

REPUTATION IN OPEN SOURCE SOFTWARE VIRTUAL COMMUNITIES

ABSTRACT

Reputation has been considered a key variable for building successful long-term relationships and it is especially relevant in online environments. In this regard, this research aims to analyse the outcomes of this aspect in the field of virtual communities, focusing on open source software (OSS) communities due to their great development in the last years. The data, collected thanks to a web survey using Spanish-speaking members of several OSS virtual communities, showed that reputation exerts a positive and significant effect on both member satisfaction and participation in the community, which are also positively linked. Besides, these two outcomes of reputation boost the member affective commitment to the OSS and, as a consequence, the intention to use OSS products is also increased.

KEYWORDS

Virtual communities, open source software, reputation, satisfaction, participation

1. INTRODUCTION

Nowadays reputation is one of the most important intangible resources to establish long-term oriented relationships (e.g. Flavián *et al.*, 2006). According to relationship marketing, reputation emerges as a consequence of the reliable and consistent behaviour of an organization over time, showing concern for other parties in a relationship, so that the credibility of the organization is enhanced since this past behaviour is a sign for its future actions (Ganesan, 1994). In this respect, the importance of reputation may be even greater in the online relationships due to the lack of physical contact between the parties that makes individuals perceive a greater uncertainty in the Internet (Harris and Goode, 2004).

But, in spite of this greater perceived risk, individuals are increasingly turning to computer-mediated communication in order to share ideas or get information on which to base their decisions (Kozinets, 2002), forming social groups that have been traditionally called virtual communities (Rheingold, 1993). However, although the importance of virtual communities is increasing day by day, there is still a lack of studies that analyze which are the main precursors of consumer's participation in these communities. In this context, reputation may be a crucial factor to promote relationships in a community. Thus, with the aim of moving on this topic, we put forward a descriptive model that characterizes the influence of reputation on member satisfaction and participation in a virtual community, two key variables in the development of a successful community.

To analyze these relationships, we used open source software (OSS) virtual communities due to their great development in the last years. In addition, OSS communities usually have the aim of developing OSS products in an altruistic manner (through members' contributions) so that it is reasonable to think that reputation will help to explain why people actively participate in virtual communities and cooperate with other members, who are usually physically unknown. Broadly speaking, in order to achieve a shared objective, people should prefer to interact with community members with a good reputation in order to avoid possible opportunistic behaviours.

Finally, due to the fact that virtual communities have been proposed to favour the development of emotional links to the interest (e.g. a brand, a product, etc.) around which the community is developed (Koh and Kim, 2004), we also analyze the influence of participating in a virtual community on the affective commitment and loyalty intentions, in terms of future use, to the OSS products. Thus, the interest of this study is twofold: (1) there is an analysis of the effect of reputation on the development of successful virtual communities; that is, communities with satisfied and active members, and (2) both satisfaction and participation in a virtual community are looked at as drivers of the long-term orientation of the relationship with the community interest (the OSS in this case).

Taking into account the previous considerations, the paper is structured as follows. Firstly, we carry out an in-depth review of the relevant literature concerning the variables included in the study. Secondly, we formalize the hypotheses. Then, we explain the process of data collection and measures validation. Finally, we present the main results, conclusions and limitations of the study and outline possibilities for future research.

2. LITERATURE REVIEW

In this section we carry out an in-depth review of the variables included in the study: reputation, satisfaction, participation in a virtual community, affective commitment and loyalty intentions.

2.1 Reputation

Traditionally, the concept of reputation has been defined at the corporate level linked to the idea of organisation's credibility for its customers (Hyde and Gosschalk, 2005). Drawing attention on a virtual community, reputation would be the result of the comparison between what members promise and what they eventually fulfil. Thus, according to Doney and Cannon (1997), reputation would show the honesty of the virtual community members and how much they are concerned about the other community members and their needs.

2.2 Satisfaction

From a global perspective, customer satisfaction may be defined as an affective condition resulting from an evaluation of all the aspects that makes up a relationship (Severt, 2002). To be precise, in this research we will analyse the psychological perspective of satisfaction (Shankar *et al.*, 2003). In this perspective, satisfaction is the result of previous interactions and means a global evaluation of the relationship history between the parties. As a result, satisfaction is built up over time (Oliver, 1999) and every new interaction made in the virtual community will suppose new feedback for the member's perception and will influence his/her level of satisfaction at any given time.

2.3 Participation in a virtual community

In general, member's participation in a virtual community is considered as a crucial element to guarantee the community survival in the long term (Koh and Kim, 2004) since participation promotes the members' identification with the community and the development of long-lasting relationship among the community members (Algesheimer *et al.*, 2005). As a consequence, it is easier to reinforce the feelings which bind every individual to the other community members, improve instruction on communal values, encourage conjoint behaviours and information sharing, and enable stronger group cohesion.

2.4 Affective Commitment

Commitment is a psychological attachment (O'Reilly and Chatman, 1986) that may be defined as the enduring desire to maintain a relationship that is considered important and valuable (Moorman *et al.*, 1992). To be precise, this work will concentrate on the affective perspective of commitment since it is the one that determines the desire to continue with the relationship in the future (e.g. Roberts *et al.*, 2003). On the contrary, calculative commitment, which emerges as a result of cost-based estimations, does not imply that the consumer is really motivated to engage in a long-term relationship with the other party (Evanschitzky *et al.*, 2006). Therefore, we will only consider the affective commitment to the OSS.

2.5 Loyalty Intentions

Obtaining consumer loyalty has been considered as a major goal for marketing strategy (e.g. Dick and Basu, 1994). In general, loyalty has at least two distinct dimensions: an *attitudinal* component and a *behavioural* one (Hallowell, 1996). Thus, although the most habitual research practice (Nilsson and Olsen, 1995) is to measure customer loyalty as a behaviour (repeated purchases), loyalty also refers to the customer's attitudinal state of intentions to repurchase (Evanschitzky *et al.*, 2006). To be precise, in this study we will use the attitudinal perspective, as the purpose of the study is to analyze the future intentions derived from consumer participation in a virtual community.

3. FORMULATION OF HYPOTHESES

One of the aspects hindering the development of relationships over the Internet is the lack of physical contact between actors, which makes individuals to perceive a greater risk when a relationship is carried out through the Internet (e.g. Harris and Goode, 2004). In this respect, several authors have proposed that the development of reputation may help to diminish the greater uncertainty perceived by the consumer in the online context, as reputation provides information about past performance that can be a sign for future actions (Ganesan, 1994). Therefore, in a virtual community, reputation would reflect a reliable and consistent behaviour of the community members over time, showing concern for the other member needs, so that the credibility of the community would be enhanced. Thus, a trustworthy environment would arise in the community and, as a result, it would be easier to promote interactions and develop long-term among the community members since individuals are more likely to take part in shared activities, like the ones conducted in virtual communities, when trust exist among them (Ridings *et al.*, 2002). Bearing in mind the previous considerations, we propose our first hypothesis:

Hypothesis 1: Greater reputation in a virtual community is directly and positively related to greater participation in that virtual community.

In addition, taking into account that reputation in a virtual community is created in accordance with the extent to which its members meet their commitments with other community members, it is reasonable to think that the community's reputation will be also directly related to the creation of successful relationships, providing satisfaction to the members involved in them. As a result, we propose the following hypothesis:

Hypothesis 2: Greater reputation in a virtual community is directly and positively related to greater user satisfaction in that virtual community.

Satisfaction reflects the degree to which expectations generated on previous occasions have been met (e.g. Bhattacharjee, 2001). That is, focusing attention on virtual communities, satisfaction would be the result of the member's perception that the benefits received from participating in the community are equal (or greater) to the expected benefits. Thus, if these member's expectations are met, s/he will feel satisfied and motivated to participate in the virtual community and to cooperate with the other community members, since s/he will feel that the other community members are trustworthy and capable of meeting its commitments. Therefore, satisfaction seems to be a crucial antecedent of the continuance intentions to participate in a virtual community. Following the previous ideas, we propose our third hypothesis:

H3: Members satisfaction is directly and positively linked to their intentions to participate in a virtual community.

As we have noted before, satisfaction with a virtual community reflects the accomplishment of the expectations regarding the past experience of the individual in the community. In the case of OSS, virtual communities are expected to offer an added value to the OSS users in terms of establishing relationships with people with similar interests or obtaining support in the correct use of the OSS products (Casaló *et al.*, 2007). Broadly speaking, these communities are believed to serve as a way to satisfy some of the OSS users needs. Thus, if these expectations are met, OSS virtual communities help to differentiate the OSS from its rival products and firms. The reason behind this may be found in the greater affective attachment toward the OSS that the user develops due to the greater services that s/he can obtain in the OSS community. Therefore, it is reasonable to think that the greater the user satisfaction with the community, the greater will be both the OSS differentiation in the user's mind and, as a result, his/her affective commitment to the OSS. Thus, we propose our fourth hypothesis:

H4: Greater user satisfaction with an OSS virtual community is directly and positively related to greater levels of affective commitment to the OSS.

In addition, participation in a virtual community is also considered to influence positively the affective commitment to the mutual interest of the community. Indeed, once consumers participate actively in a virtual community, their identification and emotional ties with the interest around which the virtual community is centred (the OSS in this case) may increase (Algesheimer *et al.*, 2005). These emotional ties emerge as a consequence of the interactions with other community members, which are usually based on topics related to that interest (e.g. development of OSS products, discussions about the correct use of these products or their properties, etc.). Thus, all of these may promote higher levels of consumer affective commitment to the interest around which the virtual community is developed, favouring the long-term orientation of the relationship between the mutual interest (the OSS in this case) and the community members (e.g. Andersen, 2005). Therefore, taking into account these considerations, we propose the following hypothesis:

H5: Greater participation in an OSS virtual community is directly and positively related to greater levels of affective commitment to the OSS.

Finally, commitment has been traditionally proposed to influence buyer behaviour and, especially, it may favour the development of brand loyalty (Morgan and Hunt, 1994). To be precise, the attachments generated by affective commitment become important drivers of loyalty since they are the basis that

determines the customer desire to continue a relationship (Evanschitzky *et al.*, 2006). Therefore, affective commitment may be considered as a key antecedent of the consumer intentions to continue using the firm products. Therefore, we propose our last hypotheses:

H6: Greater affective commitment to the OSS will lead to higher levels of loyalty intentions to the OSS products.

4. METHODOLOGY

4.1 Data Collection

In order to empirically test our hypotheses, data were collected thanks to a web survey using Spanish-speaking members of several OSS virtual communities. To obtain the responses, several posts were included on heavy traffic websites (with a high level of awareness among the Spanish-speaking OSS users), email distribution lists and well-known electronic forums (all of them related to the OSS). This method of collecting the data is consistent with the habitual research practice in the online context (e.g. Bagozzi and Dholakia, 2006; Steenkamp and Geyskens, 2006). To be precise, we obtained 215 valid questionnaires (atypical cases, repeated responses and incomplete questionnaires were controlled) from members representing over 60 different communities. In addition, to assess the reliability of the sample, we compared the socio-demographical characteristics of the sample with available information about the population. Since there are not specific studies on the Spanish-speaking OSS users, we compare some of the survey results with a recent study on OSS communities (Bagozzi and Dholakia, 2006) and results were very similar. Finally, all latent variables were measured using a multiple-item measurement scale. More specifically, subjects had to respond to several questions about their levels of perceived reputation, satisfaction and participation in the virtual community they had selected as well as about their affective commitment and loyalty intentions toward the OSS products. These measures use a seven-point Likert type response format, and respondents rated them from 1 (“completely disagree”) to 7 (“completely agree”).

4.2 Measures

The scale development was founded on the review of the most relevant literature on relationship marketing and e-marketing. Thanks to this review, an initial set of items was proposed but, due to the lack of valid scales adapted to the context of virtual communities, it was necessary to adapt the initial scales. This adaptation had the objective of guaranteeing the face validity of the measurement instruments. Face validity is defined as the degree that respondents judge that the items are appropriate to the targeted construct (Anastasi, 1988) and is habitually confused with content validity. However, content validity is the degree to which items correctly represent the theoretical content of the construct and it is guaranteed by the in-depth literature review undertaken. Face validity was tested through a variation of the Zaichkowsky method (1985), whereby each item is qualified by a panel of experts as “clearly representative”, “somewhat representative” or “not representative of the construct of interest”. Items were retained if a high level of consensus was observed among the experts (Lichtenstein *et al.*, 1990).

5. DATA ANALYSIS AND RESULTS

5.1. Data analysis

The methodology employed for analyzing the data has been the structural equation modelling using “Partial Least Squares” technique, which uses a principal component-based approach (Brown and Chin, 2004). To be precise, this study uses PLS-Graph software version 3.00 and the election of PLS for the analysis was based on three major aspects (Brown and Chin, 2004): (1) This study has a predictive nature, which is a crucial aspect when using the PLS technique (e.g. Chin and Newsted, 1999); (2) PLS requires fewer statistical specifications and constrains than the covariance-based strategy (e.g. EQS, LISREL, etc.). More specifically, PLS needs less stringent assumptions in terms of multivariate normality and measurement levels of the manifest variables (Wiertz and De Ruyter, 2007); and (3) PLS is a robust technique for small to moderate sample sizes, like in our case (e.g. Cassel *et al.*, 2000).

According to Real *et al.* (2005), using PLS implies to follow a two-step approach. In a first stage, it is necessary to assess the measurement model through the individual item reliability, the construct reliability, and the discriminant validity of the latent variables. In a second stage, the structural equation model is evaluated in order to confirm that the causal relationships proposed in the research model are consistent with the available data.

Thus, we start the analysis by specifying a null model with no structural relationships in order to assess the psychometric properties of the measurement scales (Wiertz and De Ruyter, 2007). In this model, we firstly investigated the individual reliability of all the items that form the constructs of the study. To be precise, we checked that all the items showed factorial loadings greater than .707, which is established as a cut-off point following the indications of Carmines and Zeller (1979). Results were satisfactory (see Table 1), since all items were adjusted to the required levels. Secondly, we proceeded to assess the reliability of the proposed scales. Although the Cronbach alpha indicator is frequently used to assess reliability, some authors consider that it underestimates reliability (e.g. Smith, 1974). Therefore, the use of composite reliability has been suggested (Jöreskog, 1971), using a cut-off value of .65 (Steenkamp and Geyskens, 2006). The results were satisfactory, as can be seen in Table 1. In addition, we used the Average Variance Extracted or AVE to evaluate reliability (e.g. Wiertz and De Ruyter, 2007). According to Fornell and Larcker (1981), measures should contain less than 50% error variance (AVE should be .5 or above). Results were satisfactory, as shown in Table 1, confirming that the items that compose a determined scale converge on only one construct.

Table 1. Individual reliability and construct reliability

| Construct | Individual reliability | | Construct reliability | |
|--------------------------------------|------------------------|---------|-----------------------|-------|
| | Item | Loading | Composite reliability | AVE |
| REPUTATION | REP_1 | .8925 | .89 | .8056 |
| | REP_2 | .9026 | | |
| SATISFACTION | SAT_1 | .8594 | .89 | .7356 |
| | SAT_2 | .8731 | | |
| | SAT_3 | .8456 | | |
| PARTICIPATION IN A VIRTUAL COMMUNITY | PARTI_1 | .8052 | .91 | .6674 |
| | PARTI_2 | .8540 | | |
| | PARTI_3 | .8377 | | |
| | PARTI_4 | .7706 | | |
| | PARTI_5 | .8146 | | |
| AFFECTIVE COMMITMENT | AFF_COMM_1 | .8766 | .90 | .6979 |
| | AFF_COMM_2 | .8839 | | |
| | AFF_COMM_3 | .7577 | | |
| | AFF_COMM_4 | .8171 | | |
| LOYALTY INTENTIONS | LOY_INT_1 | .9283 | .90 | .8222 |
| | LOY_INT_2 | .8847 | | |

Finally, according to Real *et al.* (2005), to evaluate discriminant validity, which verifies if a determined construct is significantly distinct from other constructs that are not theoretically related to it, we compared the squared root of the AVE with the correlations among constructs. In other words, we checked that the construct share more variance with its measures than the variance it shares with the other constructs in the model. Results showed acceptable levels of discriminant validity since each construct is more strongly related to its own than to other constructs.

5.2 Results

Once the first step of the analysis was finished, we develop a structural equation model in order to test de hypotheses (see Table 2). We evaluate the structural equation model by examining the R² levels and the size of the path coefficients (Johnson *et al.*, 2006). Lastly, to check the stability of the parameters, we used the t-statistics obtained from a bootstrap test. In this technique, a great number of random samples are generated from the original dataset by sampling with replacement (Brown and Chin, 2004). Thus, path coefficients are reestimated with each random sample and, at the end, mean parameter estimates and standard errors are calculated considering the total number of samples (Brown and Chin, 2004). Following the recommendations of Chin (1998), we used 500 random samples. In Table 2 we show the

estimated path coefficients for each hypothesis and their t-values obtained in the bootstrap test. At the same time, we show the explained variance (R^2) of the endogenous variables.

Table 2. Path estimates and explained variance of the endogenous variance

| | Hypotheses | Path coefficients | t-value (bootstrap) | Endogenous variable | R^2 |
|----|----------------------------|-------------------|---------------------|---------------------|-------|
| H2 | Reputation-Satisfaction | .622* | 12.4732 | Satisfaction | .387 |
| H1 | Reputation-Participation | .219* | 2.7789 | Participation | .231 |
| H3 | Satisfaction-Participation | .313* | 3.3412 | | |
| H4 | Satisfaction-Commitment | .212* | 2.8921 | Commitment | .318 |
| H5 | Participation-Commitment | .436* | 6.3682 | | |
| H6 | Commitment-Loyalty | .686* | 12.8392 | Loyalty intentions | .471 |

Note: “*” Significance to a .01 level

Firstly, reputation in a virtual community has been found to have a positive and significant effect on both the satisfaction with the community ($\beta = .622$, $p < .01$) and the intentions to participate in the community ($\beta = .219$, $p < .01$), supporting H1 and H2 respectively. Secondly, we have discovered that satisfaction also influences positively the intentions to participate in the virtual community ($\beta = .313$, $p < .01$), which confirms H3. At the same time, H4 and H5 were proofed since affective commitment to the OSS is influenced by both the satisfaction with the community ($\beta = .212$, $p < .01$) and the participation continuance intentions ($\beta = .436$, $p < .01$). Finally, as proposed in H6, affective commitment has a positive influence on loyalty intentions to the OSS products ($\beta = .686$, $p < .01$). Therefore, results reveal the acceptance of the six hypotheses included in our research model to a level of .01. Besides, we have also obtained quite good R^2 levels, which have allowed us to partially explain the endogenous variables of the study.

6. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

To move on analysis of virtual communities, this research has investigated: (1) the members' behaviour in OSS virtual communities, focusing on the role of perceived reputation, which has not been previously analyzed, and (2) some possible outcomes associated to the participation in these communities. To be precise, the present paper has firstly allowed us to define the decisive role of reputation in developing a successful virtual community. In a detail way, reputation is found to have a direct influence in both user satisfaction with a virtual community and his/her participation in that community. In addition, reputation also exerts an indirect effect on the members' participation in the community through satisfaction. As a result, both satisfaction ($R^2 = .381$) and participation in a virtual community ($R^2 = .231$) could be partially explained. Secondly, results have shown that it is possible to boost the affective commitment to the mutual interest of a virtual community thanks to the participation in the community and the satisfaction when participating in it. This can be explained by the development of emotional ties with the mutual interest of the community that appear as a consequence of: (1) the interactions with other community members, which are usually based on topics related to that interest, and (2) the fulfilment of expectations regarding these interactions. Indeed, thanks to these effects, it is possible to explain at a quite high level the affective commitment to the OSS ($R^2 = .318$). Finally, as expected, we have also found that affective commitment is a major determinant of loyalty intentions, which can be clearly explained in our model ($R^2 = .471$).

Thus, three main conclusions arise from this research: (1) the importance of reputation in the context of virtual communities becomes evident; (2) satisfaction of needs is a crucial aspect to guarantee the interaction among community members; and (3) the participation in a virtual community may increase the level of affective commitment to the mutual interest of the community, which may favour the development of loyalty intentions toward that interest (e.g. a brand, firm, product, etc.). This finding is especially relevant since enhancing consumer loyalty intentions is a key goal for most of the organizations (e.g. Andreassen, 1999).

6.1 Limitations and Future Research

First of all, it would be interesting to investigate further outcomes of the reputation building process in a virtual community. For instance, it is reasonable to think that reputation would boost positive word of mouth about the community that could increase the number of new community members.

Secondly, since individuals who participated in the study were Spanish speaking members of virtual communities, which is a limitation of the study, it would be interesting to carry out a new validation of our model using a wider sample of consumers, particularly in terms of different nationalities. In addition, in this paper we have analyzed a specific type of communities: OSS virtual communities. In this respect, we have seen that participation may foster the affective commitment and loyalty intentions to the mutual interest around which the community is centred (the OSS in this case). Therefore, to solve this second limitation and generalize these results, it would be a good idea to repeat this study by using virtual communities developed around firms or brands. Thus, it would be possible to state whether the participation in these commercial or brand communities have also associated the previous benefits (loyalty intentions and affective commitment), which are, as mentioned above, key objectives for most of the organizations. This analysis would help to reveal the real importance of virtual communities for marketers.

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