Most Liked, Fewest Friends: Patterns of Enterprise Social Media Use

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ABSTRACT

Enterprise social media can provide visibility of users' actions and thus has the potential to reveal insights about users in the organization. We mined large-scale social media use in an enterprise to examine: a) user roles with such broad platforms and b) whether people with large social networks are highly regarded. First, a factor analysis revealed that most variance of social media usage is explained by commenting and 'liking' behaviors while other usage can be characterized as patterns of distinct tool usage. These results informed the development of a model showing that online network size interacts with other media usage to predict who is highly assessed in the organization. We discovered that the *smaller* one's online social network size in the organization, the more highly assessed they were by colleagues. We explain this inverse relationship as due to friending behavior being highly visible but not yet valued in the organization.

Author Keywords

Social media; network size; enterprise; collaboration; factor analysis; social media platform

ACM Classification Keywords

H.5.3 [Information Interfaces and Presentation (e.g., HCI)]: Group and Organization Interfaces; K.4.m [Computers and Society]: Miscellaneous.

INTRODUCTION

Social media continues to gain ground in the enterprise for a wide range of business purposes. A recent report by Gartner [11] predicted that social media will transform communication and data-sharing in the enterprise. In fact, they predict that by 2016, for a third of businesses who adopt social media, it will achieve as much importance for the organization as email and telephone today have

in connecting people, exchanging informal knowledge, and in social filtering of information.

Social network sites (SNS) are a particular type of social media that have been attracting a great deal of interest by practitioners for their potential to leverage social connections within and outside of the enterprise. Researchers have focused on advantages that SNSs have for the organization such as enabling career trajectories and maintaining awareness of organizational dynamics [28].

However, despite the argued potential for SNSs and integrated social media platforms to be an impetus for change in the enterprise, little attention has been given to the ways they might create an impact. Historically enterprises have focused on the technical aspects of IT deployment, e.g. through providing helpdesk and training classes. However, given the growing adoption of social media in and out of the enterprise, it is timely to take a closer look at the social usage of integrated social media platforms.

Numerous studies have examined individual social media applications in the enterprise [e.g. 6, 8, 10, 21, 30, 35, and for a review, see 32]. However, enterprises are now introducing comprehensive social media platforms which include social networks, blogs, wikis, forums, people tagging, file sharing, and more. Fewer studies have examined how data from social media platforms could be used to understand organizational behavior [8, 16, 17].

In this paper we focus on social media usage in an enterprise from two perspectives to gain insights into the organization. First, we examine large-scale patterns of use to identify the types of roles users adopt when using enterprise social media platforms. For example, users might tend to be content creators, commenters, or followers. Second, we examine how one's network size can inform the organization about the user. We had the opportunity to collect comprehensive use of a broad social media platform in a global enterprise to investigate these questions. This paper is part of a larger project examining insights from large-scale enterprise social media use. In another study, a novel methodology is applied as a descriptive model to social media to examine how the traces from the media can infer reputation in the organization [18].

RELATED RESEARCH

Broadly, we are interested in how social media usage can reveal insights about contributors. Researchers such as boyd [2] and Grudin [12] have argued that social media differs from other types of organizational communication media in that it enables people's actions to become visible in the organization. Unlike users' actions with personal information systems such as file management, phone, and email, what users do on an enterprise social media platform is typically visible to all who use the system. Treem and Leonardi [32] claim that the specific affordances of social media are that it makes users' behaviors, knowledge, preferences, and online social networks visible to others in the organization. It is feasible then that enterprise social media use could provide a means to examine users' behavior and knowledge, through making online information and actions visible. Such data was formerly difficult to obtain through other methods such as ethnography or collecting email records. Further, social media data provides information on a macro scale which can allow the examination of patterns of behavior in the organization.

Social media as behavioral communication

Enterprise social media use may also reveal insights about colleagues' relations to each other, in addition to the social information that face-to-face interaction yields. People have reported that they use social media to learn about others' behaviors in the organization, which DiMicco et al. [8] termed 'people sensemaking'. Enterprise social media usage might communicate both explicit and tacit knowledge about users. Tacit knowledge refers to knowledge that is not explicitly represented but rather is gleaned through informal, non-codified means [26]. By interacting with others in a social media platform, people may gain impressions or understandings about their colleagues, based on their actions. Being socially tagged by others contains implicit meanings, as does having someone share your files or 'like' your blog. For example, these actions might lead one to judge someone's importance or potential influence in the organization. Thus, people may communicate information about themselves through their online behaviors though the information may not be explicitly articulated. Social media usage can also communicate explicit knowledge about people. The content that people post in wikis, blogs or forums could demonstrate their expertise in areas [14]. Their posts could also communicate that they are knowledgeable about the organization, and therefore could be influential. For example, the use of social tagging was found to explicitly (and intentionally) communicate social connections [30].

Thus, social media might not only be a useful source of information to researchers, but it may also contribute signals to colleagues about other users. If social media can indeed provide visibility of users' online actions as many suggest, then we envision two approaches for how we, as researchers, might use this data to understand organizational dynamics.

Our first question then, is if an organization has adopted a broad social media platform, can we identify user preferences for different social media applications within such a platform? Can we find different patterns of user groups in the organization such as contributors, followers, or commenters? In contrast to focusing on a person's usage of a single social media tool, how might people in an organization behave with a broad social media platform that offers a SNS, wikis, blogs, tagging, forums, and file sharing? One person may specialize in blogging while another in wiki creation and editing. Then again, others may adopt roles of commenting across different applications. We feel that identifying distinct patterns of social media use can provide benefits for the organization in understanding dynamics such as communication patterns, and how knowledge sharing and production occurs.

Second, within the context of an integrated social media platform, we can focus specifically on SNSs since they have received attention for their growing importance in the organization [cf 11]. Following the notion that social media makes a person's online actions visible, what could a person's online SNS usage reveal about their behavior in the organization? Could a person's SNS behavior in the organization reveal who might be considered cooperative, or who might be viewed to be a good colleague to work with, e.g. as collaborative tagging has been used to identify experts in the organization [19]? A very visible behavior with SNS is "friending" behavior [2]. Do colleagues value someone who is very active with "friending" in the enterprise?

However, we hypothesize that, in an environment with a range of social media options available to users, SNS usage would not be the sole influencing factor on colleagues' perceptions of one another. We therefore are interested to examine how SNS usage interacts with other social media use. If indeed SNS usage is consistent with colleagues' high regard of the user in the organization, then what other social media usage might interact with SNS usage to also predict high regard?

Other studies of enterprise SNS use have explored motivations and types of connections [7] as well as outcomes of SNS usage such as social capital [29]. Wu et al. [35] asked employees in an organization to rate their closeness with each other and found significant correspondence with SNS usage. To our knowledge, enterprise SNS usage, along with other social media usage, has not been examined in terms of what it communicates about colleagues in an organization.

ONLINE NETWORK SIZE AND ASSESSMENT

We have argued that SNSs can make a person's online network visible, which can offer cues about that person. One very visible cue is the size of one's network which might communicate how well-liked or socially attractive that person is. Tong et al. [31] found a curvilinear relationship between Facebook friends and social attractiveness: those with a moderate number of friends were judged to be the

most socially attractive and those with the lowest and highest number of friends were judged to be the least socially attractive. Utz [33] found that personality played a role in judging online network size: those with introverted and fewer friends were judged as more socially attractive.

However, network size on SNSs like Facebook may be regarded differently than the social network size of offline friends. Offline social networks in organizations have been shown to have optimal network configurations associated with group effectiveness [25]. Research has shown that the more friends one has in their offline social network, the more positive traits one is judged to have [24]. Those people more sociable and with higher self-esteem are more popular in both their offline and online friend networks [36]. Yet the notion of online SNS connections as "friends" has been brought into question. Due to the technological ease of "friending" (i.e. with a click), SNS friends may not be considered close friends in the same way they are considered in offline relationships [2]. Utz [33] in fact found that popularity in online SNSs do not necessarily correspond with popularity of offline friends.

Online networks in an enterprise can reveal work-related information about a person. Gao et al. [9] found that those in a U.S. enterprise were more interested to collaborate with someone when their network contained experts, which in turn was related to influence in the organization. These researchers also found that a person's reputation was connected to the desire to collaborate with that person. However, network size was not found to be related to the desire to collaborate.

Thus, it is possible that one's network size in an enterprise could reveal traits of that person, and by taking a macro view, a person's network size could reveal how others in the organization regard them. It is an open question how online network size corresponds to colleagues' assessment of others in an enterprise.

Mechanisms of SNS influence
There might be direct and indirect reasons for why we might expect a relationship between a person's SNS usage in the enterprise and colleagues' perceptions of them. One direct mechanism that could explain this relationship is through social capital. Social capital refers to the resources that people gain through their interactions with other people [5]. Social network sites, and social media usage in general, can be an indirect way that people gain benefits from others. Strong relationships have been found between the use of Facebook, in terms of network size and the accumulation of social capital [10, 34]. The use of an enterprise social network site was also found to be positively associated with gaining social capital, e.g. in employees' willingness to give back to the company [29]. Social capital can serve as a basis for developing trust and can be associated with reputation [23]. Networks can also provide expertise as a resource [9].

We may expect then, that people accumulate social capital through SNS use, and that social network size in the enterprise could be associated with colleagues' positive perceptions of them.

However, SNS friends include weak as well as strong ties. A person may be barely acquainted with some in their social network [2]. In the enterprise it is unclear how the proportion of weak and strong ties compare with those in SNS site networks more broadly.

SNS usage however, may interact with other types of social media use in a broad platform. With enterprise social media in general, people could be perceived as doing favors for others either directly or indirectly, e.g. by commenting on their blogs, contributing to their wikis, tagging others, or friending others. More broadly, people can be perceived positively when they contribute to the enterprise through social media, e.g. by creating forums, wikis, or contributing information to corporate blogs. This could be perceived by colleagues as having impact by contributing to the greater good of the organization [30]. Therefore, it would not be surprising that people who contribute to social media in an enterprise might be perceived favorably by their colleagues.

Another direct mechanism to explain why SNS use, and social media usage in general, might be related to colleagues' perceptions of others is that people who contribute content to an enterprise social media system might be considered cooperative. Collaborative behavior is associated with desirable traits such as reputation [9] and trust [20]. Some evidence exists to support this notion. Kosonen and Kianto [21] found that wiki use encouraged collaborative behaviors in the organization.

However, a relationship between online SNS and social media usage, and colleagues' perceptions of that person, may be due to indirect factors. Correlation does not imply causality. There may be other underlying traits than the actual social media usage that influence a colleagues' judgment about that person. For example, people who are heavy social network users might also be very personable offline. Some indirect evidence supports this notion as there is some correspondence with personality traits and SNS usage [27]. Users of other social media such as wikis or blogs might also be people who are experts in their fields, are opinion leaders, and have other traits regarded positively in the organization. So actions with social media per se may not directly communicate signals about a person's behavior to others, but rather it may co-occur with *other* traits that the user has.

Therefore, we argue that online enterprise social media platforms can make users' online actions visible, and that this information could contribute to the opinions that colleagues form of social media users [cf 8]. People's online actions with the system may create positive impressions through the

accumulation of social capital or through their online contributions which might be perceived as cooperative. Our position is that mining such data in the aggregate can be used as a way to investigate organizational behavior. We therefore ask the following research questions concerning enterprise social media use:

RQ1: Can we identify different patterns of enterprise social media use when people have access to a broad platform? Do people tend to exhibit particular patterns of social media usage, or is it rather ad hoc? For example, there might be people who are creators, i.e. they tend to create blogs, forums and wikis. Or there might be people who are commenters, who tend to comment on blogs, forums and wikis but not initiate new blogs, forums or wikis. There may be people who are active on social network tools but tend to not use other types of media. There could be people who specialize in maintaining blogs but not other media. Understanding platform-wide patterns of use can reveal insight both into individual behavior, and also on a macro level, how social media is used in an enterprise. These results can then be used to inform a model of SNS usage, addressed in our next research question.

RQ2: Does a person's online social network site behavior in the organization correspond to how they are perceived in the real work environment? In particular, can online social network behavior of enterprise employees predict who would be desirable to work with in the organization? Given that SNS use is becoming more widespread in enterprises, can we utilize it to locate someone who might make a good collaboration partner? For example, consider a manager who is looking to choose someone for an important task force. Can use of online social networking, in conjunction with patterns of social media use (see RQ1), be used as a determinant of who might be a good choice? On the one hand, managers can ask about various people through word-of-mouth. But perhaps social media use in the aggregate could also provide valuable information about which person might make a good choice. Following [8], we might expect that there is a correspondence between SNS usage and users' positive assessments of others. Though cues such as profile information have been examined with SNS use [cf 33], we focus on the variable of network size, which is quantifiable in the context of large-scale data analysis.

RESEARCH SETTING AND STUDY
As a first step to understanding how social media use can reveal perceptions and patterns of behavior in an enterprise, we collected large-scale data use of an enterprise social media platform--a broad spectrum of variables related to social media.

Research setting
Our study was conducted in a large global enterprise with over 400,000 employees. The organization employs a social media application platform behind its firewall. The platform consists of a blogging system that allows employees to author blog posts, comment on them, and 'like' them; a file sharing system that allows employees to upload files, share files with others (including ones they did not originally upload), to comment on files, and like them; a forum system that enables the initiation of forum threads and to reply on existing threads; an enterprise SNS that allows employees to reciprocally connect with each other, follow each other, post messages or comments on each other's boards, and tag one another; and a wiki system that allows employees to co-edit wiki pages, comment on them, and like them.

All of these applications have been in wide use (by over 20,000 users) over the past three years in the organization. We scraped the data using the platform's public API and collected a total of 57 variables over the prior two years, reflecting different aspects of the social media use, described above. The variables include actions that the user initiates, such as uploading a file or commenting on a wiki page, and actions that other users do on that user's content, such as tagging or following her, or her content, e.g. the number of downloads of her files or the number of edits to her wiki pages. Table 1 gives examples from different categories of the 57 social media variables collected. Figure 1 shows a distribution of the usage of five different applications which our paper focuses on, for 20,772 users.
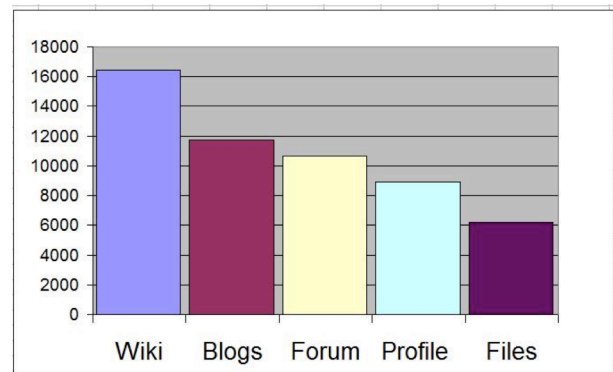

Figure 1. Usage of five social media applications (focused on in this paper) in a two-year period by the 20,772 most active users.

Survey
To examine how SNS usage relates to colleagues' perceptions of a user (RQ2), we asked colleagues to rate each other in a survey. Considering the notion, as we discussed, that social media contributors might be viewed as having positive traits through their online behavior, and informed by the work of [9, 20, 23], we hypothesized that desirable traits would include someone who might be considered reputable, trustworthy, an opinion leader, someone who could impact the company, and someone considered an expert in their field.

Category	Examples of social media variables	
	User's actions	**Actions by others on the user or her content**
Blogs	# blogs created # blog posts created	# comments on one's blog
Files	# files downloaded # files liked # comments placed on files	# of user's files downloaded by others # of comments others placed on user's files
Forums	# forums created	# posts from others in one's forum
Social networking	network size # of others the user follows	# of others who follow the user
Wiki use	# wiki pages edited # wikis one created	# of comments on one's wiki pages

Table 1. Examples of social media variables collected from the enterprise social media platform.

Using the SONAR aggregation system [15] we extracted social network information from public social media in the enterprise. SONAR yields for each person a list of people with whom they are acquainted. Each person on the list has a score reflecting the degree of acquaintance with the target person. To minimize false alarms, i.e. cases where people were on the list but not well acquainted with the target, we filtered the list using a score threshold. Then we further filtered out people who were active in less then three categories of social media usage (e.g. see Table 1). We then took the top 30 people and presented it in lists of 10 individuals each. Thus, if the SONAR results produced a list of 33 individuals, the top 30 (according to their score) would be randomized into three lists of ten people each and presented to participants. Participants could mark individuals who they did not know, and these individuals were not considered in our analysis (13.5% of people on the lists were marked as unfamiliar).

The survey was sent to 2,474 employees who were identified to be acquainted with at least 10 individuals who had substantial data in the enterprise social media platform (active in at least 3 categories of Table 1). We had 554 respondents (response rate of 22%), who rated a total of 1,073 sets of 10 individuals.

Target users were then given a set of five questions, shown in Appendix A. Users then reviewed the lists of individuals and were asked to choose from each list between 1 to 3 people who best fit each question.

RESULTS

Overview of social media use

First we present an overview of social media use in the organization. Table 2 shows mean usage for selected variables that are representative of the main categories. Data is used only from those individuals who were rated by colleagues, N=3,320. These individuals represent heavy users of the social media platform. As we would expect, the distribution of the total number of activities is a long tail. Most users use 2-3 different social network systems.

Variable	Mean (s.d.)	Range
# blog posts created	6.6 (29.6)	0-738
# files liked	0.6 (3.9)	0-96
# forums created	0.4 (1.3)	0-20
# people tagged	5.3 (61.6)	0-3015
# of wiki pages edited	19.2 (65.0)	0-2051
Network size	45.5 (70.4)	0-1653
Number of followers	2.9 (7.6)	0-235

Table 2. Sample usage (mean, s.d., range) for representative variables of the main categories. N=3320.

Patterns of social media use

Our first research question asked what kinds of patterns of social media use we might identify in an enterprise. For example can we find that people tend to be creators while others might tend to be commenters? Do people tend to "specialize" in different usage of social media?

We chose to examine 20,772 of the most active social media users in the enterprise. These users were selected based on having data in at least 5 of the 57 social media variables.

We conducted a factor analysis on the collected social media variables. Factor analysis is a statistical technique that enables a researcher to uncover a "structure" among a large number of correlated variables, by explaining the variability through latent variables or factors [22]. Our goal was to use factor analysis to uncover "unobserved variables" among our observed variables so as to identify patterns of behavior with social media use. Factor analysis results in each variable being primarily associated with a distinct factor.

Of the initial 57 variables, many of the variables were very highly correlated as they were measuring very similar activities. In terms of a factor analysis, we wanted to include variables in the analysis that were measuring distinct (though possibly related) activities. We thus averaged together those social media usage variables that were highly correlated, and that logically seemed to be measuring the same thing, to create an averaged measure. Here are some examples of the social media indicators that were highly correlated, and with which we created a composite average measure:

-Board commenting: Number of people whose boards one commented on, Number of comments placed on boards

-Post replies: Number of people whose posts one liked, Number of posts one liked

-File commenting: Number of files one commented on, Number of comments placed on files

Factor	Social media variables
1. Liking and commenting activity	Number of file liking; board commenting; blog post commenting
2. Wiki activities	Number of people whose wiki pages user edited; number who edited user's wiki pages; overall edits to user's wiki pages; user's wiki creation and editing actions
3. Actions on user's files	Number of user's files shared by others; number of people who shared user's files w/others; number who downloaded user's files
4. Blog activities	Number of blog posts user created; number who commented on user's posts; overall liking activities of user's posts
5. Social networking activities	Number of friends; number of followers; number of people the user is following, tagging activities by others on user; peoples' activities on user's board (writing and commenting)
6. Social use of one's file information	Number of people who placed user's files in their folders; overall commenting and liking activities on user's files
7. Forum activities	Number of topics, forum entries, communities created; overall replies to user's entries

Table 3. Factor analysis results: variables that loaded onto separate factors along with interpretations.

-*Files in folders*: Number of files placed in folders, Number of times one placed files in folders

-*Topic replies*: Number of people whose topics one replied to, Number of topics one replied to, Number of replies on topics

This reduced our dataset to 32 social media variables, which were based on the original variables and composite variables based on highly correlated variables that were averaged together. A factor analysis was done on these 32 social media variables to examine what factors could be identified. We used a Varimax rotation with a Kaiser normalization. A scree plot[1] revealed that seven factors should be used, accounting for 49.0% of the variance. Table 3 shows the social media activity variables that loaded onto the separate factors. In the right hand column are the specific variables that loaded onto the factors. Again, note that each variable

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[1] A scree plot is used to determine the number of factors to select based on a visual analysis of when the curve flattens.

primarily loads onto a separate factor. In the left column are our interpretations of these factors.

Our interpretations of these factors are as follows. Most factors (6 out of 7) fall along the separate types of social media categories described in Table 1. The exception is factor 1, which concerns more general activity of liking and commenting across different applications. This factor explains, for example, that people who like files also tend to comment on boards and these same people who comment on boards also tend to comment on blog posts.

Factor 2 clearly points to wiki use. It is interesting to note that some of the variables refer to one's actions in creating or editing wiki pages; other variables refer to others' edits on the wiki pages that one created. The reason is that wiki page creation and also editing by others is very much intertwined. The more wiki pages one has, the more likely it is to receive edits. But nevertheless, it is possible that number of edits by others could be an indication of the quality or maturity of one's wiki writing.

Factor 3 indicates actions by others on the user's files. This includes file sharing and downloading.

Factor 4 explains blog use, again, in terms of both the blog posts created as well as others' actions (commenting, liking) on one's blogs. This could indicate the interest level that others have in one's blogs, which could be a proxy for how interesting the blog is perceived to be by others.

Factor 5 represents social networking activity, in terms of friending, having followers or being followed, being tagged by others, and others' activity on one's board.

We call Factor 6 social use of file information, as it involves other's social input to a user's files: commenting and liking them.

Factor 7 identifies forum activity. This factor identifies a user's creation of topics, forum entries, and communities and also others' replies to the topics that the user created. Again, the more topics that one creates, the more opportunity there is for others to reply to one's topics. Thus, topic creation, and the activity of others replying to the user's topics, are deeply intertwined.

Thus, the factor analysis revealed two types of broad patterns of social media platform use. First, factor 1 (liking and commenting) explained most of the variance and is a social media activity that cuts across different tool use. Second, there are patterns that fall along the lines of distinct social media tool use, as we found with factor 2 (wiki use), factor 3 (file use), factor 4 (blog use), factor 5 (social networking), and factor 7 (forum activities). It is interesting to note that factor 3 and factor 6 show distinct uses of dealing with files. Factor 3 is more of an "operational" usage of files whereas factor 6 shows more of a social usage of files, involving annotating and liking files. Thus, there are clusters of user

roles that can be identified, based on distinct tool use, and also commenting/liking. These results can then be used to inform our model for the next research question.

RQ2: Social network size as a predictor

Our second research question asked whether SNS usage in the enterprise can serve as a predictor to find people who are positively evaluated.

For each survey question (see Survey section) we divided the number of times each individual was selected by colleagues by the number of times each individual was presented to people in the list as described earlier. This was a way to normalize the responses: i.e. a person may have been presented 5 times and selected 5 times, or presented 20 times and selected 5 times. We only consider people who were selected and presented two or more times; our reasoning is that a presentation or selection of just once could be an outlier and no selections at all indicate that no one regards that person highly. We only considered people who were selected on all five survey questions at least once. A person, for example, who was selected as reputable (Q1) and able to keep information secure (Q2) but not selected as an opinion leader (Q3) or having impact (Q4) or expertise (Q5) might not represent someone who has achieved high regard in the organization. Choosing people in the organization who were selected on all five survey questions enables us to focus on a clear set of people who are consistently "highly assessed" by two or more people. This enables us to be reasonably confident that we are working with a set of people who are rated consistently positive along what we consider to be desirable traits to have in the organization. This yielded a set of 79 individuals.

The responses to the five questions were strongly correlated and highly significant, with correlations ranging from .68 to .85, p<.0001. This suggests that these five questions may represent the same underlying social construct. A factor analysis using a Varimax rotation revealed that all of the responses fall along a single factor, with nearly equal factor scores (ranging from .83-.89), explaining 74.5% of the variance. Therefore, an additive model is appropriate. The measures from each individual question (in Appendix A) were thus added together to produce a single measure of "High Assessment". In summary, our target dataset has people who received consistent positive ratings from colleagues, along with 57 measures of their social media usage[2].

Our target variable of interest was Network Size, a measure of the number of friends that one has in their enterprise social network (similar to Facebook friends). To reduce our set of variables, we first ran a stepwise regression on the 57 social media indicators using High Assessment as the dependent variable, to see what variables were significant predictors. We found that the best fitting model included Network Size and Total Followers as significant predictors of High Assessment: $F(2,77)=15.77$, $p<.0001$. $R^2=29.6$. Total Followers is a measure of the number of followers one has. The variance inflation factor (VIF) was 1.5, which indicates that multicollinearity is not a problem.

As our theoretical interest was in Network Size, we then focused on developing a model using Network Size as a predictor of High Assessment. We hypothesized that Network Size may actually be a *mediator* of the effect of other social media usage on High Assessment. In other words, Network Size may be influenced by other social media variables, which in turn may influence colleagues' assessment. Informed by our factor analysis results in RQ1, we chose other variables to include in the model. Our theoretical reasoning was that these variables represented the most active (and perhaps visible) types of social media use.

We chose the following variables to control for, to include in our model: number of (professionally-related) files liked (in Factor 1), number of corporate wiki pages edited (in Factor 2), number of corporate blog posts created (in Factor 4), number of people tagged in the enterprise and total followers one has (in Factor 5), and number of corporate-related forums created (in Factor 7). We did not include a variable based on Factors 3 and 6, since they also concerned file activity and we have this represented by the variable of number of files liked in Factor 1.
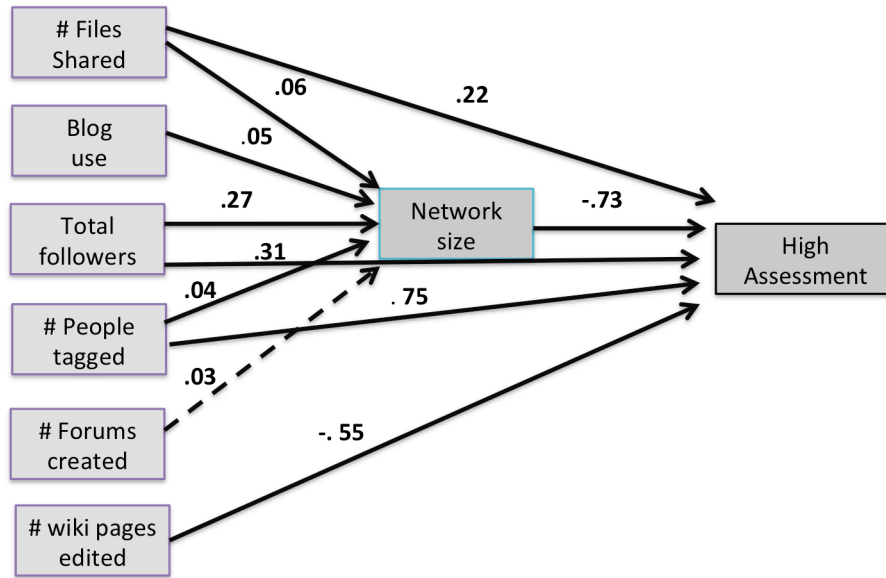
We tested the model using hierarchical regression analysis with Network Size as an independent variable, controlled by Files Liked, Wiki Edits, Blog Posts, People Tagged, Number of Followers and Forums Created. Figure 2 shows a diagram of the model based on the results. The model as shown in Figure 2 is a significant predictor of High Assessment ($F(7, 77) = 6.55$, p<.0001, and the overall R^2 of the model explains 39.6%[3] of the variance of High Assessment. Adding Network Size alone to the model, given that all other variables are included, adds 32.1% of the explained variance (R^2) of High Assessment: F change $(2, 70) = 18.86$, p<.0001.

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[2] For this analysis, we used the full set of 57 measures. For the factor analysis, we combined highly correlated variables.

[3] We would like to emphasize that this is a very high percent variance explained, mostly due to Network Size (32.1%).

Figure 2: Model of network size as a mediator of social media use on colleague's positive assessment. All arrows show relations with significance levels of p<.01. Dotted line refers to a relation of p<.08. Standardized beta coefficients are shown on arrows.

Table 4 shows the beta coefficients in the model. Note that in Figure 2, though the standardized beta coefficients might be small, because the sample size is relatively small, these indicate significant weights.

	B	t	p
Network Size	-1.67	-6.03	.0001
Files Shared	.03	2.18	.03
Blog Use	-.002	-.57	.57
Total Followers	.02	2.65	.01
People Tagged	.002	2.60	.01
Forums Created	-.05	-.97	.34
Wiki Pages Edited	-.03	-2.07	.04

Table 4. Beta coefficients for factors in the model of Figure 2. N=77.

The results in Figure 2 show that counter-intuitively, there is an *inverse* relationship between Network Size and High Assessment. The results show that the smaller one's network (the fewer friends one has in their online enterprise social network), then the *higher* one is assessed by colleagues.

The numbers by the arrows in Figure 2 indicate the standardized beta coefficients which allow us to compare the relative effects of the variables. The model illustrates several relations. Network Size has a very strong negative effect on Assessment, based on its standardized beta coefficient of -.73, relative to the other coefficients in the model. File

Sharing has a moderate effect (.22) and Tagging has a very strong effect, with a coefficient of .75. Number of Wiki Page Edits also has a strong but negative effect on Assessment with a coefficient of -.55. Total Followers has a moderate positive effect on Assessment.

Though Network Size significantly and strongly (inversely) predicts High Assessment, it is actually mediated by other variables. Blog Use, Files Shared, Forums Created, Total Followers and People Tagged indirectly affect High Assessment through their significant effect on Network Size. This shows that Network Size is a partial mediator of the relation of social media use to High Assessment. Again, as Network Size increases, people are *less likely* to rate that person with a positive assessment. In other words, the larger one's social network in the enterprise, the lower they are rated by colleagues. This is a puzzling result and we chose to examine it further in the next section.

Opportunity cost
One explanation for the inverse relationship of Network Size and colleagues' ratings is *opportunity cost*. An opportunity cost, originating in microeconomic theory, refers to the idea that if one alternative is chosen, one loses a potential gain from the alternatives that one did not choose [4]. Thus, given that in the enterprise one has limited time constraints, by choosing to use one form of social media, one loses the potential gain by not using another form of social media. When one invests time in building and maintaining friends through an enterprise social network site, there is less time to engage in other social media usage in the broad platform. It is possible that people with fewer friends in the enterprise

might actually spend more time using social media on more "professional" or "serious" activities, such as those identified in our factor analysis: file sharing (factor 3) or writing in a company wiki (factor 2) or blog (factor 4). It might be that 'friending' in an enterprise would be perceived to be wasting time. This could explain why people with the smallest network size were the most highly regarded—perhaps they are the ones who do "serious" work.

To test this notion, we first examined our target dataset used in Figure 2, of those people with the most positive assessments in the organization. We divided people's network size into three levels based on a histogram with roughly equal cases per level: low (mean friends = 29.6), medium (mean friends = 95.8), and large (mean friends = 246.4). We consider the following variables used in our model in Figure 2 to be "serious" social media use, i.e. what might be considered more central to enterprise work: blog use (number of posts to corporate blogs), file activity (number of professionally-related files liked), wiki use (number of corporate wiki pages edited), forum use (number of forums created on the enterprise network), and tagging others (number of tags given to others in the organization).

An ANOVA revealed that only blog use showed a significant difference between friend levels ($F_{(2,77)}=3.37$, $p<.04$, with low friends having the lowest blog use (mean blog use = 7.4), then medium friends (mean blog use = 13.3), and then high friends (mean blog use = 44.7). We found no significant differences among any of the other four "serious" social media variables on the low, medium, or high friend levels. In sum, the results indicate no support for opportunity cost.

However, it is possible that this set of highly rated people are special cases. Perhaps we would find evidence for an opportunity cost with a broader set of social media users than just the highest rated by colleagues. We used the data of people who received at least one rating on one survey variable (N=3,320). We divided people's network size into three friend levels based on a histogram with roughly equal cases per level: low (mean=8.5), medium (mean=26.2), and large (mean=99.9). An ANOVA showed that for all the "serious" social media use variables, there were significant differences between the friend size groups: low, medium, high (Table 5). Contrary to our expectations, with the exception of forum creation, the data shows that as one's network size increased, the social media activity also increased for our selected variables. Therefore, opportunity cost does not seem to explain the inverse relationship of Network Size on High Assessment.

DISCUSSION
Together, our findings suggest that the usage of social media in an enterprise can help reveal insights about how employees use it. Our first research question examined whether we could identify patterns of social media use within an enterprise social media platform.

	Number of Friends					
	Low (L)	Medium (M)	High (H)	F	p	Bonferroni Tests*
Blogs	3.57 (13.7)*	3.80 (14.1)	12.35 (46.8)*	32.17	.0001	L-H; M-H
Files	.09 (.95)	.30 (2.2)	1.39 (6.2)	35.48	.0001	L-H; M-H
Forums	.33 (1.31)	.28 (.96)	.59 (1.7)	17.71	.0001	L-H; M-H
Tags	.22 (1.35)	1.58 (13.8)	13.88 (105.2)	16.47	.0001	L-H; M-H
Wikis	14.44 (39.7)	17.41 (40.1)	25.28 (97.0)	8.00	.0001	L-H; M-H

Table 5. Mean (s.d.) of different social media usage, for low, medium, and high levels of friends in one's social network. All Bonferroni tests shown are significant at p<.01. N=3320.

We discovered that social media use falls mostly into factors associated with distinct tool use. Informed by these factors, for our second research question we developed a model showing that in conjunction with other social media usage, Network Size is a strong predictor of whether a person in the enterprise is highly reputable. However, Network Size revealed a surprising result: an *inverse* relationship with High Assessment, which we will address shortly.

Social media use in an enterprise platform
An integrated social media platform offers users in the enterprise a choice of media. The factor analysis results showed that there are indeed distinct identifiable patterns of use that mostly correspond to individual social media tools. However, the first factor, commenting and liking, indicates that most of the variance of broad social media use can be explained by these behaviors. These results together suggest that users might "specialize" in different types of media use: as commenters/likers, or as bloggers, wiki users, file sharers or forum contributors. These findings relate to the notion of compensatory fit of Gulatti and Puranam [13]: activities in the informal organization can enhance the effectiveness of the formal organization. Our results provide a first step in investigating more clearly how social media platform use contributes to those informal activities by identifying user roles with social media. Focusing on particular types of media could develop user skills in this media, such as becoming expert bloggers or wiki contributors. The development of such skills could provide benefits to the organization as opposed to using social media platforms in a more *ad hoc* manner.

The factor analysis results revealed that contributing content, and having others react to that content, is very much intertwined, as evidenced by these actions loading onto the same factors. We found that factor 1 revealed that behaviors of commenting and liking, but also having one's contributions commented upon and liked, loaded on to the

same factor. Similarly, factors that showed wiki and blog use indicated the same types of interdependent actions, both creating content and having others comment on that content. One explanation for these patterns of interdependent use might be found from the study of Brzozowski et al. [3] who found that comments on blogs encouraged further blog posting by the author. In a cyclical manner, the relationship of contributing and being commented upon with other forms of social media can be mutually reinforcing.

Understanding broad patterns of enterprise social media use can inform the design of social media platforms. For example, a platform might adapt to a user's pattern of preference for tools. A related idea is that notifications can be geared to a user's social media preference so that they are not overloaded with too many different updates.

Network Size and visibility

We found that Network Size was the strongest (negative) predictor of people's ratings of their colleagues. This result occurred with the most highly rated individuals. Network Size, however, was a partial mediator of other social media usage. Its negative weight in the model indicates that it actually could be a *suppressor* of the effects of other social media usage on High Assessment, i.e. it could suppress the effects of Files Shared and Total Followers.

Our finding of Network Size contrasts with that of Tong et al. [31] who found a nonlinear relationship of number of Facebook friends and social attractiveness. Several aspects of the studies are notable in their differences. First, an assessment of social attractiveness of undergraduates in the Tong et al. study is very different than an assessment of traits for an organization's employees as in our study. Second, the mean number of friends in our study was 45.5 whereas the students in the Tong et al. study had a mean of 395 friends. Our result is closer to that of Utz [33] who found that people with introverted and fewer friends are judged more socially attractive. Extending this to an enterprise context, it may be possible that in assessing others, the *type* of friend is important in connections and not necessarily the size of the network.

We hypothesized that opportunity cost could explain the negative relation of Network Size to High Assessment but we did not find evidence to support this notion. We provide an alternative interpretation of the negative relation of Network size on High Assessment as follows. Researchers of social media effects in the enterprise have argued that social media makes people's behavior visible [2, 12, 32]. It is possible that social network use, i.e. 'friending', is more visible in the enterprise than other types of social media usage. When one requests someone to be a friend on a social network site, it is a direct communication with another person and thus is very visible. In contrast, other types of social media activity such as blog use or forum creation may be less visible. One needs to seek out a wiki or blog, or subscribe to notifications of new content. If it is indeed the case that friending behavior is very visible and that 'friending' in an enterprise might be considered frivolous or non work-related, then this could explain the negative relation with High Assessment. One interpretation is that friending is not valued yet in the enterprise. However, another possible interpretation is that friending may be less relevant in an enterprise when there are so many other options for communicating with someone, especially through a broad social media platform.

How can we explain the negative relation of Wiki use (i.e. wiki pages edited) with High Assessment? Our interpretation is that Wiki use and High Assessment have actually an underlying covariate in common. Wiki edits involve technical, fact-oriented content contribution. The people selected as having "High Assessment" might be people who are instead content creators, or more active social media "leaders". Evidence for this is found in our model with the significant predictor of Files Shared. People who share files to others may be more active in the organization and thus, perhaps assessed higher as a result. Perhaps those who do technical Wiki edits are not those who are also content creators. Indeed, our factor analysis results showed that wiki use loads onto a separate factor than other social media behaviors. It is thus possible that wiki users have traits that are different than those who are most highly regarded in the organization.

Limitations

The underlying variable that we created based on the five survey questions may have actually measured some other construct than what we call "High Assessment". People could have instead rated others based on people they like or admire. If this were the case, then our interpretation for the model in Figure 2 would be that file sharing, tagging, followers, and wiki use, mediated (negatively) by network size, predict colleagues' liking or admiration for other people. This would then suggest that people's SNS usage and use of social media is correlated with a dimension such as respect. This is entirely possible. With this interpretation, perhaps those who spend their time "friending" in the organization are not the people who are highly respected or admired.

Our dataset was deliberately limited to people who were highly perceived by their colleagues (they were presented to, and selected by, at least two target users.), Therefore, our results would hold for highly regarded people and would not necessarily be generalizable to a broader set of people in the enterprise. This research was a first step in assessing the relationship of Network Size to colleague's ratings. We hope that our study can spark further research to examine this phenomenon for a more varied set of users.

Another limitation is that our study focused only on behavioral factors related to social media platform use. We

did not include institutional factors, which would be a fruitful area of research for future study.

We wish to note that the 'friending' feature exists longer (about five years) in the organization than the 'following' feature (about 2.5 years) and thus its resulting network is denser. Thus, it is possible that the differences in density could have influenced our model.

CONCLUSIONS

Broad social media platforms as well as social network use in the enterprise is still a relatively new phenomenon, compared to the use of more traditional media such as email. Employees in the enterprise do exhibit distinct patterns of use (as opposed to ad hoc usage) when they have broad social media platforms available. Our finding of a negative relation of Network Size on colleagues' positive assessment raises questions about the claim that electronic social networks will become the most valued communication medium in the enterprise [11]. That may be the case, but currently our results indicate that friending is not a trait associated with the most highly assessed colleagues. In all, our results suggest that the role of social media in the enterprise is complex and they raise new questions on how its usage can impact organizational behavior.

ACKNOWLEDGMENTS

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APPENDIX A

Q1. CNN is making a new documentary series about reputable people. Gamma[4] was asked to identify a group of the most reputable Gamma employees in various fields, to be included in a chapter about IT companies. Imagine you are sitting on the selection committee, and that the list below contains the 10 finalists. Who would you nominate?

Q2. You just got some really exciting news, but were asked to keep it under wraps until the formal announcement. You were given permission to share this news with up to three people. Suppose these people you were going to tell are ones from the list below. Who would you tell?

Q3. A group at Gamma Research has developed a new tool for internal use. The group is looking for early adopters who would be willing to use the tool and later spread it across Gamma. Imagine you are sitting on the committee responsible for picking these early adopters. The list below contains the 10 finalists. Who would you pick?

Q4. To celebrate its second centennial, Gamma is announcing an award for people whose work had the most impact on the company. Imagine you are sitting on the committee responsible for picking these people. The list below contains the 10 finalists. Who would you nominate for the award?

Q5. Gamma has created a new forum of experts, and is looking for people who are experts in their field to act as the core team of the forum. Imagine you are sitting on the committee responsible for picking this core team. The list below contains 10 finalists. Who would you pick?

[4] A pseudonym is used for the organization name.