"Personal Social Dashboard": A Tool for Measuring Your Social Engagement Effectiveness in the Enterprise

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ABSTRACT

Social media platforms have become popular in many enterprises. Employees build their social eminence by effectively engaging on these platforms. Becoming socially eminent in the organization is a personal journey and many employees need guidance to succeed. In this paper, we describe a tool called Personal Social Dashboard deployed within our enterprise. The tool provides feedback to employees on how effectively they engage in the enterprise social network by maintaining a set of scores covering different aspects of one's social role, such as Activity, Network, Reaction, and Eminence. We provide a description of the tool with a subsequent study of its use within the company and effect on employees' behavior in the company's social network.

CCS CONCEPTS

• **CCS → Human-centered computing → Collaborative and social computing → Collaborative and social computing systems and tools**

KEYWORDS

Social media, enterprise, workplace, collaboration, social analytics, social engagement analytics, eminence, influence, social effectiveness

1   INTRODUCTION

Employee engagement has become a central theme for many HR organizations in the enterprise [21,22,24,31]. Engaged

employees are more satisfied at work, and thus perform better [11, 18]. A Google study showed that companies fostering a culture of knowledge sharing and collaboration increase morale and job satisfaction, and thus attract talent and reduce retention [20]. One way of fostering engagement and collaboration within the enterprise is through the usage of enterprise social media tools, such as Jive [14], IBM Connections [12], and Yammer [33]. Employees contribute and collaborate in these tools through authorship of content items such as micro-blogs, files, and wikis, and through engagement and feedback mechanisms such as liking, sharing, and commenting. According to a McKinsey report [25], incorporation of social technologies results in a 25% productivity increase. Through their contributions and interactions on those tools, employees become engaged and get an opportunity to build their voice within the organization and promote their eminence and influence.

A recent paper by the authors [17] defines the term *socially eminent* as being socially successful, well known, and respected in the social networking sphere. It discusses the motivation of being socially eminent in the enterprise and constructs a set of tips and recommendations for raising social eminence by engaging effectively. Becoming socially eminent is a personal journey that requires employees to become dedicated to the process, which includes being active and involved in enterprise social networks, create engaging content, and get others to follow them. Naturally, not all employees know how or are able to socialize in an effective manner without some guidance. Starting the journey and failing to succeed in gaining enough engagement can result in frustration, that might draw employees to reduce their social activity and stay away from using the social network. Thus, employees can highly benefit from ongoing feedback and guidance through a tool.

There are several tools measuring a person's influence through social media on the web, such as Klout [15], PeerIndex [27], and Kred [16]. These tools aggregate social cues from various social networks such as Facebook, Twitter, and LinkedIn to compute an influence score. Measuring employees' voice and eminence within the enterprise does not only provide feedback to the employees themselves on their personal effectiveness in the internal social network, but also supply the organization with a general insight

into employees' social engagement and the breadth of social networking tools usage.

We developed and deployed a unique and novel tool called "Personal Social Dashboard" (PSD) within our company for measuring employees' engagement effectiveness within the enterprise social network. It provides feedback to employees by exposing a set of scores covering different aspects of their social engagement focusing not only on their own activities but also on the reactions they receive and the perception of others of them and their content. The scores are *Activity* (activity of an employee), *Network* (connectedness of an employee), R*eaction* (reaction to employee's content), and *Eminence* (interaction of others with the employee). The tool also includes an *Overall* score - an average of the aforementioned four - providing users with an overall perspective on their social role. Although the tool is available to all, it is not necessarily intended to be used by all employees. Out of many personas of social activity [6,9], the tool targets employees who are at least somewhat socially active and who are motivated to increase their eminence within the enterprise. Such employees are probably also more interested in monitoring their progress than others. The tool is less valuable for employees who are not socially active or are not interested or too shy to become more so. Regardless of their persona, the PSD provides feedback employees could not obtain before.

In this paper we study this novel tool through analysis of its use and effect on employee behavior within an enterprise social network. We are not aware of any other research of such an application in the context of the workplace. The paper studies the following research questions: how are the tool and its features used; who are the tool's users; do tool users seem more motivated to increase their social role within the company than others; how effective is the tool for raising its users' social engagement; and if it influences its users' social behavioral patterns.

The paper is organized as follows: the next section includes related work, followed by the PSD system description. We then define the research settings for the analysis along with results. The last sections provide discussion and conclusions.

2   RELATED WORK

Our system aims at calculating numerical scores summarizing different aspects of social behavior within the enterprise. There are several works trying to infer influence, reputation, and other indicators from social media e.g. [1,7,29,32]. For example, Jacovi et al. [13] characterize and infer reputation of users of social media within the enterprise. They also point out that reputation may assume different forms such as: trust, influence, expertise, and impact. Anger and Kittl [3] describe a grounded approach for measuring influence or as they call it – social network potential (SNP) – of individual Twitter users. To calculate the SNP score, their algorithm takes into account the number of followers, mentions, retweets, and other quantitative activity indicators of a user.   Hajian and White [10] propose a formal model for measuring influence in a social network, in which influence is measured over likes and comments posts receive. Similarly, our PSD system measures performance indicators in social media

based on raw activity data such as likes, comments and content creations.

There are many available online web tools for tracking social media influence and engagement over public social networks such as Klout, PeerIndex, and Kred. These tools usually extract digital footprints from online social platforms, which users leave behind. The data gathered is then processed into a score measuring some aspect of personal social performance, such as influence. Similarly, to our system, these systems calculate several performance indicators, each summarizing a different social aspect, which may also be integrated into a single overall score. Klout uses social media analytics to measure online social influence and provides a single score, which is calculated from data collected from 9 major social networks [28]. Three other score types supplement the Klout score: true reach, amplification, and network. PeerIndex provides social media analytics based on user-generated data collected from social media sites. It measures influence scores by considering activity, audience, and authority. Kred computes measures of influence and outreach.

The tools mentioned above provide social analytics for their users by accessing several public social networking platforms. Other tools perform social analytics within the enterprise social network, and are usually platform specific. These tools allow members of the enterprise to monitor their social status within the social network along with guidance on how they may improve it. Jive, for example, includes a "reputation" center, where users can view their current status points, which are calculated based on their social activity within a community. In Chatter [8], community managers can use a reputation measuring tool within their community and track its members' reputation level determined by point values members acquire when they engage socially. Yammer recently added social and reputation mechanics to its platform with the integration of Badgeville [4], which analyzes users' social activity and evaluates reputation. Yammer also collaborated with Klout to integrate the Klout score into its network. To the best of our knowledge, our paper is the first research on such a social scoring system within the enterprise. We are also not aware of a system supporting the four scoring aspects we defined.

An effective way of encouraging users to engage with a system is to augment it with some form of gamification e.g. [2,5,26,34] - the use of game-like strategies to enhance user engagement, such as competition, status recognition, challenges, and rewards. In the context of social scoring systems as the one presented here, the scores themselves provide some sort of gamification, giving users the incentive of improving their online social status.

3   SYSTEM DESCRIPTION

The PSD is an innovative tool based on a Big Data analytics system. It captures interactions from social applications and stores the data in a graph representation. It then performs a series of tunable analytics to generate for each employee a set of five scores and their evidence.

The tool is built to empower employees on their social journey and motivate them to increase their social engagement and

eminence within the company. The detailed feedback includes a set of scores, which help them understand different aspects of their social role in the enterprise. For each score, employees can inspect their score history, as well as evidence of what contributed to their score and what they should consider improving. The PSD's focus is not only to motivate more content contribution, but also to encourage more engaged socializing, which can potentially draw a wider crowd to one's content, increase interactions, and widen one's community of followers.

3.1 Enterprise Social Graph

The PSD is built over an enterprise social graph. The graph contains vertices and edges capturing social activity traces from social or collaboration applications. Its abstract model allows incorporating traces of any social network. The enterprise graph includes a vertex for every entity in the enterprise social network, such as person, blog, wiki, microblog, file, etc. Each directed graph edge represents a social activity performed among the entities represented by its end vertices. For example, if employee "E1" liked a blog entry "A" that was created by employee "E2", it would be represented in the graph by vertices "E1", "E2", and "A", along with a "created" edge from "E2" to "A" and a "liked" edge from "E1" to "A", as illustrated in Figure 1.   As the graph contains all activity traces within the enterprise social network, our analytics can extract a full view of all past employee activities as well as all reactions to their activities.

3.2 Scores

PSD scores are calculated over the social graph. The four base scores comprise *Activity*, *Reaction*, *Network*, and *Eminence*. The PSD includes also an *Overall* score, which is an average of the four base scores. Each base score focuses on a different aspect of employee engagement. Activity focuses on the social activities the user performs, thereby assigning higher priority to more engaging contributions. For example, a new content contribution, such as a new blog entry, is weighted higher than a "comment", and a "comment" is weighted higher than a "like" activity. The Reaction score focuses on the amount of reactions one's content received from others (such as comments, likes, follows, etc.). Only others' activity can contribute to an increase in this score. The focus of the Eminence score is to capture how others perceive a person within the company. It examines how many people are trying to interact or share information with the person, follow the person, etc. The Network score focuses on the size of the explicit network along with followers and followees.

All score computation algorithms take a very rich set of indicators along with corresponding weights as input. The indicators are counters 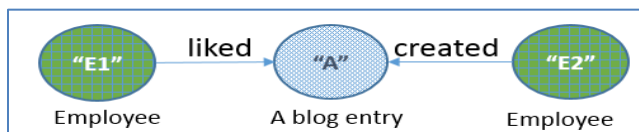accumulated over the enterprise graph for each user, such as number of comments the user placed on blog entries, number of likes the user's microblogs received, number of people who shared files with the user, number of people who mentioned the user, etc. Such indicators are extracted from all social applications within the enterprise graph, capturing different aspects of social activities. Each indicator algorithm identifies a set of vertices or edges of relevance and passes them through a date decay component. This component reduces the power of older items according to the time passed since they were created or updated. Activity decay is the strongest, then Reaction, and the lowest is Eminence. This allows for Activity to focus on relatively new contributions, for Reaction to give a bit more time for others to react on the contributions, and for Eminence to be built over a longer period. A weight is assigned to each indicator based on its source application (e.g. blog, wiki) and the engagement required to perform the activity. The algorithms then use a normalized weighted sum to calculate the scores over the indicators and weights. Similar weighting strategies have been applied by others for social networking extraction [30]. Our algorithms were influenced by previous work on employee reputation [13, 23].

PSD scores range from 1 to 100. In order to motivate people to become more socially active in an effective manner, the score schema makes it easier to increase lower scores and more difficult to increase higher scores. Employees with an Overall score between 0 and 19 are hardly active in the social arena. Scores between 20 and 59 represent employees who are somewhat socially active and contribute occasionally. Scores between 60 and 79 represent employees who are more socially active but are probably not top socially eminent. The highest scores, 80-100, belong to more socially eminent employees who have a wider presence in the enterprise social arena.

It is important to note that we do not expect all employees to get or even strive to get a perfect score of 100. As an enterprise contains many employees with different job roles and different activity levels, some are required to be very active, whereas others are free to use it as they like. However, employees who want to be more active and enjoy the benefits of being socially engaged and eminent can use the PSD to help them understand what to do in order to improve and use the score as a reference point for subsequent score changes.

The PSD includes a machine generated content detection system which recognizes large amounts of content contributions from individual accounts in a short period, potentially aimed at raising one's score. Presumably, the minority of all machine-generated content is for the sake of score increase, but as the aim of the PSD is to motivate employees to contribute their own content, such machine-generated content is ignored.

3.3 PSD User Interface

The PSD is a web application deployed in our company's intranet. Only employees themselves have access to their scores and no one else can see them (including their managers).

The PSD user interface is composed of a set of web pages. The tool entry page is the "Home" page, depicted in Figure 2. Its middle part contains the user's name, organization, profile picture, the

Figure 1. Sample Social Graph

Figure 2. PSD Home Page

Figure 3. PSD Reaction Evidence Page

Overall score, and a graph capturing the score change history. The latter is important as it visually summarizes the user's progress in the last six months. The bottom part includes details on each of the four basic scores. Apart from the scores themselves, the average score of the employee's organizational unit and whole company are presented. This allows users to understand how they relate to others without exposing any scores.

The PSD includes four evidence pages, one per each basic score. An example of the Reaction evidence page is shown in Figure 3. Users can navigate through the pages by clicking on the specific scores on the Home page. Each evidence page's middle part is similar to the Home page part but focuses on a particular basic score. The bottom part includes a description of the score along with a set of aggregated indicators that were used by the algorithm. When pressing the title of each part, a relevant description of the indicator replaces the score description and provides more in-depth details on what is considered in the score. By using the evidence pages, employees can better understand what data the algorithms take into account and what engagement patterns the PSD is trying to motivate.

Due to technical issues, scores are currently computed and published only once a month. Thus, users are encouraged to reenter the tool on a monthly basis. The tool also exposes the date of the latest refresh of its scores. We raise this limitation in the Discussion section.

4   RESEARCH SETTING

We conducted an in-depth investigation of how employees use the PSD and whether it helps them socially engage more effectively.

4.1   IBM Connections

This research was performed over a dataset of an internal deployment of IBM Connections (Connections) within our company. Connections is an enterprise social networking platform including several collaboration applications. The Micro-blogging application enables writing microblogs on one's own or

someone else's wall. Wikis enable co-editing of web pages. Forums allow discussions of topics and Blogs enable posting of blog posts. The Files application supports uploading and sharing files. Each application enables commenting and liking of its entries as a means to engage over them. People can be directly addressed by using @mention in the text, which results in an email notification of the mentioned people. Connections enables inviting other employees into one's network. It also supports following people or content items. Employees are updated through their activity stream or via an email digest on all social activities within their network.

4.2   Quantitative Analysis Data

The analysis focused on the 7-months period (research period) following the release of the tool to all company employees (September 2015 – February 2016). It included the following main data sets: employee monthly PSD scores, log of all pages accessed by employees within the PSD application, and basic employee meta data such as their organization and manager. In order to examine the effect of the PSD on employee activity in Connections, we used the enterprise social graph, populated with all social activities performed within our enterprise in Connections since its deployment in 2007. The graph instance included ~40M vertices and ~212M edges. Among them were, for example, 873K blog entry vertices and 9.64M file vertices.

During the research period, 21,127 distinct company employees accessed the PSD at least once (out of 450K employees). Out of those, 83% were regular employees and 17% were managers. Most PSD users were from the Headquarters organization, followed by Services, Sales and Development. 184,829 page visits were logged during the research period.

As PSD scores were published on a monthly basis, we focused our analysis on the number of score periods during which users accessed the tool. Thus, if a user accessed the tool several times during the same monthly period, we counted this as one accessed score period.

4.3 User Survey

After the research period, we conducted a survey with PSD users who entered the tool during at least four score periods. We randomly selected 511 users with scores from all ranges and sent the survey via email with a link to a web form. We received 183 responses (36%) with a score distribution resembling the full set. The survey included a set of nine questions about the users' experience with the PSD. The questions inspected the usability of the scores, the tool's most valuable features and whether usage of the PSD changed the users' engagement in Connections in any way. Moreover, it included questions regarding whether the tool helped users become more socially eminent, reputable or in getting a voice and if so, whether this change would have happened without the tool and general thoughts about the tool. Most questions included responses on a Likert scale. All questions had an area for free-text comments.

5 RESULTS

The following section describes the results of our study. We define *PSD users* as employees who accessed the tool at least once during the research period and *Non-users* as employees who did not access the tool during that period. We consider only employees with an Overall score higher than 1, indicating they had been involved in at least some social activity. We examine score distributions of PSD users' vs. non-PSD users' to gain more insights into the populations. We than investigate whether PSD users increased their scores more than non-PSD users, whether part of this change can be attributed to the PSD and whether the PSD succeeded in motivating its users to socialize in a more engaging manner. We also report insights into tool usage.

5.1 Tool Features

In the survey, we asked participants to mark which features they found most valuable in the PSD. 80% specified the personal Overall score as most valuable followed by the average organization Overall score. This is probably because both scores combined provide an indication of one's relative position. Third was Activity score followed by the history graph, the other basic scores and the score detail pages. We speculate that the history graph was rated higher than the score detail pages as employees may be more interested in seeing if and to what level their efforts generated improvement over time than an indication on which particular score they needed to improve.

5.2 Users and Scores

The PSD tool computes scores for all employees independently of whether they ever accessed the tool. In this section's graphs, we use a single number to represent a score range. For example, score range 10 represents scores ranging from 1 to 10.

Due to some criticism on the meaningfulness or reliability of scores calculated by other social scoring measurement tools such as Klout, [19], we investigated whether survey participants found the PSD scores useful. Among the respondents, 69% found it "Useful", 25% "Slightly" and only 6% did not find it useful. We
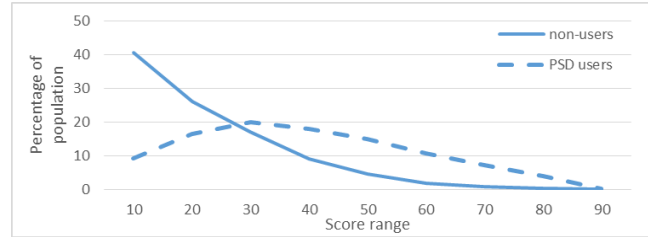
Figure 4. PSD score distribution across scores

then investigated the Overall PSD score distribution at the beginning of the research period, focusing on the difference between PSD users and non-users, as captured in Figure 4. Indeed the score distributions were different. Most non-users have low scores and as scores increase, the number of employees rapidly decreases. The PSD users' score distribution peeks at 30 and decreases slowly. Although there are significantly fewer people with high scores, the figure confirms our intuition that the higher the score, the higher the probability that the employee is a PSD user. Apparently, the PSD attracts higher percentage of socially engaged employees than their portion in the company population.

We found that 58% of users accessed the tool during one score period only, 18% during two, 9% during three, and 14% during four score periods or more. Figure 5 shows the percentage of PSD users who accessed the PSD for two score periods or more per Overall score range. Interestingly, as the score increases, the tool is used more often.

When slicing the users by the company's organizations, employees from Corporate Headquarters accessed for the highest average number of score periods (2.16), followed by Systems (1.99) and Development (1.75). Services and Sales had a bit lower numbers and the Research organization had lowest (1.51). Thus, internal facing employees probably found it more important to socialize effectively inside the enterprise. Headquarters' lead may be attributed to the fact that this organization includes many people in leading roles who thus put more emphasis on being socially engaged.

We also looked at the difference between accesses of employees whose managers were PSD users vs. those whose managers were not. We found that employees of managers who accessed the tool during four periods or more, accessed it on
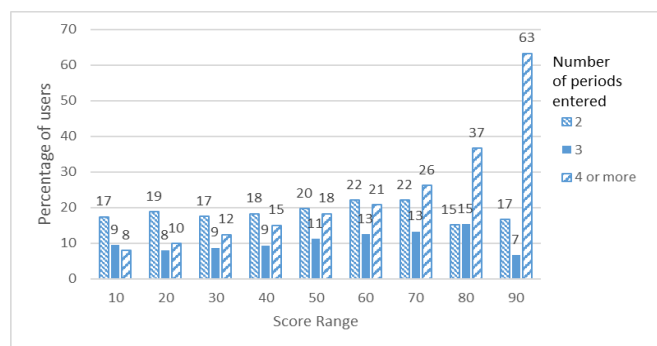
Figure 5. Percentage of users in Overall score range per number of accessed score periods

average during 1.08 periods (compared to 0.08 in the general population). Thus, having managers who were PSD users raised the probability that their employees would enter the PSD as well. Possibly managers encouraged their employees to also use the tool.

5.3   Score Change

In general, we expected employees who decided to use the PSD to be more motivated to increase their engagement within the enterprise than non-PSD users. To verify that there is indeed a stronger increase, we compared score change between PSD users' to non-users'. First, we conducted a set of one-tailed unpaired t-tests over the score difference between the beginning and the end of the investigated research period for all five scores and indeed found significant differences ($p<0.05$) for all. When examining the effects on each score level using one-tailed unpaired t-test, we also saw significant differences ($p<0.05$), apart from the 90-100 range. The percentage of employees who increased their score in each score level in the whole research period was between 0% to 38% for non-users, whereas for PSD users it was between 13% to 74%. Moreover, the average score change for both populations decreased as the score increased, as shown in Figure 6. This can be explained by the fact that the higher the score, the harder it is to raise it. Thus, in general, PSD users increased their score much more than non-PSD users, as expected.

We also examined the average score change in relation to the number of score periods the user accessed the PSD. Our hypothesis was that employees who accessed the tool during more periods were more interested in following their score change, and therefore were probably putting more effort into socializing in the social network. Figure 7 captures the average score increase in relation to number of score periods accessed. Employees who never accessed the PSD (period=0) had the lowest score increase. More frequent access periods increased the score more substantially. We expected the highest increase to be in Network and Activity scores as users can more easily influence those through their own social activity. Thus, we were surprised that Activity was third and not second. Eminence was second to increase. This is interesting as the user can hardly control this score directly. An explanation could be that employees' effort to add others to their network caused those to also follow and engage with them. Increasing the Reaction score is harder and as expected had the lowest increase.
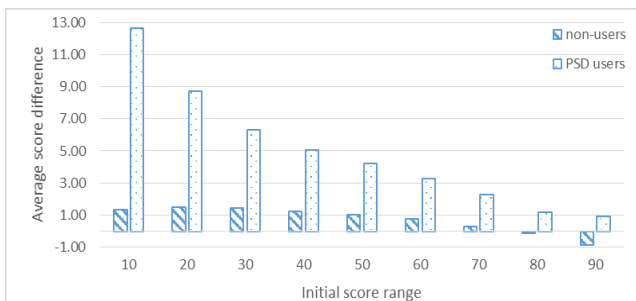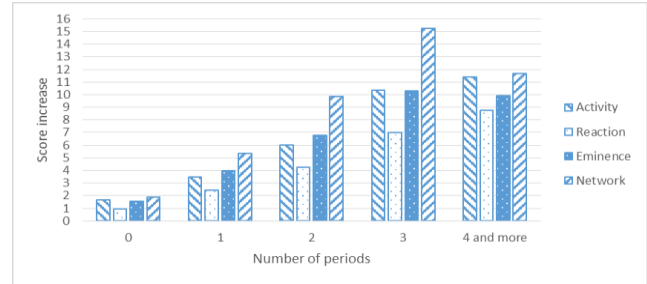

Figure 7. Average score increase by accessed score periods

5.4   Tool Impact on Social Effectiveness

To examine whether the PSD indeed assisted its users in being more socially active in an effective manner, we next narrowed our focus to employees who significantly increased their activity in a short time period and who would probably expect, as a result, to gain back more engagement from others. We divided this set into PSD users and non-users and compared their activity effectiveness.

Thus, we first extracted employees in each score range under 80 who increased their Activity score by 5 points or more (more than half a score range) in the first three months. Higher scored employees socialize effectively and are thus not of interest to this analysis. We then categorized each of those users as "successful" if they also managed to raise their Eminence and Reaction scores by 5 points or more. This enabled focusing on employees who socialized more effectively as they managed to get higher levels of reaction to their contents and drew more employees to interact with them. We then divided the resulting sets into two groups: PSD users and non-users. Overall, we compared 1,930 PSD users to 29,440 non-users divided according to their initial score range. Figure 8 captures the results of this analysis indicating what percentage of employees, in each score range and for each user group, were classified as successful. On average, there was a 27% difference between the percentages of PSD users who were more successful during this period to non-users. Moreover, as score increased, higher percentages of PSD users were more successful, whereas for non-users it stayed the same. Thus, when focusing on sets of two similarly active (and probably motivated) populations which have both increased their activity in the time period, higher
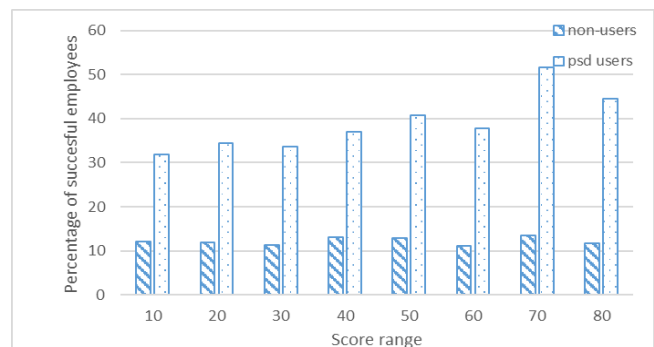

Figure 6. Average Overall score increase between first and last month of research period

Figure 8. Percentage of successful users in each score range

percentages of PSD-users were able to use their activity more efficiently across all score ranges. Thus, one can reason that the PSD indeed affected the socializing patterns of its users.

To further examine this, we asked participants whether they felt that using the PSD helped them become more socially eminent, reputable, or in getting a voice. 66% agreed, 20% were undecided and 14% disagreed. One participant stated: "I am a competitive person and accustomed to metrics in my work. Having a score inspires me to improve and adopt what is new." Another commented: "Yes, the tool allowed me to see where I can be better. I may have a huge network but no one responds to my comments, but with the help of the tool, I can make a better choice of what to post." or "What you measure, is what you get. So the focus on that measurement is also changing my behavior to get better and e.g. use tags more (which was one of my "low scores")." Another participant was undecided: "It's like gamification - wanting to improve my score. In that respect, it helps to encourage Social, intrinsically. But it *is* only a measurement tool, it does not provide "help" to more socially eminent & reputable". There was also disagreement: "this tool is just a measure no driver".

In order to further understand the impact of the tool, we asked survey participants whether they believed the change would have happened without it. We found that 54% responded "no", 35% "yes", and 11% were "indecisive". Some of those who answered positively wrote: "Without the tool, I would not know if I am making progress in these attributes and what are the areas I can improve in. The description in each of the attributes are useful to direct actions in the areas to help enhance one's eminence." Another participant also stated: "Without the tool I have no way to measure my social participation or know what aspects of my social strategy are being more or less effective." An interesting comment was related to PSD effect on a team, which is collectively using it: "Due to PSD we could see the change happen quickly. Otherwise it would have taken a very long time for us to see the change. PSD has been one of the driving forces." Another participant commented: "I think the change would have happened without the tool because I do regularly assess what productivity tools I am using it to improve the way I work. However, I think the tool helps me to pinpoint where I might want to improve." Another stated: "My behavior is independent of the score."

To better qualify the effectiveness and benefits of the PSD and get an indication on its ROI, we asked participants how the PSD helped them or their team. We provided various options and an "other" option. In their responses, 68% marked that it "Increased social efficiency", 46% marked "Helped expertise sharing", 43% specified "Strengthened team collaboration", 12% indicated that it "Saved time", and 11% marked that it "Opened new business opportunities".

In the last question, we asked survey participants to specify their general opinion about the PSD. Some positive comments included "The PSD for us is a great way to leverage our social activities in our daily job, without the dashboard it would be hard to see how well we are doing. Also, it motivates oneself to be more active and to improve in any particular area." Another commented that "[the PSD is] a good tracker of individual social

performance and a guide on which engagement parameter you need to improve to be socially connected." A negative comment was "nice stat but what does count in my area is competence and the tool is just counting activity and not quality." We will further refer to this last statement in the discussion section.

5.5   Tool Impact on Social Engagement

Changing behavioral patterns is not easy and takes time, but we set out to investigate whether the PSD effected its users' social engagement. Thus, we asked survey participants if the usage of the PSD changed their engagement. We found that 39% specified "Very much", 35% "Moderately", 14% "Slightly" and 12% stated "Not at all". Thus, 74% felt the PSD impacted their engagement. Many employees placed comments on this question reporting on the effect on their engagement patterns. Some specified that it made them analyze their current behavior and comprehend what they needed to modify in order to improve: "I am monthly checking my performance and adapting as I go. Example: I noticed that my reaction score was low so I started understanding why people were not picking up the messages I was sending on my profile. I started using the tag option and noticed reaction went up". Another specified: "It's a good indicator to see if what I'm working on is useful, interesting for others. This is helping me to focus more on some subjects and less on others". Others specified that it caused them to do more engaging activities: "it made me become more active in discussion and appreciate other ideas." or "Since we have the dashboard, I add comments and "likes" to the entries I previously just read". Only few specified that it had a negative impact on their engagement: "starting to make fake likes and not really useful comments, just to increase the score". The effect of such behavior is discussed in the next section.

6   DISCUSSION

The PSD was developed to help employees understand their role in the company's social network. Its purpose is to assist them in socializing more effectively and increasing their voice or eminence by providing important feedback not obtainable otherwise. We found that indeed the tool assisted its users to socialize in a more engaging manner and become more socially effective. Moreover, employees who embraced the PSD, on average increased their scores drastically. This was strengthened in the survey where participants stated that the change would not have happened without the tool. We plan to extend the PSD with personalized social activity recommendations based on employees' actual socializing patterns in order to further guide them in socializing more effectively.

One of the PSD's main limitation is its monthly score refresh. This may frustrate some users as they cannot get immediate feedback on their efforts. It may even lead to users abandoning it. Yet, eminence is not built in a short time and therefore inspecting its change over longer periods makes sense. We are working on removing this limitation in the near future. Another limitation is the fact that the PSD considers only the engagement and not the content of the activity. For example, the PSD does not distinguish

between flattery comments to executives to more valuable comments or sentiment expressed in the text in its relevant score calculations. We hope to include such aspects in the future depending on accessibility of this data. Furthermore, we currently include four scores providing different aspects on one's social engagement. We are aware that other aspects may exist and plan to investigate and consider additional ones in the future.

In general, the PSD seemed to be less useful for hardly socially active employees. This is an expected result as such users have not found the need to be socially active and thus are probably not motivated to become more so. However, the nature of the score computation assists those who decide to start becoming more socially active to increase their score rapidly. Socially eminent employees also found value in the PSD, which provided them with evidence on their impact level. These socially eminent users help spread the word and motivate their followers to onboard. In general, not all employees are expected or should strive to achieve a score of 100. It depends on different factors such as job role, personality traits, etc. In the future, we plan to identify what score ranges and social behavioral patterns are expected in different job roles and customize the PSD accordingly.

The PSD scores' purpose is to motivate employees to socialize effectively. The scores should serve as a numerical indication of their status in their social journey. As one survey participant stated: "Without having a piece of measurement you are blind. I felt isolated prior to seeing my results and comparing my scores to my organization." But providing scores or rewards in response to an increase in social activity can motivate some employees to try to increase their scores through meaningless activity or spamming. The four-score approach along with the impact on the audience of one's activities makes it difficult to game the system over time. In the short term, users' Activity score may increase but soon their followers will notice the quantity increase and quality decrease which will stop them from reading and following the spammers. As a result, spammers' Reaction, Eminence, and Network scores will decrease. Such employees will eventually notice that there are no short cuts and that such activity results in decrease of their eminence.

Only employees themselves have access to their scores and even their managers cannot see them. This is crucial for protecting the privacy of employees and verifying that these scores cannot be used against them in any way. Interestingly, we see many employees sharing their scores through screen captures in the enterprise social network. Some employees mentioned they would like their managers to see their score improvement towards their yearly performance assessment. We are aware that peer pressure or manager request may pressure employees to expose scores (as well as any other private information). However, we trust the company to handle any identified privacy violations. Peer pressure or managers request can also cause employees to try to rapidly increase their score. We hope that in such cases employees will use the PSD's internal documentation (or any other sources of tips) to learn how to socialize effectively and will not start spamming.

In this paper, we mainly focused on how the PSD can help enterprise employees, but we did not explicitly discuss the enterprise's gain from such a tool. Survey participants indicated that the PSD helped their team in various scenarios. Research has shown that having a socially active and engaged workforce is beneficial to the company. As employee scores are logged over time, management could still perform analytics over aggregated scores and thus gain value without compromising on employee privacy. For example, companies could identify how their workforce is adopting social applications, where to spend their onboarding efforts, and whether these efforts are indeed effective, and more.

Although our research is limited to a single company using a single social networking system, we believe our findings are of importance and applicable to other researchers and developers who are working on other influence, reputation, or eminence measuring systems in the enterprise.

7 CONCLUSIONS

In this paper, we described a novel tool called Personal Social Dashboard and investigated its use and effect on employees' behavior in an enterprise social network.

The study provides several contributions. First, it describes the innovative PSD tool itself, which was developed over a Big Data analytics framework. Its social analytics system generates for each employee a set of five scores: Activity, Reaction, Eminence, Network, and Overall, helping employees understand different aspects of their social role in the enterprise, which they could not obtain otherwise. As a second contribution, the study revealed insights into such tool's users, highlighting the characteristics of its audience in the enterprise setting. Thirdly, we found evidence that the tool is indeed effective in raising its users' social engagement and effectiveness.

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