

Identifying Value-adding Users in Enterprise Social Networks

Isabel Schmid
University of Regensburg
isabel.schmid@ur.de

Benjamin Wehner
University of Regensburg
benjamin.wehner@ur.de

Susanne Leist
University of Regensburg
susanne.leist@ur.de

Abstract

Enterprise Social Networks (ESN) have been gaining increasing attention both in academia and practice. In previous works, different user types were identified in ESN. However, there is no clear definition of value-adding users, their characteristics and how this type of user can be identified. Based on a literature review, we show that value-adding users are defined in different ways in respect to different objectives, for example spreading knowledge, vivacity of the network or real-time feedback. Each of the value-adding users shows different characteristics that are allocated to the following dimensions: network structure, message, behavior, and social network affinity. Based on the objectives and characteristics, we conduct a single case study, analyze a dataset of a cooperating company, conduct several interviews, and thereby identify value-adding users with respect to objectives. So, we can show that our approach is applicable, useful and that it is a valuable means to take decisions.

1. Introduction

Nowadays, in the globalized world, technology is continuously establishing new ways for communication. Especially large organizations face the challenge of spreading information throughout time and space [1, 2]. Systems that can facilitate networked communication and foster collaboration are so-called Enterprise Social Networks (ESN) [3, 4]. Prior research in this field showed that ESN provide employees with an effective possibility to share knowledge [5, 6], with an easy way to organize meetings and manage teams [7, 8]. Likewise, they can support the process of innovation [9, 10] and facilitate a better connection of the employees [11, 12]. To take advantage of these opportunities, organizations depend on different factors such as technological (e.g. ease of use), organizational (e.g. top management commitment), social (e.g. contribution quality) and individual factors (e.g. enjoyment of helping others) [13]. Users who consume, organize, and produce

content within the ESN constitute one of the most important factors [14]. However, in some cases, ESN do not fulfil the company's expectations making it question the investment [15]. Possible reasons are that the so-called "critical mass" of users or content could not be reached, which is indispensable for ESN acceptance in a company [13]. So, it is necessary to focus on ESN users to influence their behavior in a positive way. Especially considering the users' characteristics is of particular importance contributing to the success of ESN. Research dealing with the identification and characterization of users often draws on the network structure of the underlying ESN [16-18]. Thus, a user's behavior can be evaluated by applying social network analysis (SNA). This delineates, on the one hand, the overall shape and size of a network and, on the other hand, the relation pattern of all nodes in a network [18]. The users with the highest connectivity, the highest activity and the highest information diffusion degree are designated as value-adding users by [16]. However, only few studies consider, in addition to the SNA, further measurement approaches to describe and distinguish user types. But the mere number of ties to other nodes does not allow to draw a conclusion on the quality of the information that is spread across the network and in addition, most of the organization's information can be found in the content of text documents [19]. Thus, various studies combine centrality measures with either the content of a post [20-22] or other measures, e.g., the level of sentiment [23]. As a matter of fact, they are mostly applied on limited views based on different individual data dimensions. Research has also tended to focus on a small number of characteristics – mostly two – to characterize a value-adding user. Thus, as we want to provide a comprehensive approach, we decided to take a closer look at various measurement approaches, reasoning that further investigations give us a deeper insight into the characteristics of users. Further, the combination of different data dimensions will lead to more robust or novel insights for researchers and managers [24]. With this paper, as we want to show how users who contribute to the value of ESN can be characterized, we focus on the users who are most

promising in these terms, the value-adding users, and seek to answer these research questions (RQ):

1. Which characteristics of a value-adding user can be distinguished?
2. How can value-adding users be identified by comprehensively applying various measurements?

The remainder of this paper is organized as follows: in section 2, we give a brief introduction in conceptual basics. In section 3, the research procedure following the case study approach [25] is explained in detail. Section 4 deals with the procedure and the results of the literature review. Next, section 5 shows the results of the case study and section 6 discusses them. Finally, we draw an overall conclusion.

2. Conceptual Basics

2.1 Terms and Definition

Social Media applied by a company is typically used for the communication with external parties. But social media can also be used for internal communication, often referred to as ESN [26]. ESN have been gaining increasing attention, especially in large multinational organizations [22, 27]. Based on previous research [24, 26] ESN can be defined as digital platforms that facilitate employees to communicate with everyone in the organization, to post, edit, and sort texts and files linked to themselves or others and to connect users via various features. So, these platforms are used to improve organizational effectiveness and efficiency [28]. Investigations have shown that ESN are information-sharing platforms, areas for developing crowdsourcing ideas, spaces for receiving expert knowledge and platforms for communication [3, 26, 29]. There are two central capabilities that are fundamental in organizational application of ESN. The first one is the ability to establish and manage social networks, the second one is the ability to find and access digital content [30]. ESN allow users to visualize and navigate the relational structure of their own networks including all connections to other users [30, 31]. Furthermore, accessing digital content like information means a competitive advantage for organizations.

2.2 Value in terms of ESN

In literature, different fields of research such as economics or business administration focus on value as a central construct [32]. Thus, the concept of value is considered from different perspectives so its definition can vary widely. The definition regarding the value of a product e.g. includes the two concepts

“value in use” (value can be perceived via the use to be deduced from a product) [33] and “value in exchange” (value is (ac)countable) [32, 34]. Another definition of value can be established regarding customer valuation. The value of a company’s customer incorporates the profit that a company expects to earn with a customer. With regard to ESN a different perception of value can be found, too.

Value in terms of ESN can further be determined from three different perspectives: First, investigations focus on users who evaluate what drives the value of ESN for them [35-37]. Thus, value is defined here as the user’s evaluation of the benefits of applying ESN for receiving and spreading information against the costs caused by the usage [36]. But these benefits and thus the value in terms of an ESN can not only be evaluated by users but also from organizations. This second perspective includes i.a. the utilitarian value of an ESN for a company. Therefore, an ESN is valuable for a company when it enables e.g. the increase of task performance [38] or when organizations’ expectations are met [27, 39]. The third perspective on value in terms of ESN focuses on the value that is generated in an ESN. Users of a social network are seen as a “tool” for creating value. Thus, a consumer’s active participation in a social media network, including the creation of valuable UGC, is central in value creation [40-42]. Taking this to the internal point of view, a user of an ESN can create value. [22] has included this idea and highlighted that different user types can generate different aspects of value as a user can act as enabler of new methods of working together whereas another user can be valuable as s/he gives high business-related task support. Value-adding users are therefore employees who are rising the challenge of constantly changing business circumstances and go beyond their job obligations, which is also discussed in the research field of organizational citizenship behavior (OCB) [62-64]. So, every perspective defines value differently. It became apparent that discrepancies in the definitions result from different objectives. This applies to all above mentioned perspectives. Specifically, in terms of ESN it depends on the alignment of the objectives whether a user can e.g., be valuable or not. Only if one is aware of the objective, one can determine if someone is valuable or not [39]. Furthermore, as different types of value can be differentiated (due to different objectives), a distinction of the users who create this value must be identified as well. By scanning the literature, it became obvious that few investigations focus on user types in ESN that are in fact valuable. So, little research has focused on the value-adding user, although a company benefits especially from this user as s/he makes a positive contribution. The actual value and the

characteristics of a value-adding user vary widely, resulting in an inconsistent definition.

3. Research Method

To ensure the understandability and applicability of the development of a systematic model for the distinction of users, we applied the research method “single case study” and went by the approach of [25]. In the process of planning the case study, we conducted both interviews with the case company and a research literature review about value adding users and their objectives, which resulted in the formulation of our RQs (see section 1). The structured procedure and the results of this literature review are explained in the following section (see section 4). The RQs serve as a basis for the definition of the unit of analysis – the value-adding user – which is central in the design phase. As ‘every network context produces its own culture of intersubjectively shared expectations’ (p.53 [61]), we determined the single case study design [25, 57]. It allows us to carve out connections between constructs with the aim of highlighting theoretical insights. Afterwards we prepared the collection of case study evidence. Therefore, we developed a protocol to increase the reliability of our study. Thereby, we noted an overview of our case study project including background information (see section 5.1), the project objective (characterization of value-adding users within an ESN regarding different objectives) and the case study issues (value-adding users, ESN, SNA, sentiment, content analysis). The case study protocol also includes the field procedures (schedule of data collection activities) and our case study questions. After these preliminary considerations, we collected case study evidence. To guarantee the reliability and validity of our results we used multiple sources of evidence, which is why the analysis (see section 5.3) comprises both the detailed analysis of network data and conducting interviews with a board member and two department managers. The purpose of the analysis is to recombine evidence so we can draw conclusions.

4. Literature Review

4.1 Procedure of the Literature Review

To start the literature review, first, we defined the review scope in accordance with the research questions (cf. [43]). Consulting promising papers dealing with value-adding users in ESN and their different objectives (e.g. [19, 22]) led us to key concepts in the current literature as well as to key words such as “user types”, “value-adding user(s)”,

“user roles” in combination with “enterprise social *” and “objective” (in any combination) necessary for the further search. The consultation of seminal works was not only destined for search terms but also to define meta-databases (dblp, AIS electronic library, ACM digital library) and the time period of the literature search (2005-2020). The literature search, including study selection criteria, was conducted by two researchers simultaneously to avoid biases [44]. First, we searched for publications that use the previously defined search terms then we conducted a forward and backward search (cf. [45]) before we filtered the results to concentrate on the relevant literature. The initial literature search resulted in a total of 467 publications. In view of the aim of our paper, we selected investigations with a direct reference to user types in ESN in their title, the provided keywords and the abstract. As a result, almost three quarters of the articles had to be discarded. We also eliminated duplicates and only peer-reviewed full papers have been selected (58 remaining) which were analyzed in detail. 36 publications analyzing user types in other online social networks such as Facebook were eliminated. Additionally, we removed investigations without direct reference to the value-adding user and their objectives. Finally, we identified 16 articles as relevant. The literature analysis is based on the qualitative content analysis according to [46].

4.2 Results of the Literature Review

In literature, there is neither a consistent definition nor a homogeneous characterization of the value-adding user within an ESN. [20] e.g. define value-adding users as users who post both work-related and non-work-related content in an ESN on a balanced level to stimulate the ESN. However, [16] identify value-adding users in their investigation likewise but focus on expert identification. Therefore, they define value-adding users as users who share knowledge in ESN to support others [16]. Although both user types are value-adding for a company, they mainly differ in their overall value (thus also in their objectives) and in the specification of different data dimensions. Both the structured review of the literature regarding the characteristics (cf. table 1) and the objectives/ value will be presented and discussed in more detail here:

- **Network structure:** The network position is an often-consulted metric in the distinction of different user types. This structure can be illustrated by “a set of nodes interrelated by dyadic ties” [47]. Value-adding users are amongst the best-connected users [17-19, 48-50]. They can be described via four different centralities: degree, betweenness, closeness, and eigenvector centrality. While degree centrality shows

the number of direct links a user has [51, 52], betweenness centrality indicates how often a user is situated on the shortest path distance between various actors [51, 53]. When users have a high level of closeness centrality, they have fast access to information within the entire network [51]. By means of eigenvector centrality one can determine a node's status by investigating both the number of direct connections and how well its contacts are connected [47, 51]. Thus, the status of the users depends on who they are tied to [18]. Value-adding users are amongst the best-connected users and add value to the organization in terms of **spreading knowledge** [16, 17]. They exhibit the highest centrality measures in the social graph [17-19]. When ESN become very large the situation can change: users with lots of connections can no longer be generally rated as value-adding as they are seen as persons who want to build friendships rather than using ESN professionally [21].

- **Message:** Literature has distinguished between a professional purpose leisure posts [16, 19, 20, 22, 54]. However, it is not possible to infer directly from the content of a post to the user type. Value-adding users can be described as employees who communicate knowledge and help others by posting merely work-related content [16, 19, 22]. Moreover, the proportion of work-related to non-work-related content is also important. Work-related blogging allows users to bring out their expertise, whereas a high number of readership of non-work-related content only shows that its authors are popular among their colleagues. More popular users are mostly also happier at work [20]. So, from an organizational perspective, one can state: when companies restrict non-work-related blogging, the spread of work-related knowledge decreases as well. So, if a company is interested in the **high vivacity of a network**, users who post non-work-related content can also be seen as value-adding users, especially as there is a positive spillover effect from non-work-related posts to work-related posts [20, 55]. Based on the usage of textual data, the contents of messages and posts can be tagged as positive, neutral or negative [23]. To intervene adequately if necessary, companies therefore need to take a closer look at users who exhibit a very negative or very positive sentiment. Moreover, ESN provide new possibilities for employees to express themselves [23], providing users with the opportunity to **give real-time** (both positive and negative) **feedback**. A value-adding user may also be a person who posts constructive and criticism, with the impact on the overall health of a company, understanding its reputation as an employer.
- **Behavior:** A differentiation between active and passive user behavior within an ESN can easily be made [17, 19, 22]. Focusing on the user's active

behavior - a value-adding user is amongst the most active users [18, 49, 50, 54-58] - different activities such as writing and reading articles, writing, reading or tagging in messages, etc. can be distinguished [54]. Hence, value-adding users exhibit the highest centrality measures in the activity graph [17-19, 21]. The more network connections employees have within the ESN, the more they can exchange expertise. Hence, ESN can enable firms to trace employees' expertise as well as the dispersion in general based on their social connections [21]. Value-adding users communicate knowledge and help others by posting merely work-related content [16, 17]. Other users show their appreciation by giving likes or shares. However, further research has shown that value-adding users who are willing to support others also want to receive help in return [19]. The high activity level is directly tied with the utilization frequency: Depending on how often users are logged-in, the utilization frequency is high, as their ESN usage goes from several times a day to permanent use [22, 54].

- **Social Network Affinity:** This dimension includes the analysis of a user's affinity towards ESN usage. Value-adding users are extremely open for using social networks in general. They are highly familiar with the usage of ESN in their routines. Furthermore, they are curious which leads to the user's ability to motivate other people's ESN usage [22, 50, 58].

As a result, the conducted literature review showed that there are many different characteristics of a value-adding user (cf. table 1) and that no homogeneous definition can be found. Consequently value-adding users were essentially examined regarding different objectives. Depending on the respective objective, the different studies result in different characterizations of a value-adding user. This is in line with our previous remarks in section 2.2. So, value, and thus a value-adding user, cannot be defined isolated but only against the background of a specific objective. Thus, in the current research literature we have identified the following objectives: (1) spreading knowledge, (2) increasing the vivacity of a network and (3) giving real-time feedback.

(1) According to the literature, users who are most value-adding regarding the objective **spreading knowledge** are the ones who have a high level of centrality in both the social and the activity graph and spread their knowledge by posting merely work-related content [19, 21, 22]. Thus, a combination of the following characteristics of data dimensions is to be conducted to meet this objective: centrality, active posting behavior and work-related content.

(2) Value-adding users who support and provoke the **vivacity of a network** are, according to [20], users who are on a central position, post both work – related

and non-work-related content on a balanced level. Thus, a combination of the following characteristics of data dimensions is to be conducted to meet this objective: centrality measures and both work-related and non-work-related content.

(3) Regarding the third objective, **real-time feedback**, a value-adding user is a user who posts negative as well as work-related content. These posts that seem, at first glance, destructive can help an organization to identify their internal weaknesses and react to negative but constructive and change-oriented contents [23]. Thus, a combination of the following characteristics should be conducted to meet this objective (cf. table 1): active behavior, negative sentiment, and work-related content.

These objectives represent the contribution of a

value- adding user to the network. To prove the applicability of our approach, we conducted a case study to show how different value-adding users can be identified (combination of characteristics of the data dimensions) with reference to the different objectives.

5. Case study results

5.1 Data collection

Our case study takes place in a Data Warehouse consulting company. As an international company it has about 130 employees. To keep them all connected and up-to-date, the management decided to introduce Yammer, a leading ESN platform. Within the first three months 93% of their employees registered.

Table 1. Value-adding user

Data dimensions	Characteristics of the data dimensions	Characteristics of a value-adding user
(I) Network Structure	Analysis of the centrality measures within a network: <ul style="list-style-type: none"> • Degree centrality • Betweenness centrality • Closeness centrality • Eigenvector centrality 	<ul style="list-style-type: none"> • Central position an ESN: best-connected user in the network [17 - 19, 49, 50, 60] • High status in a network: contacts are well connected and central, too [17 – 19] • Large ESN: the more connections the less one is classified as a value-adding user [21]
(II) Message/ Post	Analysis of the messages/posts sent by a user: <ul style="list-style-type: none"> • Content of a post <ul style="list-style-type: none"> ◦ Leisure posts versus work-related posts ◦ Sentiment of a post: general temper (positive, negative, neutral) 	<ul style="list-style-type: none"> • Has a high level of knowledge: merely work-related posts, original content [16, 17, 19, 21, 22, 54] • Keeps network alive: equal proportion of work-related to non-work-related posting [20, 49] • Sends messages that are very detailed when they reply to questions [55] • Sends posts of change-oriented work-related criticism (negative sentiment) [23]
(III) Behavior	Analysis of the users´ behavior within an ESN: <ul style="list-style-type: none"> • Participation within a network <ul style="list-style-type: none"> ◦ Passive/Active ◦ Read/Post 	<ul style="list-style-type: none"> • Content creator and highly active user (including writing/reading articles, writing/reading/ tagging in messages, helping others, posting status updates) [17 - 19, 49, 50, 54 – 58] • Person who is willing to help: <ul style="list-style-type: none"> ◦ More likely to share than to seek knowledge [17, 60] ◦ Equal level of sharing and seeking knowledge [19, 55] • Helpful person: receives most likes and bookmarks [16] • Exchanges information between different working groups effectively and rapidly [19] • Behaves like an opinion leader [21]
	<ul style="list-style-type: none"> • Utilization frequency 	<ul style="list-style-type: none"> • Exhibits a medium to high utilization frequency: <ul style="list-style-type: none"> ◦ Uses ESN several times a day [18, 22] ◦ Has created 10 posts in the previous 12 months [54]
(IV) Social Network Affinity	Analysis of the individual affinity towards an ESN: <ul style="list-style-type: none"> • Attitude towards ESN 	<ul style="list-style-type: none"> • Open-minded towards the introduction of ESN [22, 50] • Motivates colleagues to use ESN [22] • Curiosity, anticipation, and enthusiasm [22]
	<ul style="list-style-type: none"> • Ability to use ESN 	<ul style="list-style-type: none"> • Familiarity with using a social network and ability to take advantage of it [22]
	<ul style="list-style-type: none"> • Opinion about future potential 	<ul style="list-style-type: none"> • High level of promotion and support of the system [22, 50, 58]

Besides promoting the interaction among the employees and providing a place for criticism, various further benefits were expected, e.g. in the fields of knowledge or by establishing discussion groups. After a few months, the management realized that there were significant differences in the ESN usage. Posts of several employees popped up frequently, others posted only in groups and many employees did not post at all. The question arose how these different usage patterns could be identified and how employees could be characterized and clustered based on their behavior in the ESN, leading to the final question which type of user was value-adding. To answer these questions, we conducted two in-depth interviews with each of three interviewees, a board member and two department managers. All interviews lasted about two hours each and were structured as follows: in the first interview, we discussed the initial situation taking into consideration the results of the literature review. In a second interview, as we had already applied the metrics, we were able to discuss the results with them. These second interviews resulted in adapting and sharpening the identification approaches regarding the different objectives. The interviews were conducted by two researchers, recorded, transcribed, and finally reduced to the most important statements. Additionally, we analyzed a full data excerpt of seven months of ESN tool usage. The data were provided in csv-files, containing for each employee: subsidiary, department, job role, hierarchy level, and date of registration. In total, the data excerpt comprised 670 posts by 122 employees in the given timeframe. We are aware that the number of posts seems to be small at first glance. However, this number must be seen against the background that the ESN has only recently been introduced. Furthermore, the company wants to carry out the analyses about the identification of value-adding users precisely because these users should increase the value and thus the success of the network.

5.2 Data cleansing and preparation

First, the data had to be prepared. Thus, we set up a Jupyter Notebook (Python). We then removed posts that were created by the ESN itself (technical post). 511 posts were the basis for the upcoming analysis. While most columns contained structured data, we also processed the unstructured posts. In this regard, we removed symbols, special characters and stopwords [59]. As explained above, we also wanted to extract the sentiment of each text corpus. The sentiment score is a numeric value ranging from -1.0 (negative) to 1.0 (positive), with a value of 0.0 indicating a neutral sentiment. As we were also intent

on distinguishing posts containing business and/or private matters, we manually classified each post as being a business or a private post. To make this differentiation more understandable, we provide an example each: business post “*Since now, we’ve got version 3.3.0, updated themes and bunch of new plugins.*” versus private post “*What about to drink some beer?*”. In some cases, the posts contained business and private topics. To analyze the network structure of the employees, we modeled the interaction network by using the networkx library in Python. While employees are considered as nodes, their interactions are represented by the edges. Consequently, the social graph equals the activity graph and we cannot distinguish between network structure and behavior in our analysis. This means that an active user is central in the network, since we can calculate the following measures: closeness, degree, betweenness, eigenvector centrality for each user. The last data dimension, social network affinity, comprises i.a. a person’s attitude towards ESN. As described above 93% of all employees registered within the first three months. This indicates that the registered persons are early adopters [50]. Furthermore, more than 80% of all employees have an IT-related qualification which speaks for a high level of ability to use ESN.

5.3 Results of the data analysis

As a first step we present a short analysis of each variable to create a solid basis for separating the value-adding users from other users in the network. Looking at the network structure, the 511 posts were sent by 48 nodes, in the following referred to as active users. The active users build a coherent network, on which the centrality measures are calculated. Looking at them in detail and calculating the Pearson correlation coefficient, we see that all centrality measures are highly correlated, with all values being higher than 0.82, meaning e.g. that an employee who has a high (low) betweenness centrality value also has a high (low) degree centrality value ($r=0.951$). Thus, we can distinguish different employee groups regarding their network positions. We chose the degree centrality, as it has a high correlation with the other centrality metrics. Looking at the sentiment values of all posts, we saw a wide range from very negative to very positive values. Moreover, the results indicated that far more posts had a positive sentiment value, enabling us to finally state that the general sentiment in the ESN was positive. When aggregating these values per employee it turned out that, on average, all users had a positive posting-behavior. Looking at the business and/or private characteristics of a post, we saw that

56.9% of all posts had a business and 59.7% a private character. 16.6% of the posts had both business and private contents. After presenting the analysis of each variable, we combine them based on the literature to meet the objectives spreading knowledge and real-time feedback. During the first interviews it turned out that the company wanted to focus primarily on value-adding users in the context of these two objectives and wanted to exclude vivacity of a network.

First, a value-adding user regarding the objective **spreading knowledge** is defined as a person sharing knowledge from a central network position. Thus, following the research literature we combined the data dimensions (cf table 1): Message (work-related) and Network structure/Behavior (centrality measures). After applying these two dimensions we presented our first results to the interviewees. It turned out that this procedure was too superficial here. For them it is interesting who is value adding in which area of knowledge. Thus, we came to the decision to differentiate not only between work-related and non-work-related but also between different work-related topics. So, we first filtered for work-related posts, as we only wanted to focus business-relevant knowledge. Then, we further identified the specific topics (three detail levels) with the help of Natural Language Understanding V1 of IBM Watson to differentiate the areas of knowledge. Thus, we aggregated the posts of each topic and, subsequently, of each employee to identify the topic a particular employee addressed most frequently. To identify which content was spread most, we finally analyzed the network position, as the knowledge of employees is more widely spread if posted by a central node. We chose the degree centrality due to its high correlation with other centralities. Looking at the topic categories, we found out that among the work-related posts 21 different topics were addressed by 40 employees on the whole. Further, as every employee addressed different topics, 146 combinations of employees and topics could be identified. However, for each topic, we were able to identify those employees who contributed most to a topic. Continuing this analysis on a higher detail level (topic_cat2) made it possible to also identify the knowledge spread on more specialized topics such as technology and computing/internet technology. In total, 88 detailed topics were identified across the 40 employees. On this detail level, 210 combinations of topics to employees could be identified. But did this knowledge also reach many other employees? Looking at the network positions of the employees and at the topics that were addressed most often (top 25% of the 88 detailed topics), it could clearly be stated that all of them were among the central nodes. Hence, we were able to identify different value-adding users

depending on the different topics. For each topic (topic_cat1), we identified two to three value-adding users and therefore experts in this knowledge area. So, all interviewees agreed to combine the dimensions business-related content, topics and centrality.

Second, regarding the objective **real-time feedback**, a value-adding user actively gives feedback in terms of change-oriented criticism. This is in line with our results of the literature review: a user who actively posts negative and work-related content. After applying this identification approach to our data, we discussed our results with the interviewees. The concurrent opinion was that these dimensions were helpful in a first step but were not fully enough for identifying a value-adding user in terms of the objective “real-time feedback”. The board member argued that further analysis was needed as not every negative post contain constructive feedback. Posts that contain e.g. furious invectiveness had to be excluded. So, to fulfil the requirement of the board member we additionally included the emotion detection. It is possible to identify the emotional sentiment of a user’s written text. Hence, by applying the Tone Analyzer V3 of IBM Watson Developer Cloud we drew a distinction between six emotional levels: anger, disgust, fear, joy, analytical and sadness. This allows us to check the emotional aspect of the criticism expressed by the employee. The distribution of the emotions can be seen in figure 1 (left).

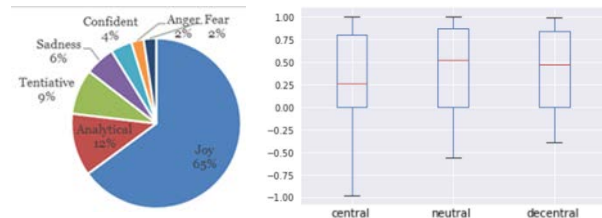


Figure 1. Left: tone analysis; Right: Sentiment analysis and centrality measures

In a first step, we focus on the negative emotion “sadness” to identify the subliminal criticism. Moreover, we excluded emotional posts (e.g. posts with high values of anger) that are so decidedly negative that a user who exhibits these kinds of emotions is not able to give constructive feedback. Further, one of the department managers pointed out that it would be important to include the centrality measure as criticism may not be realized if dispatched by decentral nodes because of their weak connectivity. As the case company wanted to react quickly to the negative feedback that spread fast across the network, we included the centrality measures. In addition, the other department manager stated that it would be further helpful to identify the topics a value-adding

user gives feedback about. As we stated above, the network position of the employees plays a decisive role in meeting this objective. Thus, we split the employees into central, neutral and decentral nodes and provided boxplots based on the sentiment values of work-related posts (see figure 1: right). Comparing the three groups central, neutral and decentral, we saw that in all of them the inter quartile range started at 0.0, indicating that 75% of all posts had a neutral or positive and 25% of them a negative sentiment. Differences could especially be seen when comparing the median of the central nodes (0.56) to the other groups (0.51, 0.47) as it was much lower and the group of central nodes had a lower skewer (-0.98) than the neutral (-0.55) and decentral nodes (-0.39). Our results show that the posting behavior of central nodes generally had a more negative sentiment than that of the other nodes. Furthermore, looking at the negative posts and analyzing their emotion, the largest share of the negative posts exhibited the emotion “sadness” with 41.7%, e.g. “*Status update: It’s endless. We can barely see our monitors*”, posted at 04:11am. Afterwards, we additionally analyzed the topics of the negative posts. Here, we saw that most negative posts contained the topic “technology and computing”, especially “technology and operating systems”, e.g. “*Yes, we are still here and we screwed only two of our seven gateways.*” We saw that across these negative posts, subliminal feedback in terms of criticism prevailed. As can be seen above, the employees complained about their workload and working hours. As the same employees repeatedly wrote similar posts, it was possible to identify them as valuable.

6. Discussion of the results

Drawing on the literature was a starting point for identifying value-adding users. Advantageously, the results of the literature summarized in table 1 covers various dimensions that can be combined to meet the three identified objectives. Moreover, these data dimensions can be combined differently to meet other objectives a company may have. But, they can be further sharpened to identify more targeted value-adding users, too. First, regarding the objective spreading knowledge, we were able to identify value-adding employees and estimate – according to their network positions – how knowledge spreads across the network, based on the assumption that knowledge provided by central nodes spreads faster and wider than knowledge provided by e.g. decentral nodes, which was already proven correct by [19]. But as there are also topics that are initiated by decentral users, specific incentives need to be identified that stimulate the employees’ needs to influence goal achievement

and therefore their helping behavior in a positive way (cf. [62]). Their knowledge, even if relevant for other employees in the company as well, does not spread fast or reach the persons of interest although they exhibit individual initiative. The question is what a company or the employees themselves can do to facilitate access to this knowledge, e.g. how employees can shift their network position from decentral to central, a problem network science literature deals with (cf. [65]). Certain software functionalities e.g. could be implemented to provide employees with the information that their posts are barely seen, which they may not be aware of, or central employees could share these posts identified as relevant but invisible to other employees. Second, regarding the objective real-time feedback (cf. [23]), we were able to identify value-adding users by combining the dimensions centrality, work-related posts, sentiment, emotion and topics. According to our interviewees this is a huge advantage for the case company. However, it is counter-intuitive to classify employees who complain about internal conditions as value-adding users, as it is of course also probable that these users spread a disadvantageous atmosphere in the company [23]. But, in the long run, it is better for the management to know of rumors and problems within the company and be aware of who is discontent with the prevailing situation. Identifying these users creates the opportunity to counteract dissatisfaction promptly and change things. Being aware of problems and reacting accordingly is by far better than ignorance. We discovered that employees complain about their workload after working late. When the board member became aware of this, the company decided to reward such employees. The identification of value-adding users based on the company’s objectives thus seems promising in terms of serving as a basis for deriving measures that are crucial to make an ESN successful. So, we saw that along the two objectives presented, value-adding users could be identified properly. We were also able to show that in an ESN there are different types of value-adding users, depending on their particular objectives.

7. Conclusion

The aim of this paper is to identify value-adding users in ESN. Based on the literature with rewarding results, it was not only possible to clearly define the characteristics of a value-adding user. Instead, we identified that different authors provide different characteristics relating to different objectives [19-23]. Even though the objectives define a value-adding user in different ways, we identified intersections that we dissolved in table 1. In the existing literature, a clear definition of value-adding users could not be found.

Instead, we concluded that value-adding users must be defined in the context of distinguishable objectives. To answer RQ1, we compiled the characteristics of a value-adding user resulting in a set of dimensions: network structure, message, behavior and social network affinity. So, we can provide a comprehensive overview of how to identify and define value-adding users. Further, we examined the applicability of the dimensions and the objectives in a case company by analyzing the dataset of the ESN and by conducting several in-depth interviews, enabling us to identify value-adding users in a practical context. Within these interviews the case company formulates further requirements a value-adding user should meet to be valuable. Thus, regarding the objective spreading knowledge the case company wanted to identify those users who spread knowledge in a specific topic area across the network. Therefore, in our analysis we included topic detection to identify the value-adding user per topic. Regarding the objective real-time feedback, the interviewees agreed that the first results were too broad, so we included further measurement approaches (emotions, topics). Including them, and highlighting objectives is an indispensable step with regards to identifying value-adding users and, from a company's point of view, applying them effectively (see RQ2). With the help of the interviewees, we were also able to confirm the value-adding users. Our research contributes to theory and practice alike. First, as a contribution to theory, we provide a comprehensive view in terms of value-adding users in ESN, identifying well-defined objectives and dimensions. Second, we contribute to theorizing how value can be generated within an ESN, which is hardly considered in literature. As a contribution to practice, first, we show the applicability of various dimensions and the combination of these dimensions in a real-life setting. Second, we identify measures to influence employee behavior, eventually influencing the network structure towards an achievement of the goals. However, our research is not without limitations. In the case study, we had to restrict ourselves to a limited number of values and objectives that were aligned to the case company. In other practical settings, different values and objectives may have to be set. Thus, for further research we are intent on carrying out a study by analyzing a larger data set. So, we plan to evaluate whether our approach applied on an extended network results in more value-adding users because of further objectives, whether these users can be distinguished more precisely, and whether further characteristics can be derived. Furthermore, since the value-adding users show characteristics that are also important dimensions of the research direction of OCB, such as helping

behavior or individual initiative, we aim to investigate to what extent the other five dimensions [62] can also be applied in the field of ESN and how this research field can be support to structure user types in ESN.

8. References

- [1] Burke, R.J. and E. Ng, *The changing nature of work and organizations: Implications for human resource management*. Human Resource Management Review, 2006. **16**(2): p. 86-94.
- [2] Giermindl, L., F. Strich, and M. Fiedler, *How Do They Differ? Analyzing the Motivations of Posters and Lurkers for Participation in ESN*. JITTA, 2018. **19**(2): p. 89-120.
- [3] Riemer, K., P. Scifleet, and R. Reddig, *Powercrowd: Enterprise social networking in professional service work*. Business Information System, 2012.
- [4] Wen, Z., et al. *How Multimedia in Enterprise Social Networks Matters to People's Performance*. International Conference on Multimedia & Expo Workshops, 2012.
- [5] Liu, D., et al. *Influence analysis based expert finding model and its applications in enterprise social network*. in International conference on services computing, 2013.
- [6] Han, S., S. Sörås, and O. Schjodt-Osmo, *Governance of an enterprise social intranet implementation: the statkraft case*. ECIS. 2015: Münster, Germany.
- [7] Richter, A. and K. Riemer. *The Contextual Nature Of Enterprise Social Networking: A Multi Case Study Comparison*. ECIS. 2013.
- [8] Riemer, K., A. Altenhofen, and A. Richter. *What are you doing?-Enterprise microblogging as context building*. ECIS. 2011.
- [9] Ding, G., et al. *Leveraging Work-Related Stressors for Employee Innovation: The Moderating Role of Enterprise Social Networking Use*. in ICIS. 2015.
- [10] Kügler, M. and S. Smolnik. *Just for the fun of it? Towards a model for assessing the individual benefits of employees' ESS usage*. in HICSS. 2013.
- [11] Kügler, M., et al., *Connect me! Antecedents and impact of social connectedness in enterprise social software*. BISE 2015. **57**(3): p. 181-196.
- [12] Riemer, K., J. Finke, and D. Hovorka. *Bridging or Bonding: Do Individuals gain Social Capital from Participation in Enterprise Social Networks?* ICIS. 2015.
- [13] Chin, C.P.-Y., N. Evans, and K.-K.R. Choo, *Exploring factors influencing the use of enterprise social networks in multinational professional service firms*. Journal of organizational computing & electronic Commerce, 2015. **25**(3): p. 289-315.
- [14] Oestreicher-Singer, G. and L. Zalmanson, *Content or Community? A Digital Business Strategy for Content Providers in the Social Age*. MIS quarterly, 2013. **37**(2).
- [15] Li, Z. and H. Tang. *Identifying Lead User in Mass Collaborative Innovation Communit*. International Symposium on Knowledge and Systems Sciences. 2016.
- [16] Berger, K., et al. "Who is key...?" *Characterizing value adding users in ESN*. ECIS. 2014.
- [17] Cetto, A., et al. *The Blessing of Giving: Knowledge Sharing and Knowledge seeking in ESN*. in ECIS. 2016.
- [18] Smith, M., D.L. Hansen, and E. Gleave. *Analyzing ESM networks*. in Computational Science & Engineering. 2009.
- [19] Cetto, A., et al., "Thanks for sharing"—*Identifying users' roles based on knowledge contribution in Enterprise Social Networks*. Computer Networks, 2018. **135**.

- [20] Huang, Y., P.V. Singh, and A. Ghose, *A structural model of employee behavioral dynamics in enterprise social media*. Management Science, 2015. **61**(12).
- [21] Mark, G., et al. *Most liked, fewest friends: patterns of enterprise social media use*. in *ACM conference on Computer supported cooperative work*. 2014.
- [22] Oettl, C., et al. *Archetypes of Enterprise Social Network Users*. in *HICSS*. 2018.
- [23] Shami, N.S., et al. *Understanding employee social media chatter with enterprise social pulse*. in *Computer supported cooperative work & social computing*. 2014.
- [24] Behrendt, S., A. Richter, and M. Trier, *Mixed methods analysis of enterprise social networks*. Computer Networks, 2014. **75**: p. 560-577.
- [25] Yin, R.K. *Case study research: Design and methods*. in *United States: Library of Congress*. 2009.
- [26] Leonardi, P.M., M. Huysman, and C. Steinfield, *Enterprise social media: Definition, history, & prospects for the study of social technologies*. Journal of Computer-Mediated Communication, 2013. **19**(1): p. 1-19.
- [27] Wehner, B., C. Ritter, and S. Leist, *ESN: A literature review&research agenda*. Computer Networks, 2017. **114**.
- [28] Stei, G., S. Sprenger, and A. Rossmann. *Enterprise social networks: status quo of current research and future research directions*. in *ICIS*. 2016.
- [29] Ellison, N.B., J.L. Gibbs, and M.S. Weber, *The use of enterprise social network sites for knowledge sharing in distributed organizations: The role of organizational affordances*. American Behavioral Scientist, 2015. **59**(1).
- [30] Kane, G.C., *ESM: Current capabilities and future possibilities*. MIS Quarterly Executive, 2015. **14**(1).
- [31] Kane, G.C., et al., *What's different about social media networks? A framework and research agenda*. MIS quarterly, 2014. **38**(1): p. 275-304.
- [32] Woodall, T., *Conceptualising 'value for the customer': A structural, attributional and dispositional perspective*. Academy of Marketing Science Review, 2003. **12**(1)
- [33] Bovea, M. and R. Vidal, *Increasing product value by integrating environmental impact, costs and customer valuation*. Resources, Conservation and Recycling, 2004.
- [34] McKnight, D., *The value theory of the Austrian school*. The Appraisal Journal, 1994. **62**(3): p. 465.
- [35] Chin, P.Y., et al., *Understanding factors influencing employees' consumptive and contributive use of ESN*. Information Systems Frontiers, 2019: p. 1-20.
- [36] Mäntymäki, M. and K. Riemer. *Information, ideas and input: The value of ESN*. 2014. ACIS.
- [37] Zhang, J., et al. *A case study of micro-blogging in the enterprise: use, value, and related issues*. in *Conference on Human Factors in Computing Systems*. 2010.
- [38] Meske, C., K. Wilms, and S. Stieglitz, *ESN as digital infrastructures-understanding the utilitarian value of social media at the workplace*. Information Systems Management, 2019. **36**(4).
- [39] Richter, A., et al., *Success measurement of enterprise social networks*, in *WI*. 2013.
- [40] Bechmann, A. and S. Lomborg, *Mapping actor roles in social media: Different perspectives on value creation in theories of user participation*. New media & society, 2013.
- [41] Lone, A.N. and Y. Rashid, *Value Co-Creation: Exploring the Role and Purpose of UGC*. Research Journal of Social Science & Management 2015. **5**(8): p. 104-111.
- [42] Trkman, M. and P. Trkman, *A framework for increasing business value from social media*. Economic research-Ekonomska istraživanja, 2018. **31**(1): p. 1091-1110.
- [43] Cooper, H.M., *Organizing knowledge syntheses: A taxonomy of literature reviews*. Knowledge in society, 1988. **1**(1): p. 104-126.
- [44] Kitchenham, B., et al., *Systematic literature reviews in software engineering—a systematic literature review*. Information and software technology, 2009. **51**(1).
- [45] Vom Brocke, J., et al., *Standing on the Shoulders of Giants: Challenges and Recommendations of Literature Search in IS Research*. CAIS, 2015. **37**(9).
- [46] Mayring, P., *Qualitative content analysis: theoretical foundation, basic procedures & software solution*. 2014.
- [47] Kane, G.C., et al., *What's different about social media networks? A framework & research agenda*. MISQ, 2012.
- [48] Beck, R., I. Pahlke, and C. Seebach, *Knowledge exchange and symbolic action in social media-enabled electronic networks of practice*. MISQ, 2014. **38**(4): p. 1245-1269.
- [49] Hacker, J. and K. Riemer, *Identification of User Roles in Enterprise Social Networks: Method Development and Application*. BISE, 2020: p. 1-21.
- [50] Holtzblatt, L., et al., *Evaluating the uses and benefits of an enterprise social media platform*. Journal of Social Media for Organizations, 2013. **1**(1): p. 1-21.
- [51] Freeman, L.C., *Centrality in social networks conceptual clarification*. Social networks, 1979. **1**(3): p. 215-239.
- [52] Scripps, J., P.-N. Tan, and A.-H. Esfahanian. *Node roles and community structure in networks*. in *2007 workshop on Web mining and social network analysis*. 2007.
- [53] AlFalahi, K., Y. Atif, and A. Abraham, *Models of Influence in Online Social Networks*. International Journal of Intelligent Systems, 2014. **29**(2): p. 161-183.
- [54] Schwade, F. and P. Schubert. *Developing a User Typology for the Analysis of Participation in Enterprise Collaboration Systems*. in *HICSS*. 2019.
- [55] Hacker, J.V., F. Bodendorf, and P. Lorenz, *A framework to identify knowledge actor roles in ESN*. Journal of Knowledge Management, 2017. **21**(4): p. 817-838.
- [56] Muller, M. *Lurking as personal trait or situational disposition: lurking & contributing in ESM*. *Conference on computer supported cooperative work*. 2012.
- [57] Trier, M. and A. Richter, *The deep structure of organizational online networking—an actor-oriented case study*. Information Systems Journal, 2015. **25**(5).
- [58] van Osch, W., C.W. Steinfield, and B.A. Balogh. *ESM: Challenges and opportunities for organizational communication and collaboration*. *HICSS*. 2015.
- [59] Angulakshmi, G. and R. ManickaChezian, *An analysis on opinion mining: techniques and tools*. International Journal of advanced research in computer and communication engineering, 2014. **3**(7): p. 7483-7487.
- [60] Beck, R., Pahlke, I. and Seebach, C. "Knowledge exchange & symbolic action in social media-enabled electronic networks of practice." MISQ. 2014. **38** (4).
- [61] Fuhse, J. A. *The meaning structure of social networks*. Sociological theory. 2009. **27**(1), 51-73.
- [62] Aggarwal, A., & Singh, R. *Exploring the nomological network of organizational citizenship behavior*. Journal of Organizational Behavior. 2016. **15**(3).
- [64] Borman, W. C. *The concept of organizational citizenship*. Current directions in psychological science. 2004. **13**(6): p. 238-241.
- [64] Bateman, T. S., & Organ, D. W. *Job satisfaction and the good soldier*" Academy of management Journal. 1983. **26**(4): p. 587-595.
- [65] Barabási, A.-L. *Network Science*. Cambridge University Press. 2016.