The Impact of Influential’s Betweenness Centrality on the WOM Effect under the Online Social Networking Service Environment

Ji Hye Park  
Sookmyung Women's University, wannajihye@gmail.com

Bomil Suh  
Sookmyung Women's University, bmsuh@sookmyung.ac.kr

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THE IMPACT OF INFLUENTIAL’S BETWEENNESS CENTRALITY ON THE WOM EFFECT UNDER THE ONLINE SOCIAL NETWORKING SERVICE ENVIRONMENT

Ji Hye Park, Division of Business Administration, Sookmyung Women’s University, Seoul, Korea, wannajihye@gmail.com

Bomil Suh, Division of Business Administration, Sookmyung Women’s University, Seoul, Korea, bmsuh@sookmyung.ac.kr

Abstract

The Social networking service (SNS) has been growing as the means of Communication. Therefore, this research focuses on the social network analyses of Facebook Users to find Influence people (Opinion Leaders) and demonstrate their Influences. In order to measure the influence of Opinion Leaders, advanced SNA (Social network analyses) methods and traditional survey were conducted at the same time. As a result of the research, it was found that the direction of message in SNS had an influence on the attitude of message receiver (consumer) for products. As a result, the moderating effects of Opinion Leadership was verified by using survey, and above all, network measurements (Betweenness Centrality) of Social network analyses.

Keywords: Social Media, Social Networking Service, Social Network Analyses, Influential, Opinion Leadership
1 INTRODUCTION

According to advances in information and communication technologies including internet and the expansion of smart phones with mobile internet, SNS (Social Networking Service) showed up, making personal networking in the online environment. SNS is an online service or platform or sites focusing to establish social relationship networks between people who share their interests, activities, life [Wikipedia, 2013b]. There are Cyworld, Facebook, Twitter, Google+ and Blogs. The global SNS users are estimated to be 1.2 billion people at the end of 2011, and the number is expected to increase up to 1.85 billion people by the end of 2014[eMarketer, 2012].

SNS based on personal relationship networks has gained enormous popularity over the past years, so the need of systematic research about social, cultural influences of SNS is becoming the main issue. Especially, there is a growing interest in opinion leaders (influential) who have enormous influence on the information diffusion through social networking services and opinion creation processes. The increasing attention about influential results from social network environments are strong mediators for viral marketing about specific products or brands and play a lead role for online opinion formation [Lee Won Tae, 2011]. As a result, influential statuses and roles are increasing in SNS.

To analyze the influence of the influential people, application methods of SNA(Social Network Analysis) are variously presented. A large quantity of semi structured data are made by SNS such as Facebook, and Twitter. As a result, the drawing of meaningful analysis and available implication is increasingly important on the basis of SNS data. According to this trend, Social Network Analysis methods are also developing from traditional self-assessment methods, surveys to automatically extract and analyse network data, SNA methods. As a result, this research studies word of mouth effect in SNS and the impact of message creator’s influence on word of mouth effects. Especially, Betweenness Centrality Measure which is extracted by SNA of SNS network data is used for the estimation of message creator influences.

Centrality is explaining the concentrated degree for specific 1 node in networks based on network structure, so Centrality could interpret 1 node’s influence over the total network [Park Ji Hye,2013]. Betweenness Centrality is a type of centrality which measures can explain network member’s broker or bridge roles degree. Also it is used to measure the amount of information flow.

To fulfill the research purpose, this research extracts Facebook user’s network data and from network data, Betweenness Centrality is measured by SNA tools. Next, Facebook friends are selected on the basis of Betweenness Centrality, and the Facebook Timeline message’s the word-of mouth effect on the attitude for product is verified with set up a moderating variable(message creator influence). Above all, opinion leadership which has presented as message creator’s influence is measuring through survey, and then compared and analyzed with Betweenness Centrality which is a network measure extracted by SNA.

2 CONCEPTUAL FOUNDATION

2.1 Online word-of mouth effect

The earlier studies insisted on viral communication is important on purchasing decision making process[Kim, C.H. and Hwang U.L., 1997; Richins, 1983]. Actually more than 80% of general buying decision making were performed by others direct suggestion [Lee W.J.,2011] and word-of mouth effect was 2 times more effective than radio advertisement and 4 times more effective than personal sales and 7 times more effective than newspaper, magazines [Katz & Lazarsfeld 1955; Lazarsfeld, et al., 1948].
In general, influence changes perception, behavior, attitude. Meanwhile, social science research about influence develops from the research about minority’s power group to persuasion process research, relation network analysis, expectation theory in many different dimension [Lee, W.H., 2011]. In general, influential play importance roles as a opinion leader or trend setter, and they are defined as special individuals who are affecting directly for adopt speed of new information technology [Watts, 2007; Watts & Dodds, 2007], and the influence concept related with information diffusion resulted from opinion leadership concept in communication research area. The first systematic study of opinion leader is about two-step flow theory of communication. It was explaining that information or influence are not delivered directly from mass media to recipient. So, comment of opinion leader who is actively representing the opinion by individual contacts [Lazarsfeld, 1948]. Also, the further research about people’s attitude change show that opinion leader who contact with recipient than mass media has big influence in a change of attitude, and In marketing research area, opinion leader is defined as a people who have more influences than others in customer’s buying decision. [Rogers & Cartano, 1962].

According to the advent of internet, consumer could share one’s and others experiences directly in online. So online word-of-mouth also began to develop through internet. Online word-of-mouth is more faster than traditional word-of-mouth and have widespread viral effect. To judge reliability in online word-of-mouth, other consumers’ agreement degree could be standard for determining. If there are many agreement opinion or comment in online community, reliability will be high. According to attribution theory, when many people experience similar effect for same thing, people get it into their head that it is true. So information which have agreement appear larger effect than haven’t agreement. [Kelly, 1973]. So, consumer become utilize online community which is gathering people with similar interest to get word-of-mouth information. The more community interaction is active, the more word-of-mouth effect is grow [Elliot, 2002] namely community’s interaction would make reliability.

SNS’s network plays a role as a online community, this research would want to focus SNS network influence based on network structure. So, it has the perspective that influence evolves and develops interacting through network, not a steady or originally given.

### 2.2 Social Networking Service and Social Network Analyses

SNA began to develop in social science and behavior science area from 1930. Various constructs such as sociometry, graph theory, subgroup are becoming theorization, the attention for SNA is grown and expanded to many areas. SNA builds on graph theory. Graph could express node and link. Node means player and link is relationship between players [Kim, B., Bae, S., and Baek, S., 2012]. SNA represents various social relationships visually and analyzes connection degree within nodes and the feature of link structure quantitatively. Social relation categories can divide into ego-centric network, dyadic network, total network according to analysis focus [Son D.Y., 2002].

Ego-centric network expresses ego’s link between individual’s ego with specific 1 ego as the center. Dyadic network is network between two people and total network consists of many player. Traditional ego-centric network analysis is performed by survey to arrange member who have relationship with respondent and find high centrality member [Choi Chang Hyun, 2012].

Nowadays personal network formation is possible in online community because of SNS’s introduction, different research methods using SNA are increasing. So advanced analysis technologies with SNA tool are developing from traditional survey method. Web crawling which is collecting social big data automatically and public API from SNS [Choi K.S., 2012]. Recent SNA methods improve convenience and save cost and time in comparison with existing survey network analysis methods with development of method and tool analyzing SNS network data automatically.

Also, social big data is analyzed by specialized method and increases accuracy and efficiency of analysis process. So application of SNA data is increasing in business, organization areas. Scientific decision making and systematic analysis with specialized tools could possible. It means that SNA have
possibilities and application prospect.

2.3 Network Measures of Social Network Analyses (SNA)

Graph theory which described link as a matrix is mainly used for social network analyses, and measures graph features of node and link. So it could explain network structure [Kim Byungsuk, 2012]. At this point, network measures describe that as quantitative indicator of member’s relationship structures. Also major network measures divided by connected relationship degree and structural position. First, Degree is extent of connected relationship between network members. If degree is high it means that connected member’s number is increasing. And next Centrality explain the structural position within network. So if particular member is located in center, it means that the member will have high centrality [Borgatti et al., 2009; Newman, 2010; Stibel, 2009]. Like this to measure the importance of node, network measures divided into Centrality and Degree. And the difference between degree and centrality can confirm at figure 1.

Figure 1. Centrality and Connectivity

Centrality is not related to connectivity. Degree is quantitative indicator about specific node’s connectivity with neighborhood nodes. So degree measures not influence of node in total network but influence of node with surrounding node in limited region [Merton, 1968; Restrepo, 2006]. But, Centrality is measuring influence of node based on specific node’s location. So, Degree measures regional influence and Centrality is indicator of large area. As below [figure 1], node V never has many nodes. So influence of node V is not to be measured by connected number of node. Because node V have little link but, located in center position connecting between Region C1 and C2. Therefore, removal of node V will have great influence in whole network.

Centrality which could understand member’s influence based on structural position is classified into Closeness Centrality, Betweenness Centrality [Wikipedia, 2013a]. Closeness Centrality is measuring distance between the nodes. And Betweenness Centrality is measure that understand centralization degree based on role of specific node’s bridge or broker [Kim Byungsuk, 2012].

\[
C_B(v) = \sum_{s \neq v \neq t \in V} \frac{p_{st}(v)}{p_{st}}
\]

Figure 2. Betweenness Centrality

At Figure 2’s formula, Pst indicate a number of the shortest path, Pst(v) is a coefficient of the shortest path between s and t via node V. So, The bigger Betweenness Centrality is the more number that the shortest path for a pair of nodes pass through the node V. So it means that node V is located in between the shortest path and also it represent an abundant information flow. At Figure 1, node V has only two neighborhood nodes (v1,v2). But all the shortest paths for a pair of nodes located region 1 and region 2, have to pass the node V. So, if node V is eliminated, whole network will be divided and
lose organic function. In social network perspective, The node that have big Betweenness Centrality is to be connector of social cluster[Stibel, 2009; Freeman, et al., 1991].

2.4 Network Centrality and Opinion Leadership

Centrality is able to find member who have high influence and explain influence of specific member. Centrality is measure that indicate concentrated degree at center in network. So, the member who have high centrality is noticeable or distinguishable. Also it means that have many exchanges for various information with diverse members, or when member is in a broker’s position. High centrality means that approach possibility to information is high from a information flow point of view and can control information flow[Freeman, et al., 1991; Opsahl, et al., 2010]. So the higher centrality, have the bigger influence to network members. In this way, created information acquisition and delivery in network are possible, so member who have higher centrality is theory, a member have high centrality accept innovative information in advance at the center of networks. Also they they therefore they means opinion leader who is possible to control communication in network. They have ability to control communication[Rogers, 2003]. From these abilities, quick acquisition and transfer of forming information within network, so they could play roles in opinion leader who have influences of information diffusion and opinion formation [eyorison, et al, 2000]. They have a decisive effect on network’s development and performance because They are located in center of network and control information in link with other members.

In this research, centrality was used to measure opinion leader’s influence based on structural position in SNS network. Also Betweenness centrality among centrality measures was used to verify influence of opinion leader as a information provider.

3 RESEARCH MODEL

In this research, we measure influence of WOM Creator by using Betweenness Centrality from SNA. And we would want to understand the effect of these influences on word of mouth effect in SNS. Also, we compare Betweenness centrality with opinion leadership which have discussed as a measure of influence of WOM creator on the existing research. So we examine validity of Betweenness Centrality’s application to measure influence of WOM creator. Therefore, the following was research model to fulfill research object.
Direction of WOM information is divided into positive and negative information according to content of WOM information. Positive WOM is admiring the objects and negative WOM is criticizing the objects [East, et al., 2008]. There is general opinion about research of online viral that online viral messages affect on customer like offline messages [Chen, et al., 2011; Iyengar, et al., 2011; Jalilvand & Samiel, 2012; Khammash & Griffiths, 2011; Kim, et al., 2012; Lee, et al., 2012]. So receiver who had access positive online viral message will make positive attitude and purchasing intention for the product. And receiver who had access negative online viral message will make negative attitude and purchasing intention for the product.

H1: Directions of WOM information on SNS have an effect on attitude toward product.

Kim Na Min[2006] argues that internet shopping mall’s credibility have moderating effects on WOM effect by direction of online WOM [Kim Na Min,2006]. Because WOM receiver will have more trust when they judge that WOM creator has professionalism and reliability. But, WOM information receiver is difficult to confirm WOM information creator’s identification. So, WOM receiver is hard to check message creator’s reliability. Therefore they perform research focusing on not WOM sender but internet shopping mall’s credibility. But in SNS environments, individual network is based on offline network such as company, neighborhood, and school. So, most SNS users reveal their identification on SNS. It means that WOM receivers are easy to check sender’s identification. Thus, we focused on influence of WOM information creator.

Welmann(1991) introduced opinion leadership concept is based on John Stuate Mill’s Libertarianism which is penetrating the significance of personal influence and social role of influential[Weimann, 1991; Weimann, 1994]. So, opinion leader concept has fairly close link with influential concept in these days. Thus, we could consider that influential who is located in center of network developed the opinion leader concept that influence on information sharing, diffusion, measured in opinion in existing researches[Park Ji Hye, 2013]. Nowadays, we could calculate influence through individual’s network measure, centrality due to advance of SNS and network analysis technology (SNA). The members who have high centrality in network are considered that there influence is also high. Also in existing study, network centrality is considered with influence, opinion leadership concept. Kim Byung Suk studied that centrality in Social Network could interpret as 1 node’s effect on total network. [Kim, B., Bae, S., and Baek, S.,2012] So, the member who have high centrality in network is considered high influence and we could judge that they are opinion leader performing information creation and transfer roles. Especially, Betweenness Centrality measure which can guess the degrees of information flow based on connected position and structure[Kim, B., Bae, S., and Baek, S., 2012]. High Betweenness Centrality members have big influence in network, and they are considered for opinion leader doing roles of information creation and messenger.

So, we made hypotheses to verify the impact of Influential’s Betweenness Centrality on the WOM effect under the Online Social Networking Service Environment. Also we added hypotheses about opinion leadership which has been presented as a measure of WOM creator’s influence, to compare and analyze with effects by Betweenness centrality.

H2-1: WOM creator’s Betweenness Centrality in SNS have moderating effect on Impact for Direction of WOM message for WOM sender’s attitude

H2-2: WOM creator’s Opinion Leadership in SNS have moderating effect on Impact for Direction of WOM message for WOM sender’s attitude
4  RESEARCH METHOD

4.1 Selection of the Products

Products and Services are divided into Search goods and Experience goods. Search goods is products which are available to acquire and evaluate the information easily before decision making of purchase. Experience goods is difficult to evaluate before doing direct experience or consumption [Nelson, 1974]. In this research, we will verify WOM effects by WOM information in SNS. Thus, we consider the Products of Experience goods because Experience goods is more influenced by WOM messages for other people’s indirect experience than Search goods. And we consider whether that there is a writing possibility for product review, sharing (regardless of gender) or not, and sales ranking based on top 5 shopping mall sites. Also, we are considering products which have many reviews with positive and negative evenly distribution. We exclude famous, expensive brand products to eliminate bias. As a result, we select unknown brand’s perfume as an object of research.

4.2 Design of word-of-mouth information

There was not sufficient research about the customer reviews as to the design of WOM messages, we used content analysis method which is categorizing consumer reviews by context unit and drawing sort items [Yang, S.-Y., 2008]. As a result, we extracted characteristic factors per product by looking reviews written by consumers, and understood the considering product’s properties when consumers buy perfume products by searching online review about the perfumes [Jeong, W.C., 2007]. Thus, the factors which are considered importantly in perfumes buying situations were identified as the scent, sustaining and spray strength, case design, price. We wrote positive and negative review messages which are keeping the ratio of 5:5 for objective/realistic, subjective/evaluative expressions separately based on the existing reviews in internet sites. Stories are limited to 85 words together, emoticon also used in review messages similarly.

Figure 4. WOM information on Facebook
4.3 Sample Design

Facebook which is the one of Social networking service is Egocentric network that formed network around Ego. And Facebook is consist of various network gathering many ego networks, these networks are based in company, region, high school, university. Also each network is linked strongly because members had already strong ties [Hansen, et al., 2010]. So, To verify friend’s influence on WOM, we judged that Facebook which have strong relationship and high density networks is the best social networking service to figure out network effect. We selected study participants who have Facebook account and friends more than 30 people, Undergraduate and graduate university students in Seoul. Total 51 Facebook users participate in this research. Study participant’s 78.4 percent were students, workers were 15.7 percent, professionals of 3.9 percent, etc of 2 percent. And 82.4 percent of participants were women. Early 20s were 58.8 percent, late 20s were 31.4 percent, and early 30s were 9.8 percent according to age. There were 20-30s participants, but we judge that analysis is available because SNS users are mainly young people. 98 percent of total participants have experience in search and buying of product with consumer reviews.

4.4 Research Process and Survey Design

To calculate Betweenness centrality of friends in participants’s Facebook, Facebook network data collection is needed. To do this, participants extracted their network file personally because Facebook account login was necessary to extract Facebook network file, and then they sent network graph files to researcher. We used NameGenWeb to extract Facebook network data files. NameGenWeb is Facebook crawler application which could extract network graph data file from Facebook user’s account. We sent the manual which explaining way to access NameGenWeb and extract data file to support network file(GraphML) extraction by themselves. In this way, after collecting Facebook network files, we analyzed network files (GraphML) by using NodeXL which is added in excel and operated as add-in SNA tool. NodeXL is available to analyze individual network by using information extracted from SNS and Microsoft Outlook e-mail data. We chose Facebook friends 4 people who to be response target (4 people) of participants (51people) based on Betweenness centrality extracted from SNA. Research candidates (the highest Betweenness Centrality member (group A), the second highest member (group B), and member who fell into median value of network Betweenness centrality (group C), are selected from Facebook network of 51 people who was collected individual Facebook network’s graph files. And finally, the members who fell into Betweenness Centrality value 0(zero) are excluded considering further statistical test process. After then, select one member who had the lowest Betweenness centrality value among members who had Betweenness centrality value with over 1(group D). So, we evenly distributed the Betweenness centrality. Group A’s mean of Betweenness centrality is 4.278.7, the mean of Group B is 3.226.5, Group C is 22.9, Group D is 1.2. total 204 (51 participants x 4 friends) people’s mean of Betweenness centrality is 1,883.2. In this research, measurement items for research model’s concept are completed questionnaire of Likert 5 scales from 'highly agree' to 'don’t quite agree'. Modified questionnaire items are used to suitable for research purpose. First of all, we question about opinion leadership of each Facebook 4 friends to 51 participants. The questionnaires for opinion leadership measurement are made to measure personal, behavioral dimensions of opinion leadership. And we used modified 7 questionnaires (OLS1~OLS7) about personality strength [Weimann, 1991], those items divided into individual capacity or resource based leadership (OLS 1~OLS3) and Activity based leadership (OLS4~OLS7) [Yun Jung Choi, 2009]. Also OLS 8~OLS9 questionnaires are added to measure online community leadership [Yun Jung Choi, 2009]
After, we instructed participants to look product introduce picture<Figure 5>. And then we requested to answer about the direction of WOM information after looking positive WOM message of scenario. Also we used proven items to measure the direction of WOM information based on existing research [Jeong, W.C., 2007]. These items are composed of 3 items (POS 1 ~ POS 3) which is measuring that whether WOM message posted in Facebook is positive or negative for perfume products . After that, we instructed 51 participants to response for the attitude toward product supposing their friends (4 people) wrote posting message in respectively <Figure 4>. The questions for the attitude toward product are using Kim Na Min [2006]’s research survey items (ATT1~ATT3) [Kim, N. 2006]. Negative WOM message also follows the same procedure with positive message.
5 RESULTS

This research used IBM SPSS Statistics, Version 19 package to analyze statistically.

5.1 Reliability and Validity test

This research analyzed construct’s reliability by using Cronbach’s α values, and analyzed item’s convergent validity by using item-to-total correlation coefficient. Opinion leadership is comprised of three dimensions such as (1) Resource based Leadership (2) Activity based Leadership (3) Online community Leadership. Therefore, we used 2nd-order factor analysis. First of all, we analyzed reliability and validity test for each dimension’s questions, and then analyzed reliability and validity test for total opinion leadership based on the average of each dimension’s questions. Analyzed result, as shown in the <Table 1> Cronbach’s α values was over the recommended criteria 0.70. As a result, sufficient reliability was confirmed. In addition, item-to-total correlation coefficient was also over the recommended criteria 0.50, convergent validity was also confirmed.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>α</th>
<th>Item-to-Total</th>
<th>Construct</th>
<th>Item</th>
<th>α</th>
<th>Item-to-Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Based Leadership</td>
<td>OLS1</td>
<td>0.807</td>
<td>0.782</td>
<td>Opinion Leadership</td>
<td>RBL</td>
<td>0.724</td>
<td>0.638</td>
</tr>
<tr>
<td></td>
<td>OLS2</td>
<td>0.678</td>
<td></td>
<td></td>
<td>ABL</td>
<td>0.594</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OLS3</td>
<td>0.747</td>
<td></td>
<td></td>
<td>OCL</td>
<td>0.716</td>
<td></td>
</tr>
<tr>
<td>Activity Based leadership</td>
<td>OLS4</td>
<td>0.800</td>
<td>0.798</td>
<td>Direction of WOM Information</td>
<td>POS1</td>
<td>0.987</td>
<td>0.978</td>
</tr>
<tr>
<td></td>
<td>OLS5</td>
<td>0.758</td>
<td></td>
<td></td>
<td>POS2</td>
<td>0.970</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OLS6</td>
<td>0.703</td>
<td></td>
<td></td>
<td>POS3</td>
<td>0.964</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OLS7</td>
<td>0.734</td>
<td></td>
<td>Attitude toward Product</td>
<td>ATT1</td>
<td>0.952</td>
<td>0.925</td>
</tr>
<tr>
<td>Online Community Leadership</td>
<td>OLS8</td>
<td>0.905</td>
<td>0.827</td>
<td>Attitude toward Product</td>
<td>ATT2</td>
<td>0.932</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OLS9</td>
<td>0.827</td>
<td></td>
<td></td>
<td>ATT3</td>
<td>0.847</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Reliability and convergent validity test

Discriminant validity of Items is confirmed by using factor analysis’s Pinciple Component Analysis and Varimax methods. We extracted factors which have eigen value over 1.0. Opinion Leadership is comprise of three dimensions. Thus, we analyzed Discriminant validity between dimensions first, and analyzed Discriminant validity between Opinion Leadership, Direction of WOM, Attitude toward Products. Analysis results is <Table 2> as follows. All factor loading scores were over recommended criteria 0.60, and cross-loading was under recommended criteria 0.5. As a result, we could understand items had sufficient Discriminant validity.

<table>
<thead>
<tr>
<th>Items</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Items</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS1</td>
<td>0.783</td>
<td></td>
<td></td>
<td>RBL</td>
<td>0.837</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLS2</td>
<td>0.864</td>
<td>0.845</td>
<td></td>
<td>ABL</td>
<td></td>
<td>0.810</td>
<td></td>
</tr>
<tr>
<td>OLS3</td>
<td>0.712</td>
<td></td>
<td></td>
<td>OCL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLS4</td>
<td>0.698</td>
<td>0.751</td>
<td>0.803</td>
<td>POS1</td>
<td>0.899</td>
<td>0.889</td>
<td>0.911</td>
</tr>
<tr>
<td>OLS5</td>
<td></td>
<td></td>
<td></td>
<td>POS2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLS6</td>
<td></td>
<td>0.678</td>
<td></td>
<td>POS3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLS7</td>
<td></td>
<td></td>
<td></td>
<td>ATT1</td>
<td>0.812</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLS8</td>
<td>0.888</td>
<td>0.875</td>
<td></td>
<td>ATT2</td>
<td>0.816</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLS9</td>
<td></td>
<td></td>
<td></td>
<td>ATT3</td>
<td>0.876</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Discriminant validity test
5.2 Hypothesis testing

To test the research hypothesis, Linear regression analysis is used. The average of items is used for constructs of research model. Opinion leadership calculated each average of three dimensions (Resource based Leadership: OLS1~OLS3, Activity based Leadership: OLS4~OLS7, Online community Leadership: OLS8~OLS9), then we calculated average of three dimension’s averages.

The purpose of this research is verifying that Betweenness Centrality extracted by SNA represent WOM creator’s influences, and there is moderating effects on WOM effect in SNS. Before verifying this, we would like to suggest criteria for comparison by checking Opinion Leadership effects which was presenting WOM creator’s influences in advance. Analysis results about Opinion Leadership’s moderating effect is <Table 3> as follows.

<table>
<thead>
<tr>
<th>Step</th>
<th>Regression Equation</th>
<th>F</th>
<th>F Change</th>
<th>R2</th>
<th>R2 Change</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ATT = POS</td>
<td>641.145***</td>
<td>641.145***</td>
<td>0.612</td>
<td>0.612</td>
<td>0.782***</td>
</tr>
<tr>
<td>2</td>
<td>ATT = POS + POSxOLS</td>
<td>351.592***</td>
<td>24.666***</td>
<td>0.635</td>
<td>0.022</td>
<td>0.486*** 0.332***</td>
</tr>
</tbody>
</table>

Table 2. Regression Analysis for Opinion Leadership’s moderating variable ***: p < 0.01

Table 3’s 1step regression analysis, F-value (641.145) was significant at 1% level, and according to $R^2$ (0.612) Attitude toward Product (ATT) has 61.2 percent explanation power. Independent variable, Direction of WOM (POS)'s $\beta$ value (0.782) was significant at 1% level. Thus, hypotheses 1 was supported. In Table 3’s 2step regression analysis, F-value (351.592) was significant at 1% level and F-change (24.666) was also significant at 1% level, this result means there is significant difference between 1step and 2step regression equation. According to $R^2$ (0.635) Attitude toward Product (ATT) has 63.5 percent explanation power. The Direction of WOM (POS)'s $\beta$ value (0.486) was significant at 1% level. Thus, hypotheses 2-2 was also supported.

As a result, we verified that WOM has WOM effects according to the Direction of WOM Information, and Opinion Leadership which means WOM creator’s influence by existing research has significant effects on WOM effects.

Next, we performed regression analysis to verify moderating effects of WOM creator’s Betweenness Centrality on WOM effects. Before verifying hypothesis H2, The correlation of Betweenness Centrality and Opinion Leadership is significantly confirmed at 5% level (0.12). As a result, there is significant relation between Opinion Leadership which was presented as the WOM creator’s influences and Betweenness Centrality. Analysis results about Betweenness Centrality’s moderating effect is <Table 4> as follows.

<table>
<thead>
<tr>
<th>Step</th>
<th>Regression Equation</th>
<th>F</th>
<th>F Change</th>
<th>R2</th>
<th>R2 Change</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ATT = POS</td>
<td>641.145***</td>
<td>641.145***</td>
<td>0.612</td>
<td>0.612</td>
<td>0.782***</td>
</tr>
<tr>
<td>2</td>
<td>ATT = POS + POSxBC</td>
<td>328.575***</td>
<td>6.817***</td>
<td>0.619</td>
<td>0.006</td>
<td>0.761*** 0.083***</td>
</tr>
</tbody>
</table>

Table 4. Regression Analysis for Betweenness Centrality moderating variable ***: p < 0.01

We decided to skip step 1’s result <Table 4> because this result was same with <Table 3>. F-value (641.145) was significant at 1% level, and according to $R^2$ (0.612) Attitude toward Product (ATT) has 61.2 percent explanation power. Independent variable, Direction of WOM (POS)'s $\beta$ value (0.782) was significant at 1% level. Thus, hypotheses 1 was supported. In Table 4, step 2 regression
The analysis, F-value (328.575) was significant at 1% level and F-change (6.817) was also significant at 1% level, this result means there is significant difference between 1step and 2step regression equation. According to $R^2$ (0.619) Attitude toward Product (ATT) has 61.9 percent explanation power. The Direction of WOM (POS)'s $\beta$ value (0.761) was significant at 1% level, and (POS x BC)'s $\beta$ (0.083) was also significant at 1% level. Thus, hypotheses 2-1 was also supported. Therefore, Betweenness Centrality presented as a WOM creator's influence criterion in this research has significant moderating effects on WOM effects. This result is similar to Opinion Leadership. As a result, Betweenness Centrality could substitute for Opinion Leadership which has been adduced in existing research, and Betweenness Centrality can be used as the influence criterion of WOM creator. But, model explanation power is rather reduced (-1.6%) from Opinion Leadership research model's explanation power (63.5%) to Betweenness Centrality model (61.9%), but it was a slight decrease, and considering the analyzable numerical network measure's benefit such as cost, time saving to measure member's influence (opinion leadership) because of automation extraction method through web, network measure (Betweenness Centrality) is extremely useful with improvement of convenience and effectiveness.

6 CONCLUSION

6.1 Research Summary

This Research focus on Social network analyses of Facebook Users to find Influentials (Opinion Leaders) and demonstrate their Influences. In order to measure influences of Opinion Leaders, advanced SNA (Social network analyses) methods and traditional Survey were conducted together. To analyse network of individual or organization, survey and interview methods were conducting. But advanced analysis tools and technologies for Social network analyses(SNA) with the growth of Social Networking Service(SNS) offer more accurate and objective outputs for network analysis through automation extraction from the web, not through subjective self-rating method, survey. So, this research used network data of SNS (Facebook) to conduct Social network analyses, and analyzed network feature by using numerical network measure (Centrality). First of all, moderating effect of message creator's credibility is verified by using questionnaire item of measuring opinion leadership. And in network structure perspective, actual influence of opinion leader(influential) who is located on central network in Facebook is verified by extracted Betweenness Centrality. As a result of the research, It was verified that the direction of viral message in SNS had an influence on the viral message acceptance attitude of receiver for product. And The moderating effects of Opinion Leadership was verified by using network measure (Betweenness Centrality) automatically extracted from the web for Social network analyses (SNA) with survey method.

6.2 Research Contribution and Further Research Directions

Contribution of this research is that First, Applicability of advanced Social network analyses (SNA) method and technique is found in Social networking service area and business. Second, this study discovered the necessity of research about social big data application. In this research, Social networking service data is used to analyse network by SNA method. So more accurate and scientific analysis will need to make useful implication to business area in the academy based on semi structured social big data. Third, this study found the applicability of Social network analyses in marketing area.
From the Facebook network analysis result of this research, members who are located in central position in network had influences. And this study verified that their influences had effect on viral message effect in online purchasing situation. So, companies will have to develop continuous utilization plan in viral marketing, WOM(Word-Of-Mouth), influential customer targeting, SNS marketing by using SNA of influential who can have impact on viral effect based on network structure, relationship of SNS users. And also, the founding of Social network analyses’s applicability in business and organizations area such as forecasting, decision making, human resource management, knowledge management by analysing social networking service data with strategy and finding meaningful patterns result. Finally, this research created opportunities that seek progressive research method with the utilization of social network analyses technologies. Existing relative research about network analysis have studied the network structure and relationship through survey, interview. But, In this research extracted network measure through SNA tool and method to analyse network structure, and then verified significant of network measure (Centrality) with existing survey method to find influential (opinion leader) and confirm their actual influence. This finding imply that network measure(Centrality) can be substitute for survey method in network study. Also the studies of using SNA tools and network measure can expect extremely improvement of convenience, effectiveness (cost, time saving), analysis accuracy through advanced SNA tools.

Appendix

Opinion Leadership

OLS1. “A” have many things other people envied.
OLS2. “A” is ahead of other people.
OLS3. “A” is excellent to achieve what “A” want.
OLS4. “A” enjoys persuading others about “A”s opinion.
OLS5. “A” willingly takes on a responsibility for the given tasks.
OLS6. “A” likes playing leader roles in groups.
OLS7. “A” never hesitated about how to behave.
OLS8. The message of “A” has a great effect on Facebook friends.
OLS9. Facebook friends consider “A” to the important source of information.

Direction of WOM Information

POS1. This message is positive about the products.
POS2. This message is well disposed to the products.
POS3. This message is considering favorable to the products.

Attitude toward products

ATT1. I like this product.
ATT2. This product impressed me favorably.
ATT3. I’m interested in purchasing this product.
References


References


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eMarketer, “When in the World Are the Hottest Social Networking Countries?”


