Network externality and future usage of Internet services

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Abstract

Purpose — The purpose of this paper is to investigate different effects of three network externality factors, i.e. local network size, network strength, and total network size, on online messenger, online community, chat room and e-mail services.

Design/methodology/approach — In the paper hypotheses are tested with a regression model using a survey data collected from 107 MBA students at a business school in South Korea.

Findings — The paper finds that the three network externality factors have different effects on the users’ future usage intention for the four Internet services. Local network size is significant for online messenger services, local network size and network strength are significant for online community services, and total network size is significant for chat room services. For email services, none of the network externality factors are significant.

Research limitations/implications — The paper shows that a total network size is an important network externality factor affecting the success of a network. However, users’ satisfaction with network services and two additional network externality factors, local network size and network strength, are also important determinants. To generalize the finding, investigations into other network services in other environments and into some offline networks are necessary.

Originality/value — The paper shows that depending on types of networks, managers can focus on different important network externality factors in managing their networks.

Keywords Internet, Networking, South Korea

Paper type Research paper

Introduction

In markets where network externalities play important roles, marketers need different strategies from those applied to traditional markets where the economy is characterized by decreasing returns (Arthur, 1996; John et al., 1999; Shapiro and Varian, 1999; Yoffie, 1996). The network externality arises when consumer utility of using a product or service increases with the number of users of that product or service (Economides, 1996a; Farrell and Saloner, 1985; Katz and Shapiro, 1985, 1986). Prominent examples of services with the network externality include fax, telephone, online instant messenger services and network games.

Researchers in various academic fields have investigated effects of network externalities such as economics, management science and marketing. They commonly suggest that a company with the greatest installed base will eventually take all the market (Arthur, 1996; Brynjolfsson and Kemerer, 1996; Katz and Shapiro, 1985, 1986; Lee and O’Connor, 2003). The “winner takes all” concept implies that total network size is the most important network externality factor that determines the success of network services.

We agree that the total network size is a critically important factor in early markets with the network externality. However, we suggest that users’ satisfaction with a
network service and two other network externality factors are also important determinants for success of the network service. The main focus of this paper is to investigate the effects of two additional network externality factors, local network size and network strength, on the members’ future usage intention for four popular Internet services, i.e. online messenger, online community, chat room and e-mail services. We empirically show that local network size and network strength plays important but different roles for the four online services.

The paper is organized as follows. We first explain two additional network externality factors as well as total network size. We also present a model that explains the future usage of a network service incorporating these factors and users’ satisfaction with network services. Next, we develop research hypotheses for four representative Internet services. Then, we empirically investigate differences in the importance of the network externality factors for different Internet services. Finally, we close this paper with discussion on its contributions and managerial implications.

**Network externality factors**

A common understanding in the network externality literature is that total network size is the powerful competitive advantage. A firm, which has taken advantage of building a larger installed base in the early stage of a product market, is expected to dominate the market.

However, there are cases where market followers with smaller network sizes catch up with market leaders who have larger network sizes. For example, in the USA, AOL quickly built its installed base in the early stage of the online messenger market. It was expected to dominate the market. However, according to a MSN product manager, MSN messenger was serving 29.5 million people by February 2001, serving more people than AOL who were serving 29.1 million (Geek.com, 2001). In the Japanese home video game industry, Nintendo actually got ahead of Sega despite its lower initial market share (Shankar and Bayus, 2003). In the messenger service market of South Korea, Nate-On messenger became the leader in terms of the number of individual visitors by July 2005, passing MSN who dominated the early stage of the market (www.metrixcorp.com). All three cases were observed in product markets where network externalities are extremely important. These cases show that the total network size alone could not ensure the on-going success in such markets.

Therefore, we need to identify other factors including other network externality factors than total network size that affect the success of networks. In this paper, we focus on network characteristics related to “interaction among network members” along with total network size. We identify two interaction factors, one representing its width and the other representing the depth, as shown in Table I. In the following, we discuss expected effects of total network size, local network size and network strength.

<table>
<thead>
<tr>
<th>Network externality factors</th>
<th>Total network size</th>
<th>Local network size</th>
<th>Network strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width of interactions in a network</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Depth of interactions in a network</td>
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</table>

**Table I.**
**Total versus local network size**

Typically, consumers in a network do not interact with everyone in the network. For example, online messenger users typically communicate with their close friends, family members, or co-workers, who are on their buddy lists. In this case, size of active members in the buddy list will be more important than that of the total network size for the users. On the other hand, users in certain networks interact with a great number of members including with who they are not familiar. For example, users of a telephone service interact with not only intimate people but also unfamiliar members in the network. They can interact with any members unless calls are refused by receivers. In such networks, total network size may become extremely important for the success of the networks. However, even in this case, a consumer may mostly communicate with his or her intimate persons limiting the number of users he or she interacts actively. Watts and Strogatz (1998) proposed possible structures of the network as shown in Figure 1. In a random network where every node is connected to every other node, a member can interact with everyone in the network. In a regular network where a node is connected directly to only a few relatively close nodes, a member typically interact mostly with highly overlapping acquaintances in the network. In a small-world network, a member is open to interactions with less familiar members in the network.

In small world or regular networks, members mostly interact with a limited portion of networks. Thus, size of the active network could be as important as or more important than the size of the total network in many networks. We call the active network that is typically smaller than the total network a local network[1].

Depending on the structure of a network, importance of the local network size will be different. Suppose there are two competing networks, X and Y, in a market as shown in Figure 2. Network X has a larger total network size than network Y. However, local network size of person A is larger in network Y than in network X. Typically, size of the total network could be of importance to person A if he or she seeks future expansion of his or her local network. On the other hand, person A may get higher utility from network Y than network X if he or she considers the local interactions more important.

**Network strength**

We suggest that network strength is another crucial network externality factor that influences the future usage of a network. We define network strength as total amount of interactions consumers make in a certain period of time. While total and local

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**Figure 1.**
Typology for social networks

*Source: Watts and Strogatz (1998)*
Network sizes deal with the width, network strength deal with the depth of interactions consumers make in a network. It represents the quality of interactions a member participates in the network. If someone spends more time in a network making more interactions with other members in network X than Y, then the network strength of X is greater for the person than Y.

The greater the strength of a network, the stronger is cohesiveness among the network members. Cohesiveness is the degree to which members are attracted to each other and are motivated to stay in a group (Keyton and Springston, 1990). When a group is more cohesive, its members are more motivated to perform well and are able to coordinate their activities better for successful performance (Cartwright, 1968; Davis, 1969; Summers et al., 1988; Mullen and Cooper, 1994).

We propose that as network strength of a network becomes greater, members will get higher utility from the network. Such members will be motivated to stay in the network. Figure 2 shows the case where network strength plays an important role. In the figure, number of arrows in a local network represents network strength. Network Y has the larger local network size than network X. However, person A shows stronger interactions in network X than Y. In this case, person A may get higher utility from network X even if his or her local network size is smaller than network Y.

Figure 2.
Possible interactions within a network
Figure 3 summarizes our conceptual model that incorporates the three network externality factors we have proposed. The dependent variable, network success, is operationalized as future usage intention of the network among the members. Note that, along with the three network externality factors, we also include satisfaction with the network service as an independent variable in the model. It is well known in marketing literature that consumers’ satisfaction level with a service affects their intention to use the service in the future (Anderson and Sullivan, 1993; Bolton and Lemon, 1999; Cronin et al., 2000; Shemwell et al. 1998; Taylor and Baker, 1994; Yu and Dean, 2001).

Research hypotheses for Internet services
This paper focuses on four different types of popular Internet services. They are online messenger, online community, chat room, and email services. These are typical online network services that users sign up to participate in the network and get utility by communicating with other members in the network. They are Internet services that exhibit typical network externality effects as consumers get higher utility as the number of users in the same network increases.

For each of the four Internet services, we propose that important network externality factors are different from those of other Internet services. If it is true, Internet service managers should understand the nature of the network externalities of their networks before they make any resource allocation decisions. We develop hypotheses for the four Internet services based on three dimensions that characterize the networks. The first dimension is compatibility of a network. A network is compatible if a user can interact with users who are in a different network. The second dimension is focus of a network. A network is internally focused if the focal concern of a network is on the well-being and development of the network members. On the other hand, a network is externally focused if the focal concern of a network is on the well-being and development of the network itself. Finally, the third dimension is relationships among users. An average user of a network may have close relationships with other users. Alternatively, he or she may have shallow relationships with other members in the network. The characteristics of the four Internet services with respect to the three dimensions are summarized in Table II.

First, online messenger, online community and chat room services are low on compatibility dimension as they are typically incompatible with their competing services. Because technologies used for the services are typically not compatible with
those used for competing services, users have to be in the same network to interact with one another. This very property is the main reason that network externalities occur for online messenger, online community and chat room services.

Among the three services, online messenger and online community services are internally focused networks whereas chat room services are externally focused, relatively. Internal or external focus of an organization represents whether the organization is more concerned with the well-being and development of its people or of the organization itself (Quinn and Rohrbaugh, 1983). While the concept has been proposed for typical organizations, we are applying it on networks of people enjoying Internet services. Users of online messenger and community services mainly seek for their individual benefits or pleasure interacting with their close friends, family members, or co-workers. They are very much concerned with number of close acquaintances registering in the network. Their individual benefits or pleasure can be significantly enhanced by participating actively in their local networks. In this case, size of the active members in the buddy list, i.e. local network size, rather than total network size will be more important to the users. On the other hand, the growth of the network itself can bring high utility to users of chat room services. The users can communicate with many and a variety of people in large and well developed networks. They can get benefits or pleasure from the growth of the network itself. Thus, users are likely to put more emphasis on the total network size.

The same prediction can be deduced using the concept of tie strength that characterizes the closeness and the interaction frequency of a relationship between two parties (Granovetter, 1973). For example, users of online messengers and online communities will be more concerned about the strong ties than those of chat room services. For users of online messengers and online communities, strong ties are important because they tend to seek more accessible and helpful relationships with their close friends, family or co-workers. In this situation, the local network size will have a strong influence on the success of the network. On the other hand, chat room users typically have distant and infrequent interactions with other members. That is, they tend to have weak ties with unfamiliar members for relatively short-term periods. In this situation, total network size will help them find new sources of information and friends. Therefore, we propose the following hypotheses:

**H1.** Users of an online messenger service will have greater intention to use the service in the future if the size of their local network gets bigger.

**H2.** Users of an online community service will have greater intention to use the service in the future if the size of their local network gets bigger.

**H3.** Users of an online chat service will have greater intention to use the service in the future if the size of their total network gets bigger.

<table>
<thead>
<tr>
<th>Compatibility</th>
<th>Focus</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online messenger</td>
<td>Incompatible</td>
<td>Internal</td>
</tr>
<tr>
<td>Online community</td>
<td>Incompatible</td>
<td>Internal</td>
</tr>
<tr>
<td>Chat room</td>
<td>Incompatible</td>
<td>External</td>
</tr>
<tr>
<td>E-mail</td>
<td>Compatible</td>
<td>Various</td>
</tr>
</tbody>
</table>

*Table II. Comparison of the nature of four Internet services*
Another dimension of Internet service characteristics is the relationship among users, i.e. whether their relationships are close and long-term or not. Users of online messengers typically have long-term and close relationships with a limited group of members that include close friends, family or co-workers. Similarly, users of online community services have long-term relationships with a limited number of members as they communicate with their friends or those who have the same interests or hobbies. However, in this case, the relationships may not be as close as those observed for users of online messengers. Users of a community may leave the community whenever their interests or hobbies are changed. On the other hand, in chat room services, users typically make very short-term relationships with others. They can communicate with a variety of different people whenever they want, but leave the chat room whenever they want. We propose that, other things being equal, network strength can enhance future usage intention of a network service only when members have long-term relationships with others. The network strength in a network where there are long-term relationships will enhance the group cohesiveness among members motivating them to stay in the network. On the other hand, when users have short-term relationships, effect of the network strength on future usage will be relatively small. They will be mainly interested in the growth of total network size. Therefore, we state the hypotheses as follows:

\[ H_4 \text{. For online messenger services, the higher the network strength, the stronger will be the users' future usage intention for the service.} \]

\[ H_5 \text{. For online community services, the higher the network strength, the stronger will be the users' future usage intention for the service.} \]

Finally, an email service is compatible with other competing email services. A user who login to network X can interact with a user who login to network Y. You don't need to register in network Y to communicate with your friend who registers in network Y if you already registered in any email service network. Thus, we do not expect any significant effects of the network externality factors for email services as they are already well developed. Neither the total or local network size nor the network strength will be important for users in making decision to stay in a network. In this case, only the satisfaction with the network service among the independent variables will influence future usage intention of the network:

\[ H_6 \text{. For e-mail services, none of the externality factors influence the users' future usage intention for the service.} \]

**Methodology**

A sample of 107 MBA students at a business school in South Korea participated in the survey. Ages of the respondents ranged from 22 to 43. The mean age was 31. More than 92 percent of the respondents had experience in using the network services, except for chat room services. Among the respondents, 36 percent had experience with chat room services.

Subjects answered three items asking about levels of the network externality factors. First, to estimate local network sizes, we asked what percentage of their acquaintances such as friends, families and colleagues were using each of the four Internet services we are studying. Second, we asked the respondents to guess the
percentage of total Internet users who might use each of the four Internet services. The
answer to this question was used to estimate the total size of the networks. Third, we
asked the number of times the respondents log in to each of the online networks per
week and the length of time they stay in each of the network once they login, on
average. We operationalized network strength as the total number of hours a
respondent is staying in a network per week, multiplying these two answers. We also
asked the overall satisfactory level of users for each of the Internet services. Finally, we
measured the respondents’ future usage intention of the four services using a
seven-point scale.

Empirical analysis and results
Hypotheses are tested using the following regression model:

\[
FU = \beta_0 + \beta_1(SAT) + \beta_2(TOTAL) + \beta_3(LOCAL) + \beta_4(STRENGTH) + \\
\beta_5(GENDER) + \beta_6(AGE)+
\]

where:
- SAT = satisfaction with an Internet service,
- TOTAL = total network size,
- LOCAL = local network size
- STRENGTH = network strength, and
- FU = future usage intention of the network service.

The regression model represents the relationship described in Figure 3. Also included
covariates were AGE and a dummy variable GENDER. The same regression model was
applied for each of the four Internet services. Table III summarizes the descriptive
statistics of the four network externality factors, satisfaction with the services, and
future usage intention. Total size, local size and network strength are the greatest for
email services whereas they are the lowest for chat room services. Likewise, satisfaction
level and future usage intention are also the greatest for email services and the lowest for
chat room services. The statistics were all consistent with our expectations.

The parameter estimates and $R^2$ of the model are presented in Table IV. The
estimated models are significant for all the Internet services. Also, as expected,
satisfaction with a network service is significantly related to future usage intention of the service for each of the four Internet services.

In case of online messenger and online community services, local network size is significant having positive effects on future usage of the networks. Thus, $H1$ and $H2$ are supported. For these services, total network size is not significant. The result suggests that users of internally focused networks such as online messenger and online community services are highly interested in having many close friends or colleagues in the same network. On the other hand, in case of chat room service which can be classified as an externally focused network, total network size is significant having positive effects on future usage intention of the network. The result supports $H3$. For the service, local network size is not significant. Thus, for users of this network, total size of the network is the main source of their utility. The results suggest that, for managers of online messengers and communities, it is important to provide useful local network services for their users. On the other hand, increasing the size of the total network could be the top priority for managers of chat room services.

Providing convenient services for helping users develop personal local networks like buddy list in online messenger services is a good example. For these networks, focusing on total network size will be a mislead strategy. For example, The Nate-On messenger in South Korea has been enthusiastic with providing convenient local network services. Less focus was given to the growth of total network size. Currently, it provides a lot of complementary services including online community site and SMS (Short Message Service). It helps users utilize their local network in effective ways. Users in Nate-On messenger can visit their own and friends’ blog site without logging into the blog site. Also, the messenger automatically finds the messenger ID’s of their friends when they send SMS to their friends who are not yet in the buddy list. Nate-On messenger became the leader in this industry in terms of the number of individual visitors by July 2005, passing MSN who used to dominate the early stage of the market (www.metrixcorp.com).

Network strength is significant for online community services having positive effects on future usage intention of the network, but not for online messenger services. Thus, $H5$ is supported but $H4$ is not. It may imply that network strength is an important determinant only when the closeness level of relationships among users is intermediate. For most users of online messengers who have already developed close relationships with actively interacting members, network strength may not be relevant for determining their future usage of the network. In other words, effects of network

<table>
<thead>
<tr>
<th></th>
<th>Online messenger</th>
<th>Online community</th>
<th>Chat room</th>
<th>E-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAT</td>
<td>0.559 ***</td>
<td>0.702 ***</td>
<td>0.431 ***</td>
<td>0.525 ***</td>
</tr>
<tr>
<td>TOTAL</td>
<td>-0.077</td>
<td>-0.099</td>
<td>0.361 **</td>
<td>0.022</td>
</tr>
<tr>
<td>LOCAL</td>
<td>0.215 **</td>
<td>0.144 **</td>
<td>0.117</td>
<td>0.097</td>
</tr>
<tr>
<td>STRENGTH</td>
<td>0.091</td>
<td>0.134 **</td>
<td>0.102</td>
<td>0.020</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.016</td>
<td>0.084</td>
<td>-0.078</td>
<td>-0.069</td>
</tr>
<tr>
<td>Age</td>
<td>0.019</td>
<td>-0.102 *</td>
<td>-0.022</td>
<td>0.014</td>
</tr>
<tr>
<td>$F$-statistic</td>
<td>17.78 ***</td>
<td>39.528 ***</td>
<td>5.069 ***</td>
<td>7.121 ***</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.427</td>
<td>0.596</td>
<td>0.495</td>
<td>0.301</td>
</tr>
</tbody>
</table>

Notes: * Significant at $\alpha = 0.10$; ** Significant at $\alpha = 0.05$; *** Significant at $\alpha = 0.01$
strength may be negligible when cohesiveness of network is very high or very low. Therefore, for managers of online community services, it is important to make users to stay longer in the network. It can increase the cohesiveness of users and is likely to increase the future usage of the network. An additional finding that may interest managers of Internet community services is that future usage intention is stronger for younger users.

In case of email services, we find no significant effect of network externality factors on future usage intention of the network supporting $H6$. The result may reflect a unique characteristic of e-mail services. Because most Internet users are already using email services and because an email service is compatible with other email services, they may consider total and local network size to be already satisfactory. Table IV shows that, on average, subjects estimated the size of the total and local network to be 93 and 89 percent, respectively. The standard deviations for the estimates are very small, too. In addition, most users intend to continue using e-mail services. In summary, the results imply that there is little network externality effects for email services.

**Conclusion**

In this paper, we investigated effects of three network externality factors on the users’ future usage intention of the network services, total network size, local network size and network strength. Included in the model was the satisfaction with the network services. As expected, satisfaction with the services significantly affected the future usage intention of the network services. Also, we showed that local network size and network strength are indeed important network externality factors for some online network services.

For the online messenger service, local network size is found to be a significant determinant for future usage intention of the network. For online community service, local network size and network strength are significant determinants. On the other hand, for chat room services, total network size is the only significant network externality factor. For email services, none of the network externality factors are significant. Being in the mature stage of the life cycle, email services may not have network externality effects any more. Although it is not a network externality factor, satisfaction with the service is also an important determinant of users’ future usage intention of the network.

The results suggest some meaningful implications. For online messengers and online communities, local network size is more important than total network size. For example, it will be important to provide easy-to-use buddy lists or easy-to-find-new buddies services for users of online messengers. For managers of online communities, it will be important to provide useful local network services such as helping close friends to form new communities. On the other hand, total network size, emphasized by typical network externalities literature, is truly the most important factor for chat room services. In this case, increasing the size of the network should be the top priority trying to add more and a variety of new members.

Analysis of e-mail services suggest that network externalities effects may disappear when the service is compatible to competing services or reaches the mature stage of life cycle. When most of potential users are already members of such networks, network externality factors may not be a significant determinant of the members’ future usage
intention of the network services. Thus, depending on the types of networks, managers need to focus on different factors in managing their networks. Managers of Internet services should understand the nature and types of their networks before they make any resource allocation decisions.

There may be several directions for future studies. First, further investigations into different types of networks will be valuable. This study empirically analyzed four Internet services offered in South Korea. Investigation into other online services in other environments may be necessary to generalize the results we have. Similar investigation into offline networks will be also interesting. Second, other network externality variables can be defined. For example, the concept of network strength for a total network may be defined in addition to that of a local network. Third, it will be valuable to collect objective measures if possible. In this study, we used the subjects' perception in measuring variables. The measurement based on subjective perceptions gives us flexibility enabling us to investigate models with a variety of variables for different types of online networks. Use of objective measures will improve the generalizability of the findings of this study.

Network externality is one of many new concepts that have appeared in the digital economy. Incorporating these new concepts into marketing models and comparing them with traditional models will provide opportunities and challenges for research in marketing in the digital economy.

Note
1. Here, we focus on the size of a network, i.e. the number of other members that a member can actually make interactions with. It is conceptually related but different from 'centrality' used in the social network literature. The centrality refers to how central an individual member is in generating relations with other members.

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Further reading


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