPDs.

**Social implications** – This paper investigates the value of OPRs for a specific group of information users and suggests that information about products generated by anonymous consumers can be crucial.

**Originality/value** – While extant studies have focussed on the impacts of OPRs on consumers' purchasing intention and behavior, this paper is among the first attempts to investigate the impacts of OPRs on developers' information adoption. Therefore, it contributes to the body of knowledge on knowledge transfer from consumers to business as well as the information adoption literature.

**Keywords** Heuristic and systematic model, Information adoption, New product developer, Online product review, Review helpfulness, Title attractiveness

**Paper type** Research paper

## 1. Introduction

Currently in the information technology (IT) industry, companies are launching new products more frequently than before, due to everlasting decreases in the price of raw materials (e.g. memory chips) and rapidly changing consumers' expectations. Hardware manufacturers, such as personal multimedia players (PMPs) and Smartphones, launch new lines of products almost every season, or at least bi-yearly (e.g. Apple launched two new versions of the iPod and the new iPhone4 in 2011). In order to continuously improve their products and eventually attract consumers in the highly competitive e-marketplace, companies should always listen to consumers'

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opinions (Constantinides, 2004). For this reason, they build various online channels between consumers and their employees who are involved in developing new products, normally with "online consumers' forums" and "contact us by e-mail" alternatives. Other than these direct channels, consumer-generated feedback, often referred to as online product reviews (OPRs), are available on e-commerce sites, such as Amazon.com (Mudambi and Schuff, 2010), personal blog pages (Hsu *et al.*, 2013), online communities (Chang *et al.*, 2013), and even on social networking sites (Choi, 2013; Sotiriadis and van Zyl, 2013). Currently with the growing popularity of e-commerce and the provision of online review options, consumers voluntarily post their reviews for other potential consumers. These OPRs are becoming important information channels for consumers and may have an even stronger impact on companies' competitive advantage than advertising in some industries (Jalilvand and Samiei, 2012). Thus, new product developers (NPDs) who are involved in developing a certain product and service can look into such OPRs, which may contain valuable information for product improvement, as well as new product development (Anderson and Magruder, 2012).

OPRs are found to be a helpful source of information not only for consumers (Sun, 2012), but also for firms that release products (Anderson and Magruder, 2012; Dellarocas, 2003). Although numerous extant studies have investigated the role of OPRs, they have focussed primarily on consumers' learning (Zhao *et al.*, 2013), purchasing intentions or behavior (Cheung *et al.*, 2008; Lee *et al.*, 2013), marketing (Hsu *et al.*, 2013), and revenue (Liu, 2006). As such, little effort has been made to empirically investigate how NPDs adopt information from OPRs on their products. This study addresses this issue by trying to answer the following research question:

*RQ1.* How do the properties of OPRs affect NPDs' information adoption?

Based on the theoretical perspectives of the heuristic and systematic model (HSM) (Chaiken, 1980), this study proposes a model of NPDs' information adoption from OPRs, which will be empirically investigated with objective data and content analysis data gathered from OPRs on Amazon.com. More specifically, it is hypothesized that both the heuristic properties (review helpfulness rating and product rating) and the systematic properties (the degree of disconfirmation and the degree of referencing) of OPRs influence NPDs' information adoption. Moreover, this study also investigates the moderating role of title attractiveness for the relationship between OPR properties and NPDs' information adoption.

This paper develops as follows. First, literature review on HSM and OPRs is presented to describe how the properties of OPRs can be considered either as heuristic or systematic cues for information adopters (NPDs). Second, the research model is presented, followed by methodologies and a data analysis. Finally, conclusion and implications section presents how the results extend the theoretical understanding of the impact of OPRs on NPDs' information adoption.

## 2. Theoretical background

### *2.1 HSM*

Information adoption refers to the extent to which people accept the content that they are presented with as meaningful, after assessing its validity (Zhang and Watts, 2008). HSM has often been used to explain information processing and adoption in extant studies (Chaiken, 1980; Zhang and Watts, 2008). Recently, HSM is also used to explain individual consumers' attitude toward the information in online informediaries (Chung, 2013).

It holds that information adoption is influenced by dual modes of information processing: heuristic or systematic cues. When an individual is engaged in heuristic processing, s/he adopts information based on heuristic cues, in other words, non-content cues, such as identity of information sources, credibility of sources, or other opinions of the audience (Miller *et al.*, 1976). On the other hand, when an individual is engaged in systematic processing, s/he scrutinizes the message content itself rather than other peripheral issues by making a considerable effort to comprehend and evaluate the message before adopting information in the content. Thus, when an individual employs systematic processing, the characteristics within the message content play important roles for information adoption (Zhang and Watts, 2008).

Each one of these dual processing modes has its pros and cons. Since heuristic processing does not require scrutiny of the message content, it is more time-efficient; however, the conclusion could be misinterpreted by relying on peripheral cues of the information source. With systematic processing, message recipients actually spend time understanding the contents. Thus, it requires motivation, ability, and sufficient cognitive resources to understand the message (Zhang and Watts, 2008). Although individuals may have enough cognitive resources to understand a message, they also need motivation to scrutinize a message for systematic processing.

### *2.2 OPRs*

OPRs are defined as peer-generated product evaluations posted on web sites (Mudambi and Schuff, 2010). Although they are written primarily for other potential customers, the information embedded in OPRs is helpful for firms in numerous ways, such as brand building (Chang *et al.*, 2013), customer acquisition (Ahrens *et al.*, 2013), and quality control (Dellarocas, 2003). Since OPRs are basically used for consumer-to-consumer (C2C) communication, they can also be referred to as "electronic word-of-mouth" (eWoM) communication (Cheung *et al.*, 2008; Lee *et al.*, 2006, 2013). Thus, OPRs are important learning channels not only for consumers (Zhao *et al.*, 2013), but also for NPDs, who can obtain valuable information through eWoM communication among (potential) customers from all over the world without much effort to reach them.

*2.2.1 Heuristic cues in OPRs*. Mudambi and Schuff (2010) identified two important observable properties of OPRs: product ratings and review-helpfulness ratings on Amazon.com. First, product ratings, shown normally as product star-ratings from one star (the lowest quality) to five stars (the highest quality), refer to whether the review on the product is positive, negative, or neutral. Second, review-helpfulness ratings refer to whether the OPR is helpful for other consumers who read it, and it is given to each OPR by other potential customers (e.g. "23 of 33 people found this review helpful" on Amazon.com). In the context where NPDs search for information from OPRs, these two observable properties of OPRs will affect NPDs' information adoption (Zhang and Watts, 2008).

*2.2.2 Systematic cues in OPRs*. While those two observable properties of OPRs are important heuristic factors that influence information adoption, it is found that that within OPRs, there are two important properties of the message content itself: the degree of disconfirmation; and the degree of referencing (Zhang and Watts, 2008; Kudaravalli and Faraj, 2008). First, the degree of disconfirmation refers to the extent to which an OPR describes a situation that is inconsistent with product information previously released or held by NPDs (Zhang and Watts, 2008). In other words, disconfirmation is high when NPDs find that the stories shared in OPRs contradict: the

product information released (or posted on the web); product knowledge that the NPD possesses; and the way in which the product is supposed to work. It is found that disconfirmation works as a strong "motivating force" for systematic processing (by increasing the issue involvement of readers) (Chaiken, 1980; Zhang and Watts, 2008). Therefore, if the message readers are NPDs involved in product development, disconfirmation should be an important systematic cue that will provide them with important ideas for product improvement and development. Second, the degree of referencing is defined as the extent to which the information in OPRs refers to previous products of the company, competitors' products, and related products. When consumers post OPRs on e-commerce web sites, they often mention other products that are somehow related to the focal product. For instance, some OPRs of this study compared the focal product with other competitors' products (e.g. iPod), and others mention products that should go with this product (e.g. headphones, cases, etc.). Such OPRs contain a kind of benchmarking information for new product development, which leads to successful product development (Cooper and Kleinschmidt, 1995).

*2.2.3 Title attractiveness of an OPR as a hybrid information processing cue*. In this study, it is proposed that title attractiveness plays an important role in NPDs' information adoption. It is defined as the extent to which the title of an OPR is interesting and makes the reader generate some questions about the contents of the OPR, so that it encourages her/him to read the OPR. The title of OPRs can be interpreted as both systematic and heuristic cues (hybrid information processing cues). It is a short systematic cue, in that the content of the title (albeit very short) should be read by message readers. At the same time, it can be interpreted as a heuristic cue because it provides only peripheral information about the content of the actual information in an OPR. Quite often, anecdotal evidence (e.g. the title of online entertainment news articles) shows that attractive title may encourage the message readers to look into the actual message. Thus, title attractiveness may increase the "issue involvement" of the content of OPRs (Chaiken, 1980), so that it will encourage readers to scrutinize the actual content of the OPRs. In the next section, it is proposed that title attractiveness moderates the relationship between heuristic/systematic cues and NPDs' information adoption.

## 3. Research model and hypotheses

### *3.1 The impact of heuristic cues*

Product ratings, often manifested by star-ratings of products, provide very important information for potential customers' purchase decisions (Chevalier and Mayzlin, 2006). Previous studies have suggested that moderate level of product ratings is better adopted by customers. For example, Mudambi and Schuff (2010) argued that moderate levels of product ratings (often manifested by three out of a five star-rating) are more helpful for potential customers in the case of experience goods (e.g. music files). Also, Schlosser (2005) found that a moderately rated OPR with two-sided opinions (i.e. both positive and negative comments within one OPR) leads to more positive attitudes about a movie. In the case of NPDs as well, OPRs with moderate product ratings will influence NPDs' information adoption more strongly than those with extreme ratings due to the following reasons. First, extremely positive ratings are not attractive for NPDs because they have fewer constructive comments upon which they can build new products. Oftentimes, extremely positive comments are all about praising the good side of products. Such information might be good for potential customers, but not for NPDs.

Second, on the other hand, OPRs with extremely negative ratings might be posted by consumers who have less understanding of how to use the products. They oftentimes are full of insulting comments about the products. Since NPDs are those who actually made the products and are emotionally attached to them, they would most likely not want to take information from such extremely negative comments, which do not necessarily address concrete problems. Another reason for being cautious about taking information from extremely rated OPRs is that both extremely positive and negative OPRs could be strategically manipulated by many different parties (e.g. marketers in their company may manipulate such OPRs without letting NPDs know about it) (Hu *et al.*, 2012). Therefore, it is hypothesized that:

*H1*. The extremeness of product ratings of an OPR negatively influences NPDs' information adoption.

If an OPR is regarded as helpful by many other potential customers, NPDs will be likely to put more weight on it, even before they read the content because this particular OPR is seen as credible by many consumers. In the context of OPRs, where most people are weakly tied, a review helpfulness rating can play an important proxy role in message validation and information credibility. Thus, it can be taken by NPDs as an important heuristic cue for source credibility, which leads to information adoption in the online context (Zhang and Watts, 2008). One can intuitively think that review helpfulness ratings may encourage NPDs to become engaged in more systematic information processing so that such ratings could influence information adoption indirectly through systematic processing. However, once an NPD sees a high helpfulness rating in an OPR, an important indicator for source validity and credibility, the high helpfulness rating is predominant in her/his mind, so that s/he views the OPR more favorably. Thus, high helpfulness ratings will trigger NPDs' heuristic information processing, which leads to higher information adoption, regardless of whether or not NPDs read the article more or less carefully. Therefore, it is posited that:

*H2*. The helpfulness ratings of an OPR positively influence NPDs' information adoption.

### *3.2 The impact of systematic cues*

As stated, after NPDs scrutinize an OPR, disconfirmation may occur when the information in the OPR is inconsistent with product information; product knowledge that NPDs already have; and the way the product should be used. The way NPDs see disconfirming information in OPRs would be different from the way online consumers do. In the case of (potential) customers, they first see whether a posted message has any disconfirming information. If this is the case, they scrutinize the content more carefully and then adopt the information by judging whether the information quality is good for adoption. That is, disconfirming information encourages consumers to do more systematic information processing, so that disconfirmation becomes the moderating factor for the impact of information quality on information adoption, as found by Zhang and Watts (2008). However, in the case of NPDs, who are rather highly involved in planning, making, and improving their products, disconfirming information could be considered as either "key information for them to build upon," or "third-party product beta-testing results." Therefore, NPDs may be engaged in systematic processing to look for anything that they did not know, but should have known, in order to improve the focal products or plan other better product designs. Thus, rather than serving as a moderating factor for systematic processing, disconfirming information in OPRs

should act as a direct influence on NPDs' information adoption. In sum, the more disconfirming the message is, the more NPDs prefer to adopt information in OPRs to improve and upgrade products, or at least to update their product information. Therefore, it is hypothesized that:

*H3.* The degree of disconfirmation of an OPR positively influences NPDs' information adoption.

Referencing in this study refers to the degree to which an OPR mentions other related issues: competitors' products; previous versions of the same product; and related products (or complementary products, e.g. earphones for PMPs). A number of studies on product innovation and environmental scanning emphasize the importance of market-orientation, information about competitors, and the external environment on NPD success (e.g. Kohli and Jaworski, 1990). The essence of market information involves competitors and consumers. Thus, OPRs containing information on how consumers think about a focal product, as compared to other competitors' products, will be better adopted by NPDs than ones without such information. Moreover, OPRs with information mentioning other related products and the previous version will be well accepted by NPDs because they can use the information in addressing compatibility and functionality. Again, this kind of information should come from the systematic processing of OPRs, as it can be found after an NPD actually reads the message more carefully. Therefore, it is postulated that:

*H4.* The degree of referencing of an OPR positively influences NPDs' information adoption.

*3.3 Title attractiveness as a moderating factor*

According to HSM, an important factor for the choice of either type of information-processing mode is found to be "issue involvement" (Chaiken, 1980). That is, an individual NPD is engaged in systematic information processing in an OPR when s/he is more involved in the particular OPR. In this study, it is argued that the title attractiveness of OPRs, a hybrid (both systematic and heuristic) information-processing cue, plays an important role in improving the issue involvement of OPRs. In the context of OPRs, the main trigger to engage an NPD in systematic processing should lie in the OPR's title. For instance, some titles are written with more intriguing sentences for NPDs (e.g. "XXX is the top dog for Audio […] everything else meh […]"), while others are written with less meaningful phrases (e.g. "my opinion"). If an OPR has a more interesting and attractive title for NPDs, then it will increase issue involvement with the OPR. Thus, increased issue involvement via an attractive title moderates the abovementioned relationships (*H1-H4*) differently. For the impact of heuristic cues, high title attractiveness will mitigate the relationship between heuristic cues and information adoption because issue involvement encourages systematic information processing, thus attenuating the impact of heuristic cues. On the other hand, in OPRs with high title attractiveness, systematic cues (the degree of disconfirmation and referencing) will play a stronger role in predicting information adoption, since an attractive title will encourage NPDs to scrutinize the actual contents. Therefore, this study proposes the following hypotheses:

*H5a.* The attractiveness of an OPR title negatively moderates (mitigates) the negative relationship between the extremeness of a product rating and NPDs' information adoption.

*H5b.* The attractiveness of an OPR title negatively moderates (mitigates) the relationship between the helpfulness rating of an OPR and NPDs' information adoption.

*H6a.* The attractiveness of an OPR title positively moderates the relationship between the degree of disconfirmation and NPDs' information adoption.

*H6b.* The attractiveness of an OPR title positively moderates the relationship between the degree of referencing and NPDs' information adoption.

Finally, two control variables are added: OPR volume and the time elapsed between the date of product launch and the date of the OPR posted to see whether the identified antecedents are significant, even when control variables are added in the research model. Figure 1 illustrates the research model.

## 4. Methodology

### *4.1 Data source and sample*

The unit of analysis for this study is an OPR. To investigate the research model, 146 OPRs (posted on Amazon.com from December 2008 to September 2010) on a certain PMP manufactured by an anonymous company were collected. The OPRs of this product were chosen for the following reasons. First, the OPRs on the PMP contain both heuristic cues (product- and helpfulness-ratings) and systematic cues (disconfirmation and referencing) proposed. Second, enough samples for a statistical analysis are posted on one product model. Third, Amazon.com is the most famous e-commerce site in the world, and the OPRs of this site can be considered as a good representation of consumers' eWoM communication. Out of 146 samples, three samples were removed because these three were written in a language other than English. In the final sample of 143, the mean volume (word count) of the OPRs was 194.73 words, and the mean product rating was 4.29. On average, 5.30 out of 7.14 people found the OPR helpful.

### *4.2 Coding scheme*

While heuristic cues (product- and helpfulness-ratings) were coded from objective values shown in the message headers, systematic cues (disconfirmation and

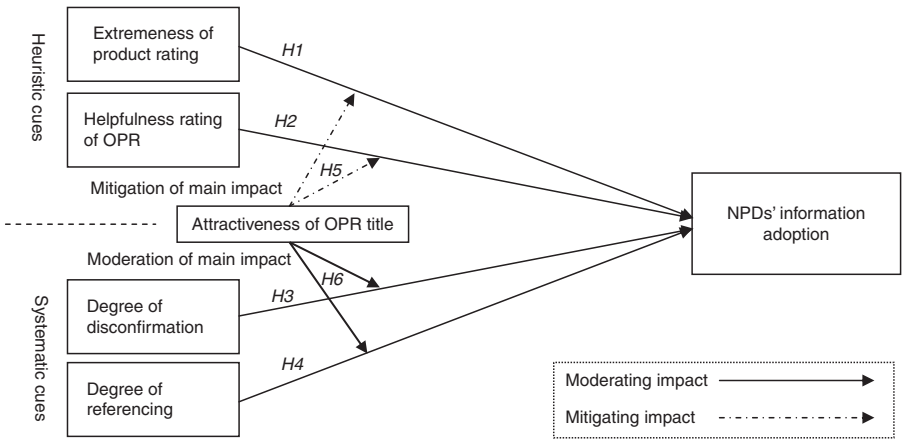



**Figure 1.**
A research model of NPDs' information adoption in OPRs

referencing), and information adoption were rated by human raters. The coding schemes for the content analysis were developed, according to the methods suggested in extant studies (Krippendorff, 2004; Weber, 1990). First, preliminary schemes for systematic cues were developed, based both on extant studies (Zhang and Watts, 2008; Kudaravalli and Faraj, 2008) and on the conceptualization proposed in Section 3. Using this coding scheme, the authors examined a number of threaded discussions and evaluated the preliminary schemes to see whether all items of each variable existed in the focal OPRs. Third, the coding schemes were presented to a key informant who was involved in developing the PMP. The coding scheme was revised, based on his comments. The final coding scheme is summarized in Table I. Briefly, the measure of information adoption

| Variable | Coding scheme (items) | References |
|---|---|---|
| Information adoption (IA) | The information in this OPR … (strongly disagree 1-7 strongly agree)<br>IA1: can be used to upgrade this product<br>IA2: can be used to modify product information released<br>IA3: is helpful to improve this product<br>IA4: can be used to make similar types of new products<br>IA5: can be used to make different types of new products than the focal product<br>IA6: is helpful to make new types of products | Zhang and Watts (2008) |
| Extremeness of product rating (EPR) | The star rating of the product review<br>1 (3 stars) – 2 (2 or 4 stars) – 3 (1 or 5 stars) | Mudambi and Schuff (2010) |
| Helpfulness rating of OPR (HR) | N/D (%) calculated from helpfulness rating<br>("N out of D people found the following review helpful") | Mudambi and Schuff (2010) |
| Degree of Disconfirmation (DoD) | The information in this OPR … (strongly disagree 1-7 strongly agree)<br>DoD1: is inconsistent with the product information that our company already knows<br>DoD2: makes me doubt the concepts of these products<br>DoD3: is inconsistent with the product information posted on the web site or product specification released with the actual product | Zhang and Watts (2008) |
| Degree of Referencing (DoR) | This OPR … (Yes/No) (DoR1~DoR5 are formatively added)<br>DoR1: mentions other products in the company<br>DoR2: mentions competitors' products<br>DoR3: mentions complementary products (Headphones, Cases, Speakers, etc.)<br>DoR4: compares this product with other products in the company<br>DoR5: compares this product with competitors' products | Self-developed |
| Attractiveness of OPR title (AoT) | The title of this OPR … (strongly disagree 1-7 strongly agree)<br>AoT1: is interesting<br>AoT2: makes me have some questions about the actual contents of this OPR<br>AoT3: makes me read this OPR | Self-developed |
| OPR volume (VOL) | Word Count of each OPR | n/a |
| Time elapsed (TE) | Time (day) when the OPR is posted minus (–) Time (day) when the product is released to Amazon.com | n/a |

**Table I.**
Coding scheme

is modified from Zhang and Watts (2008) and the measures of two heuristic cues are adopted from Mudambi and Schuff (2010). Among systematic cues, while the degree of disconfirmation was modified from Zhang and Watts (2008), the measures of the degree of referencing and title attractiveness were developed for this study.

### *4.3 Measurement using coding scheme*

Using the coding scheme, actual coding was administered in the following procedure. First, objective measures (product rating, helpfulness rating, volume, and time elapsed) were coded and calculated by authors. Second, to measure information adoption and two systematic cues (disconfirmation and title attractiveness), three booklets containing all sampled OPRs ($n = 143$) were prepared. In order to obtain precise rating results from the OPR content analysis, three NPDs rated the dependent variable (information adoption) of all OPRs first. These three NPDs were deeply involved in developing the particular PMP about which the sampled OPRs were written. One month later, the same three NPDs rated the remaining two systematic cues (disconfirmation and title attractiveness). In this way, the potential risk of common method bias was reduced.

In order to test inter-rater agreement, the $R_{wg}$ measures (LeBreton and Senter, 2008) of all 143 OPRs for each of the three variables measured on 1-7 Likert scales were calculated. The median $R_{wg}$ values of information adoption, disconfirmation, and title attractiveness are 0.93, 0.97, and 0.95, and the means are 0.87, 0.87, and 0.90, respectively, which are above the generally accepted level of 0.70, thus indicating strong agreement among the three raters for those variables. These $R_{wg}$ measures justify the aggregation (by taking the averages of) the measures rated by the three human raters. Finally, the degree of referencing was coded by the authors because the numbers of referred competitors' products, previous versions of the same product, and related products in OPRs can be more objectively coded by the authors, who are more willing to carefully scrutinize the content. After the two authors individually counted the occurrence of referencing in all of the sampled OPRs, they compared their coding results and reconciled discrepancies until they reached an acceptable level of Cohen's (1968) $\kappa$ value between the two coded scores (0.66), which was considered as substantial agreement (Landis and Koch, 1977). The processes of data analysis are illustrated in Figure 2.

## 5. Results

An exploratory factor analysis using SPSS as well as a partial least squares (PLS) analysis using SmartPLS 2.0 (Ringle *et al.*, 2005) were conducted for the measurement and structural model validation, respectively. PLS is more appropriate to apply in order to examine the structural model of this study for the following reasons. First, PLS does not require the assumption of normality in the data set, as it uses the distribution-free bootstrap re-sampling technique (Chin and Todd, 1995). Most of the variables in this study are non-normal (counted or ratio) variables (e.g. degree of disconfirmation, degree of referencing, helpfulness rating, etc.). Second, PLS also allows us to test moderating impacts not only with the level of significance ($t$-statistics) of interaction terms (moderating variable×main effect variable), but also with the effect size increased by adding the interaction terms into the structural model (Chin *et al.*, 2003; Henseler and Fassott, 2010).

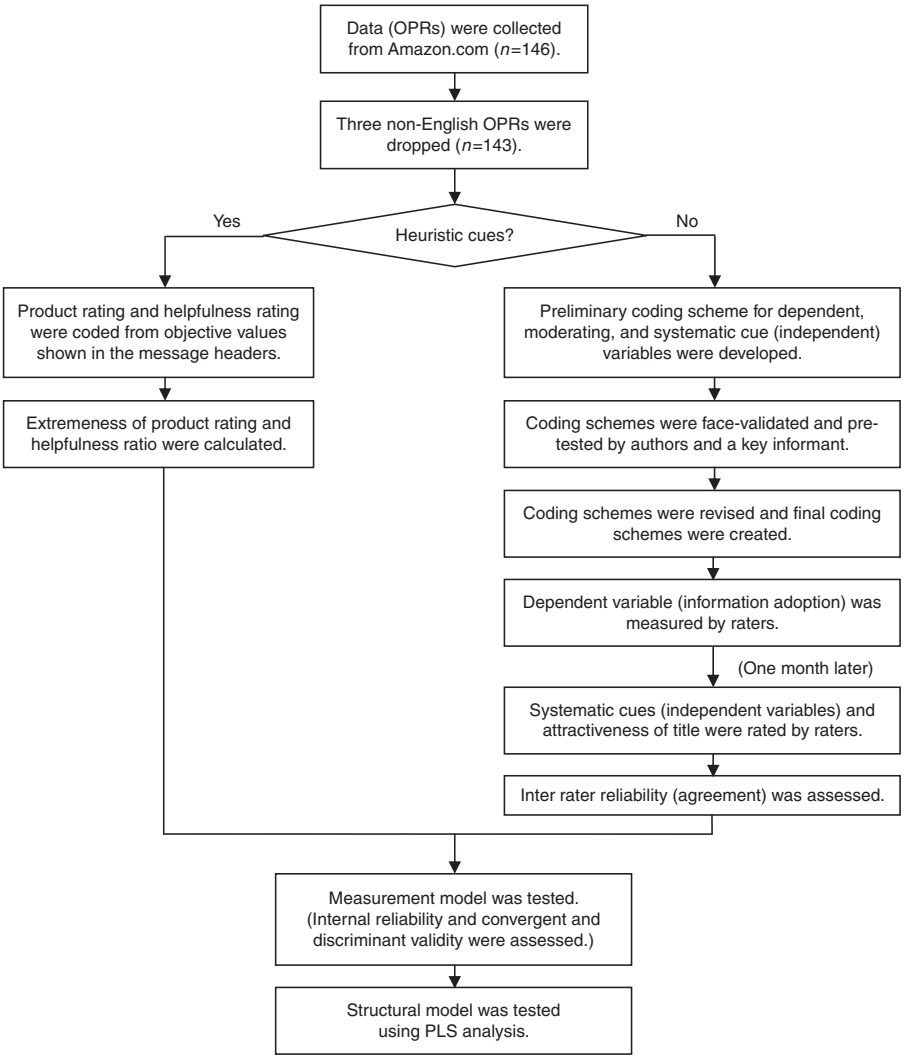



**Figure 2.**
The process of data analysis

*5.1 Measurement assessment*

As the extant measures were modified to fit this study or new measures were developed for this study, an exploratory factor analysis for three latent variables using Varimax Rotation were conducted, which resulted in a three-factor solution. In total, 12 items reflectively measured three constructs: information adoption, the degree of disconfirmation, and the attractiveness of the title (Table II).

The reliability was confirmed by investigating the values of Cronbach's $\alpha$ and the composite reliability of information adoption, the degree of disconfirmation, and the attractiveness of the title (the latent variables measured by more than one item). As shown in Table III, all values of the three latent variables were greater than the recommended threshold value of 0.7 (Chin, 1998), which ensures high construct

reliability. The convergent validity was then examined, based on the values of standardized loadings and AVE of the three latent variables. All factor loadings were well above the threshold value of 0.7 (see Table II), and the AVE estimates were also greater than 0.5 (Fornell and Larcker, 1981), thus confirming the convergent validity. Finally, the cross loadings from the confirmatory factor analysis in Table II shows that all three indicators have higher loadings on their own construct than the other constructs. In addition, the square root of the AVE value of each construct was higher than its correlation with other factors, which ensures the discriminant validity of the three latent variables (Gefen *et al.*, 2000; Ryoo and Koo, 2010).

### 5.2 Structural model testing

The structural model was assessed based on the $R^2$ value, path coefficients, and their significance levels. Figure 3 presents the results of the structural model test, using SmartPLS with the bootstrapping method of 300 re-samples; solid lines are significant relationships, while dotted lines represent insignificant relationships. Even with the presence of two control variables (i.e. OPR volume and the time elapsed between the date of product launch and the date of the OPR posted), *H1*, *H2*, and *H4* were supported, while *H3* was not supported. Approximately 43 percent ($R^2 = 0.426$) of the variance in NPDs' information adoption was explained by four independent, one moderating, and two control variables.

The supported result of *H1* implies that NPDs are more likely to adopt information from OPRs when the ratings are moderate because they often imply more valuable information. Whereas too positive ratings often do not have much information for NPDs to adopt for their product development, too negative ratings might be related to simply unacceptable derogatory language.

The significant result of *H2* shows that even NPDs do listen to the "opinions of peer consumers' opinions." If the helpfulness rating of an OPR is high, then the information in the OPR is generally validated as valuable information by potential customers, so that NPDs will be willing to adopt the information in it without carefully scrutinizing it.

The insignificant relationship between disconfirmation in OPRs and NPDs' information adoption (*H3*) implies that although some disconfirming information in an OPR may intrigue NPDs and, therefore, they could pay more attention to it as suggested in Zhang and Watts (2008), it is possible that they may be reluctant to adopt such information because they are so attached to the products they produced and tend

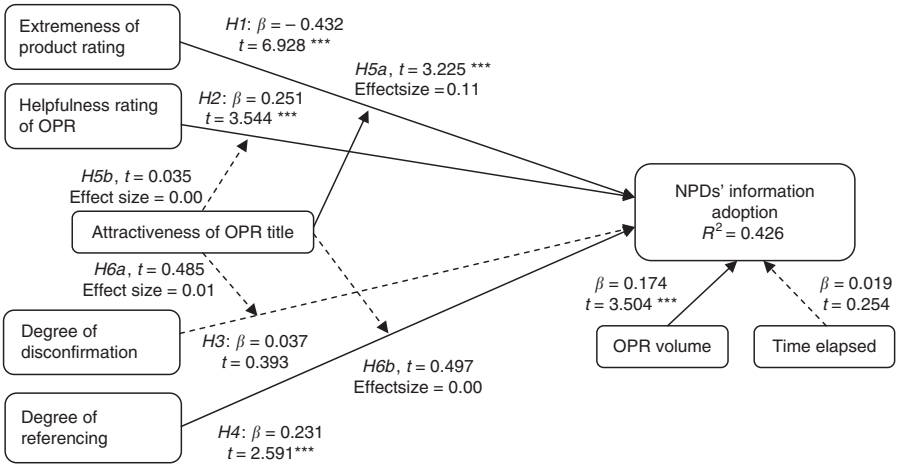
| | Info adoption | Degree of disconfirmation | Attractiveness of OPR title |
|---|---|---|---|
| IA1 | *0.827* | 0.031 | 0.253 |
| IA2 | *0.824* | 0.074 | 0.170 |
| IA3 | *0.843* | 0.063 | 0.235 |
| IA4 | *0.923* | −0.106 | 0.065 |
| IA5 | *0.900* | −0.095 | 0.006 |
| IA6 | *0.905* | −0.103 | 0.042 |
| DoD1 | −0.038 | *0.978* | 0.103 |
| DoD2 | −0.015 | *0.978* | 0.103 |
| DoD3 | −0.048 | *0.973* | 0.104 |
| AoT1 | 0.104 | 0.066 | *0.947* |
| AoT2 | 0.183 | 0.110 | *0.931* |
| AoT3 | 0.189 | 0.146 | *0.936* |

**Table II.** Cross loadings from an exploratory factor analysis for reflectively measured constructs

**Table III.**
Descriptive statistics, reliability, validity, and correlation coefficients

| | Mean | SD | No. of items | CR-$\alpha$ | AVE | CR | IA | EPR | HR | DoD | DoR | AoT | VOL | TE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IA | 3.60 | 0.73 | 6 | 0.94 | 0.77 | 0.95 | *0.88* | | | | | | | |
| EPR | 2.57 | 0.63 | 1 | 1.00 | 1.00 | 1.00 | −0.40 | 1.00 | | | | | | |
| HR | 0.65 | 0.40 | 1 | 1.00 | 1.00 | 1.00 | 0.32 | 0.14 | 1.00 | | | | | |
| DoD | 2.60 | 0.68 | 3 | 0.98 | 0.97 | 0.99 | −0.05 | −0.25 | −0.36 | *0.98* | | | | |
| DoR | 1.94 | 1.19 | 1 | 1.00 | 1.00 | 1.00 | 0.37 | 0.08 | 0.46 | −0.30 | 1.00 | | | |
| AoT | 4.26 | 0.86 | 3 | 0.96 | 0.92 | 0.97 | 0.31 | −0.26 | 0.03 | 0.21 | 0.11 | *0.96* | | |
| VOL | 194.73 | 276.1 | 1 | 1.00 | 1.00 | 1.00 | 0.38 | −0.11 | 0.26 | −0.18 | 0.44 | 0.10 | 1.00 | |
| TE | 233.41 | 146.3 | 1 | 1.00 | 1.00 | 1.00 | −0.19 | 0.14 | −0.25 | 0.04 | −0.24 | −0.15 | −0.17 | 1.00 |

**Note:** Italized numbers are square root of AVE




**Notes:** $^{**}p<0.05$; $^{***}p<0.01$

**Figure 3.**
Hypotheses test results

to ignore it for their new product development (Aloia *et al.*, 2011). Another possible explanation is that the vast majority of disconfirming information in OPRs may originate from a misunderstanding or miscommunication about the product by consumers. Thus, the reaction of NPDs toward the disconfirming information in OPRs could be to forward it to marketing or sales personnel, who take care of communication with consumers, rather than adopt it for their product development. Nevertheless, further investigation is needed to investigate the relationship between disconfirming information in OPRs and information adoption by other groups (e.g. marketers) of manufacturing companies.

The supported result of *H4* shows that if other related issues (competitors' products; previous versions of the same product; and related products) are referred to in the OPRs, NPDs are more willing to adopt the information from the OPRs, as information with a good amount of reference will be helpful for product enhancement and new product development.

In order to investigate *H5* and *H6*, the steps taken in Chin *et al.* (2003) were followed. In addition, the effect size of the moderation impact was calculated, based on the suggestion of Henseler and Fassott (2010). As shown in Figure 3, the moderation effect analysis results indicate that the interaction between title attractiveness and extremeness of product rating (*H5a*) is only significant at the 0.01 level ($t = 3.225$) with an effect size of 0.11, a small, but not negligible effect size, according to Henseler and Fassott (2010), while the other three interaction terms were found insignificant. Finally, in order to check whether the significant impact of the interaction term between title attractiveness and extremeness of product rating on information adoption was a "mitigating impact" (i.e. a moderator reduces the negative and direct relationship between the extremeness of the OPR and information adoption), the path coefficient of the main effect (the impact of extremeness of product rating on information adoption, −1.871) and that of the interaction term (the impact of the interaction between title attractiveness and the extremeness of product rating on information adoption, +1.626) in the SmartPLS output were compared. According to Chin *et al.* (2003), it can be interpreted that a one-standard deviation increase in title attractiveness may decrease

the negative impact of the extremeness of the product rating by 1.626 from −1.871 to −0.245, so that it mitigates the negative impact of the extremeness of the product rating on information adoption. Therefore, the result of *H5a* implies that although a review is extremely positive or negative, if the title of the OPR is attractive enough, then the likelihood that NPDs will read the OPR and eventually adopt the information from it will increase.

In *H5b*, the insignificant moderation impact of title attractiveness on the relationship between the helpfulness rating and information adoption implies that regardless of title attractiveness, NPDs will adopt information from an OPR anyway if the OPR has a high review helpfulness rating. Also, in *H6a* and *H6b*, the insignificant moderation impact of title attractiveness on the relationship between systematic cues and information adoption shows that the impact of title attractiveness may entice NPDs to scrutinize OPRs, as proposed previously, but the impact of other systematic cues (e.g. the degree of referencing) may weaken the impact of title attractiveness because by reading OPRs further, the main effect (e.g. the impact of referencing) attenuates the impact of title attractiveness.

## 6. Conclusion and implications

### *6.1 Implications for research*

Based on the theoretical perspectives of HSM, this study focussed on the antecedents of information adoption by NPDs and found that a moderate level of product rating, high helpfulness rating, and the degree of referencing are important antecedents of NPDs' information adoption. In addition, title attractiveness was found to be an important moderator between product rating and NPDs' information adoption. The empirical results of this study contribute to the literature in several ways.

First, to the best of our knowledge, this study is among the first attempts to investigate the role of OPRs for NPDs' information adoption (instead of consumers' information adoption). On top of extant studies that investigated the impact of OPRs on consumers' behavior (Jalilvand and Samiei, 2012; Lee *et al.*, 2013), marketing (Chang *et al.*, 2013), or revenue (Liu, 2006), the findings of this study highlight the role of information embedded in OPRs for new product development. Thus, this study will contribute to the literature on information adoption and knowledge transfer from consumers to business (C2B) through online channels. Second, the vast majority of literature on IT acceptance and information adoption relied on the framework of "the impact of individuals' perceptions on behavioral intentions." Instead of looking into the impact of perceptions (information quality and source credibility) about online information sources on information adoption (Zhang and Watts, 2008), this study proposed the direct impact of the actual properties (heuristic and systematic cues) embedded in online information sources (i.e. OPRs) on information adoption and empirically tested the relationships. Therefore, this study will contribute to the body of knowledge regarding information adoption and HSM. Third, this study suggested new systematic and hybrid-type cues that are specific to OPRs – the degree of disconfirmation and referencing, and title attractiveness – and validated their measurement properties. Such variables, along with the measurement items, can be used in a series of future studies.

### *6.2 Implications for practice*

OPRs posted on e-commerce web sites are important information sources not only for online consumers, but also for NPDs who are involved in product development, as they

provide NPDs with valuable learning opportunities through eWOM communication (Anderson and Magruder, 2012). The findings of this study lead to a greater understanding of how NPDs adopt information from online information sources in several ways.

First, this study provides insightful implications to the practice, in that it not only emphasized the importance of OPRs on NPDs, but it also helped us understand which factors are important when NPDs examine OPRs. It was found that OPRs referring to other products with high helpfulness ratings and moderate product ratings are better adopted by NPDs. Moreover, higher levels of OPR title attractiveness reduced the negative impact of extreme product rating on information adoption. Second, this study identified and tested the impact of a new set of systematic and/or heuristic cues that are relevant for NPDs. For example, this study suggested the importance of title attractiveness. Actually, in OPRs, the title is among the first things that readers of online postings look at. As aforementioned, the title of an online posting plays an important role in intriguing the readers of online postings (e.g. the title of online new articles). Thus, by suggesting the important role of title attractiveness, this study provided interesting insights for NPDs, who are important adopters of information embedded in OPRs. In a nutshell, this study suggests that NPDs should look into OPRs for their product development tasks. They need to focus on the OPRs that have high helpfulness ratings and a moderate level of product ratings with interesting titles, as well as those with related product information.

### *6.3 Limitations and future research*

The first limitation of this study is that it measured information adoption intention, and not actual adoption of the information from OPRs. A future study should look into the actual adoption behavior of NPDs and its impact on the actual performance of NPDs, addressing the research question:

*RQ2.* What is the impact of information adoption from OPRs on the performance improvement of NPDs at the individual level?

Second, this study focussed on NPDs' information adoption; it did not compare the impacts of heuristic/systematic cues on two different user groups of OPRs: NPDs and potential customers. Thus, a future study could compare the different impacts of identified heuristic, systematic, and hybrid cues on information adoption by these two groups. Third, this study relied on human rating for the content analysis. Although the best possible methodologies were used to avoid certain downsides of using human raters for the content analysis (e.g. common-method bias and disagreement among raters) by measuring the dependent variable first and the other systematic cues one month later, as well as analyzing inter-rater agreement, future research may use a different methodology (e.g. text-mining) to supplement the results of this study.

## References

Ahrens, J., Coyle, J.R. and Strahilevitz, M.A. (2013), "Electronic word of mouth: the effects of incentives on e-referrals by senders and receivers", *European Journal of Marketing*, Vol. 47 No. 7, pp. 1034-1051.

Aloia, M., Pasquale, B.P. and Aloia, P. (2011), *Rescuer Mindset*, March Baby Publishing, Collegeville, PA.

Anderson, M. and Magruder, J. (2012), "Learning from the crowd: regression discontinuity estimates of the effects of an online review database", *The Economic Journal*, Vol. 122 No. 563, pp. 957-989.

Chaiken, S. (1980), "Heuristic versus systematic information processing and the use of source versus message cues in persuasion", *Journal of Personality and Social Psychology*, Vol. 39 No. 5, pp. 752-766.

Chang, A., Hsieh, S.H. and Tseng, T.H. (2013), "Online brand community response to negative brand events: the role of group eWOM", *Internet Research*, Vol. 23 No. 4, pp. 486-506.

Cheung, C.M., Lee, M.K. and Rabjohn, N. (2008), "The impact of electronic word-of-mouth: the adoption of online opinions in online customer communities", *Internet Research*, Vol. 18 No. 3, pp. 229-247.

Chevalier, J.A. and Mayzlin, D. (2006), "The effect of word of mouth on sales: online book reviews", *Journal of Marketing Research*, Vol. 43 No. 3, pp. 345-354.

Chin, W.W. (1998), "The partial least squares approach to structural equation modeling", in Marcoulides, G.A. (Ed.), *Modern Methods for Business Research*, Lawrence Eribaum Associates, Mahwah, NJ.

Chin, W.W. and Todd, P.A. (1995), "On the use, usefulness, and ease of use of structural equation modeling in MIS research: a note of caution", *MIS Quarterly*, Vol. 19 No. 2, pp. 237-246.

Chin, W.W., Marcolin, B.L. and Newsted, P.R. (2003), "A partial least squares latent variable modeling approach for measuring interaction effects: results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study", *Information Systems Research*, Vol. 14 No. 2, pp. 189-217.

Choi, S. (2013), "An empirical study of social network service (SNS) continuance: incorporating the customer value-satisfaction-loyalty model into the IS continuance model", *Asia Pacific Journal of Information Systems*, Vol. 23 No. 4, pp. 1-28.

Chung, S. (2013), "The role of online informediaries for consumers: a dual perspective about price comparison and information mediation", *Internet Research*, Vol. 23 No. 3, pp. 338-354.

Cohen, J. (1968), "Weighted kappa: nominal scale agreement provision for scaled disagreement or partial credit", *Psychological Bulletin*, Vol. 70 No. 4, pp. 213-220.

Constantinides, E. (2004), "Influencing the online consumer's behavior: the web experience", *Internet Research*, Vol. 14 No. 2, pp. 111-126.

Cooper, R.G. and Kleinschmidt, E.J. (1995), "Benchmarking the firm's critical success factors in new product development", *Journal of Product Innovation Management*, Vol. 12 No. 2, pp. 374-391.

Dellarocas, C. (2003), "The digitization of word of mouth: promise and challenges of online feedback mechanisms", *Management Science*, Vol. 49 No. 10, pp. 1401-1424.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

Gefen, D., Straub, D.W. and Boudreau, M.C. (2000), "Structural equation modeling and regression: guidelines for research practice", *Communications of the Association for Information Systems*, Vol. 7 No. 7, pp. 1-78.

Henseler, J. and Fassott, G. (2010), "Testing moderating effects in PLS path models: an illustration of available procedures", in Esposito, V.V., Chin, W.W., Henseler, J. and Wang, H. (Eds), *Handbook of Partial Least Squares: Concepts, Methods and Applications*, Springer, Berlin and Heidelberg, pp. 713-735.

Hsu, C., Lin, J.C. and Chiang, H. (2013), "The effects of blogger recommendations on customers' online shopping intentions", *Internet Research*, Vol. 23 No. 1, pp. 69-88.

Hu, N., Bose, I., Koh, N.S. and Liu, L. (2012), "Manipulation of online reviews: an analysis of ratings, readability, and sentiments", *Decision Support Systems*, Vol. 52 No. 3, pp. 674-684.

Jalilvand, M.R. and Samiei, N. (2012), "The impact of electronic word of mouth on a tourism destination choice: testing the theory of planned behavior (TPB)", *Internet Research*, Vol. 22 No. 5, pp. 591-612.

Kohli, A.K. and Jaworski, B.J. (1990), "Market orientation: the construct, research propositions, and managerial implications", *Journal of Marketing*, Vol. 54 No. 2, pp. 1-18.

Krippendorff, K. (2004), "Reliability in content analysis", *Human Communication Research*, Vol. 30 No. 3, pp. 411-433.

Kudaravalli, S. and Faraj, S. (2008), "The structure of collaboration in electronic networks", *Journal of Association of Information Systems*, Vol. 9 No. 10, pp. 706-726.

Landis, J.R. and Koch, G.G. (1977), "The measurement of observer agreement for categorical data", *Biometrics*, Vol. 33 No. 1, pp. 159-174.

LeBreton, J.M. and Senter, J.L. (2008), "Answers to 20 questions about inter-rater reliability and inter-rater agreement", *Organizational Research Methods*, Vol. 11 No. 4, pp. 815-852.

Lee, J., Lee, J.-N. and Tan, B.C.Y. (2013), "The contrasting attitudes of reviewer and seller in electronic word-of-mouth: a communicative action theory perspective", *Asia Pacific Journal of Information Systems*, Vol. 23 No. 3, pp. 105-129.

Lee, M., Kim, M. and Peng, W. (2013), "Consumer reviews: reviewer avatar facial expression and review valence", *Internet Research*, Vol. 23 No. 2, pp. 116-132.

Lee, M.K., Cheung, C.M., Lim, K.H. and Sia, C.L. (2006), "Understanding customer knowledge sharing in web-based discussion boards: an exploratory study", *Internet Research*, Vol. 16 No. 3, pp. 289-303.

Liu, Y. (2006), "Word of mouth for movies: its dynamics and impact on box office revenue", *Journal of Marketing*, Vol. 70 No. 3, pp. 74-89.

Miller, N., Maruyama, G., Beaber, R.J. and Valone, K. (1976), "Speed of speech and persuasion", *Journal of Personality and Social Psychology*, Vol. 34 No. 4, pp. 615-624.

Mudambi, S.M. and Schuff, D. (2010), "What makes a helpful online review? A study of customer reviews on Amazon.com", *MIS Quarterly*, Vol. 34 No. 1, pp. 185-200.

Ringle, C.M., Wende, S. and Will, A. (2005), *SmartPLS*, Universitat Hamburg, Hamburg.

Ryoo, S.Y. and Koo, C. (2010), "The moderating effect of media synchronicity in the communication media use and knowledge creation", *Asia Pacific Journal of Information Systems*, Vol. 20 No. 2, pp. 103-124.

Schlosser, A. (2005), "Source perceptions and the persuasiveness of internet word-of-mouth communication", *Advances in Consumer Research*, Vol. 32 No. 1, pp. 202-203.

Sotiriadis, M.D. and van Zyl, C. (2013), "Electronic word-of-mouth and online reviews in tourism services: the use of twitter by tourists", *Electronic Commerce Research*, Vol. 1 No. 22, pp. 103-124.

Sun, M. (2012), "How does the variance of product ratings matter?", *Management Science*, Vol. 58 No. 4, pp. 696-707.

Weber, R.P. (1990), *Basic Content Analysis*, Sage, Beverly Hills, CA.

Zhang, W. and Watts, S.A. (2008), "Capitalizing on content: information adoption in two online communities", *Journal of the Association for Information Systems*, Vol. 9 No. 2, pp. 73-94.

Zhao, Y., Yang, S., Narayan, V. and Zhao, Y. (2013), "Modeling consumer learning from online product reviews", *Marketing Science*, Vol. 32 No. 1, pp. 153-169.

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