# The domain driven data mining (D3M) Approach for Performance Evaluation in virtual organizations using ICT Social Network Mining & 360° Assessment

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## Abstract

The aims of this research are to study and explore Domain Driven Data Mining approach on HRM perspective for assessing employee performance evaluation behaviors from various literature surveys, to understand and clarify the positive and negative impacts of the existing 360° performance assessment method for a virtual organization like e-publishing industry, and the perception towards performance evaluation in the minds of workforce by conducting personal interview with employees in a virtual organization, to observe and examine the mobile, email communications of employees and people opinions in web blogs of a virtual organization and to combine the performance evaluation Key Performance Indicators (KPIs) using mobile social network mining, e-mail social network mining and opinion mining methods, to design and develop an automated, ICT based Domain Driven data Mining system with a conventional 360 degree performance assessment method implementation for assessing employee performance evaluation using 360 degree records, mobile CDR (Call Data Record) files, e-mail log files, and opinion blog files kept in a company server, and to test the validity of the proposed D3M approach by developing a prototype to demonstrate the primary features, to investigate the results, and to derive findings by observing the results. The researcher has focused three virtual organizations of Newgen Imaging Systems Pvt. Ltd. as the preferred location for undergoing the pilot study for the research, and used the Empirical methodology for the study. The researcher found that the social network perspective has traditionally avoided a focus on specific individuals, preferring to examine systematic patterns of interaction. Bringing performance research into the picture requires a new integration of network theory and methods to account for not just structural patterns, but also the focused

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activities of powerful individuals. This research on designing a tool for identifying human relationship and performance behavior using social network analysis presents a first step towards addressing this problem. What it provides is a look at how one could design a tool to support email and mobile, that social information brings salient employee relationships. Team members' relations are important to the Employee's performance. Stronger relational links are associated with higher task performance and the effectiveness of information exchange. So this research has aimed at fulfilling such objectives as developing an online social network analysis and discovering interaction patterns of teams for employee performance in concerns. It implies that the system conforms to the cognition of employees and assistants, since employees and assistants interact frequently with team members in leading the team.

**Keywords:**   Domain Driven Data Mining ($D^3M$) , Performance Evaluation , Virtual Organizations, Social Network Mining, 360° Assessment

**Introduction**

Performance evaluation is the important issue that have been considered due to the transition from industrial age to knowledge era. Perceptions of unfairness can be more detrimental for geographically distributed workers than for collocated teams. Even though businesses continue to drive demands for virtual organizations, most contemporary studies of evaluation system are limited to traditional organizational settings.

An interpretive, phenomenological Domain Driven Data Mining (D3M) approach utilizing 360° performance assessment for subjective measurement and mobile social network, email social network, and opinion mining for objective measurement enabled a hermeneutic analysis process. The main objective of this study is to investigate the main factors which affect the employees' performance in virtual organization and to show how these factors can be applied for performance evaluation in virtual organization. A virtual organization is an organizational network that is structured and managed to function as an identifiable and complete organization. Determining what meanings virtual team members attach to performance evaluation system in e-business organizations is a vital precursor to understand the effectiveness of the management practice, rendering this study a preliminary investigation. The literature confirms that perceptions of management practices in e-business organizations can influence employee loyalty and role-related behaviors.

## Statement of Problem

Employee performance evaluation, a superior evaluates and judges the work performance of employees, is the common management practices utilized in all organizations including a MNC like virtual organization. The widespread use of performance evaluation can be attributed to the belief by many managers and human resource professionals that performance evaluation is a critically needed tool for effective human resource management and organizational performance improvement.

An organization comes across various problems and challenges of performance appraisal in order to make a performance evaluation system effective and successful. Notwithstanding, in spite of the attention and resources applied to the practice, dissatisfaction with the process still abounds and systems are often viewed by employees as inaccurate and unfair.

Then an effective automated tool using Data Mining and Business Intelligence has to be designed for employees, performance evaluation in virtual organizations. A novel Domain Driven Data Mining (D3M) approach using 360° Assessment, mobile and email social network mining and opinion mining has been proposed in this study to solve the problem of performance evaluation in virtual organizations.

## Background of the problem

Employee performance evaluation is used as management tools in any organization. Although, the traditional research agenda has done little to improve the usefulness of performance evaluation as a managerial tool. The main performance evaluation challenges involved in the performance evaluation process (Howard and Charles, 2007) are as followed:

• The identification of the appraisal criteria is the biggest problem faced by the top management.

• The purpose of the performance evaluation process is to judge the performance of the employees only.

• Top management should choose the raters or the evaluators carefully.

• Many errors based on the personal bias like stereotyping, halo effect may creep in the appraisal process, and so the rater should exercise objectivity and fairness in evaluating and rating the performance of the employees.

• The appraisal process may face resistance from the employees and the trade unions for the fear of negative ratings. Then, the employees should be communicated and clearly explained the purpose as well the process of appraisal.

• The manager and the employees in virtual organizations are physically dispersed in various locations, the possibility for supervising the employee performance by a manager leads the traditional methods to become failure.

Employee performance evaluation in virtual organization has been studied as an important factor in this research. Employees have to be engaged with their job, when they show a positive attitude toward their organization and express a commitment to remain with the organization which is otherwise called as Organizational Citizenship Behavior (OCB).

Not all the employees are engaged in an organization. Employees in virtual organization who feel disconnected emotionally from their coworkers and supervisor do not feel committed to their work, the managers can help employees refocus on the demands of their roles and on the skills, knowledge, and talents they bring to their jobs.

The manager who takes the proper time to have a dialogue about an employee's strengths which can lead employee commitment and keeps them engaged in the role. If employees are disengaged and unhappy at work. They might spread their discontentment to other employees and undermine the work of others. They are not just indifferent to company goals and mission but also express their mistrust to the organization.

Employees today are different, they are not the ones who don't have good opportunities. If they feel dissatisfied with the current employer or the job, they will change to the next job immediately. Then, the responsibility of the employer is to retain their best employees. A good employer should know how to attract and retain their employees.

Employers who always have positive feedback to the subordinates can help in boosting the morale of non-engaged employees. Because of poor performance evaluation of a manager in a virtual organization, it will lead employees' dissatisfaction. Widespread frustration and dissatisfaction with performance evaluation has challenged researchers and practitioners in virtual organization to evaluate the effectiveness of performance evaluation systems.

The success of a performance evaluation system in virtual organizations is recommended as part of the system implementation and management process. However, comprehensive research of the evaluation of performance evaluation system in a field setting is inefficient.

Employee reaction to evaluations is a class of neglected criteria that should be considered in the success of evaluation system which are usually indicators of the overall viability of a system. Using the above techniques, Demographic, procedural, behavioral, network and social attributes for performance evaluation are derived using Domain Driven Data Mining (D3M) approach by combining data intelligence, domain intelligence, human intelligence, social intelligence and network intelligence, which is otherwise called as Meta synthesis of ubiquitous intelligence.

## Objectives of the study

The researcher intends to bring in insights into the following:

• To study and explore Domain Driven Data Mining approach on HRM perspective for assessing employee performance evaluation behaviors from various literature surveys,

• To understand and clarify the positive and negative impacts of the existing 360° performance assessment method for a virtual organization like e-publishing industry, and the perception towards performance evaluation in the minds of workforce by conducting personal interview with employees in a virtual organization,

• To observe and examine the mobile, email communications of employees and people opinions in web blogs of a virtual organization and to combine the performance evaluation Key Performance Indicators (KPIs) using mobile social network mining, e-mail social network mining and opinion mining methods,

• To design and develop an automated, ICT based Domain Driven data Mining system with a conventional 360 degree performance assessment method implementation for assessing employee performance evaluation using 360 degree records, mobile CDR (Call Data Record) files, e-mail log files, and opinion blog files kept in a company server,

• To test the validity of the proposed D3M approach by developing a prototype to demonstrate the primary features, to investigate the results, and to derive findings by observing the results.

**Hypothesis**

The following objectives of the study were established as hypotheses based on the available performance evaluation:

1. The ten scales of performance evaluation will form five distinct intelligences which conform to Meta synthesis of ubiquitous intelligence of with data collected from the employees of selected virtual organization that utilize e-publishing services and a standardized D3M based performance evaluation system.

2. A positive relationship will exist between the scales measuring data intelligence as perceived by employees of selected virtual organizations that utilize e-publishing services as measured by the scales of 360 degree technical assessment records.

3. A positive relationship will exist between the scales measuring domain intelligence as perceived by the employees of selected virtual organizations that utilize e-publishing services as measured by the scales of 360 degree business assessment records.

4. A positive relationship will exist between the scales measuring human intelligence as perceived by the employees of selected virtual organizations that utilize e-publishing services as measured by the scales of e-mail social network mining graphs and results.

5. A positive relationship will exist between the scales measuring network intelligence as perceived by the employees of selected virtual organizations that utilize e-publishing services as measured by the scales of mobile social network mining graphs and results.

6. A positive relationship will exist between the scales measuring social intelligence as perceived by the employees of selected virtual organizations that utilize e-publishing services as measured by the scales of opinion mining results.

**Significance of the study**

This study investigated employee's performance evaluation system utilizing a Domain Driven Data Mining Approach using 360° Assessment, Mobile and Email Social Network Mining and opinion mining as the technical basis. The findings of the study indicated that respondents perceived the performance evaluation system was to be fair as indicated.

A Domain Driven Data Mining approach using Social Network Mining, Opinion Mining and 360° assessment based performance evaluation pertain to the strategic development of any organizational performance. Selecting the appropriate individuals for performance evaluation positions is paramount to organizational success.

All industries will be intensifying their efforts to attract new talents. This mobile and email workforce makes it even more challenging to retain the talented individuals in employee performance evaluation roles. However, the effort must be made in order to succeed in this consumer driven market. By combining social network mining, Opinion Mining procedures and effective 360° assessment based on employee performance development activities, and organization facilities can create a long-term process that will provide them with boundless performing talents.

**Scope and Limitation of the Study**

The researcher has focused three virtual organizations of Newgen Imaging Systems Pvt. Ltd. as the preferred location for undergoing the pilot study for the research, as there is dearth in terms of research or study on other industries. Delimitations of the research that this study would specifically exclude are investigation of any of the following:

• The mobile communication used in this research is homogeneous. For heterogeneous support, it requires a very costly set up using high-end technologies.

• In e-mail communication, content based mining is not made in this research, since it reduces the privacy of employees.

• The size of the adjacency matrix should not cross the limit of 150. If we need to conduct a study for more than 150 employees at the same time, it is not possible using UCINET.

• There are many reputable sources that have expressed doubts about the validity and reliability of the performance evaluation process.

• Effective reward systems are hard to establish when creating performance evaluation.

**Research Methodology**

The researcher used the Empirical methodology for the study. This type of research requires that data be collected. Thus, empirical research is grounded in reality. Data will be collected by observation or by experiment.

The purpose of empirical research is to explain the data collected through the development of a model or theory that hypothesizes about the relationship between the data and relevant variables of the environment.

The results of empirical research will be able to be replicated as adherence to this method implies the use of objective, reliable and valid research methodology and criteria. It is more of a fact finding study based on data.

In this research, an idiosyncratic Domain Driven Data Mining (D3M) approach using mobile, email social network mining, opinion mining and 360° performance evaluation method with Organizational Citizenship Behavior has been proposed.

A social network (Brass, 2003) is consisted of a group of people and their meaningful relationships, such as friend, co-working or information exchange, which is the machine of connecting the networks.

In this research Simellian ties (Kelley, 2007), role analysis, centrality measurement, structural analysis and clique analysis have been imposed to attain the performance results. Traditional data mining research focuses largely on algorithms for inferring association rules and other statistical correlation measures in a given data set.

The notion of finding communities differs from the fact that, the relationship exploited is co-citation, whereas in data mining it is performed based on the support and confidence. One of the earlier uses of link structure is found in the analysis of social networks, where network properties are used to analyze the collective properties of interacting agents.

**Sample Design**

Sampling method in this research is clustered which was used to collect the data from the employees of various branches in different virtual organizations of NewGen Imaging Systems Pvt. Ltd. for data collection. The size of employees in NewGen Imaging Systems Pvt. Ltd. is too large to be listed precisely using the adjacency matrix.

Another main reason is the employees in one cluster have very few mobile and email communication and opinions with other clusters. Hence the categories are restricted to each cluster separately with more number of employees, with more performance target for the feasibility of the research. Apart from narrowing down to make the research well focused, it was also planned in such a way that samples are obtained from all employees in different kinds of virtual organizations to get representation for all characteristic features of employee performance evaluation system in virtual organizations. This has been taken to have an in-depth study, attempting to cover any type of virtual organization having a corporate mobile and email network service for their employee's communication.

## Sample Size

The target group was employees of NewGen Imaging Systems Pvt. Ltd. main branches of India, UK and US. The data was questionnaire results of 360° performance evaluation, mobile CDR files, email logs, web blogs and that are collected for administrative levels of employees from the above three branches of the virtual organization in the target group available.

The pilot study was conducted over 352 employees in the three branches of NewGen Imaging Systems Pvt. Ltd. Due to limitations in the restrictions of some branches in providing permission to collect information for their privacy policy, some of the offices could not be cooperated due to the time constraint. Out of the 352, 15 were rejected, as these employees were resigned their job or taking long leave during the pilot study. As a result 337 were valid samples and hence taken for the research study.

## Tools of Data Collection

360° performance evaluation results, continuous behavioral data logged by mobile and email communications and opinion blogs are collected and used for this research. A 360° Assessment Questionnaire for Organizational Citizenship Behavior based performance evaluation, mobile CDR (Call Detail Record) files, email log files, opinion blogs are used as data collection for tracing mobile and email communications and opinions of employees in the organization.

Mobile and email communications and web blogs are well suited for context-aware computing. In this study, the CDR files are collected to retrieve the connection detail of subscribers in a mobile switching center (MSC).

CDR files (Knowledge@wharton, 2006) are made by any switching system to prepare the billing information about subscribers such as call duration, originating and terminating numbers, furthermore origin and destination physical coordination are recorded. These files are worth investigation which can be used to prepare the communication graphs between subscribers that can be termed in social network as actors.

By transforming the latter files to text files or Excel sheets and then changing them to a matrix, it can be easily linked to the graph theory's fundamentals. Such aspect of social network can be easily disclosed by simple software. Gathering such information can be achieved only by pre-prepared complex software which can change the CDR files to text format that is solely used by communication corporations.

E-mail logs are extracted to identify human intelligence of an employee using e-mail social network analysis.

Web blog files are extracted, tokenized, and indexed for identifying positive, negative or neutral comments for an employee performance from the customers as well as company people. A key requirement for human interaction in pervasive environment is capturing trace data from the real world (e.g. human connectivity and intermittency of connections between people) in order to construct realistic synthetic models.

The setup was made based on the review of related literature and the objectives of the study.

The pilot study had different dimensions for assessing performance evaluation attributes and each dimension had a no. of variables to get an in-depth measurement on the research study.

The pilot study was administered in the target place by getting permission from the high authorities. But it has been conducted for 6 months without giving prior notice to the employees so that the results are casual and true. The purpose of the study and the confidentiality of the data were assured.

## Literature Review

Employee performance evaluation, the historical background of performance evaluation concept, looking at the emergence of this concept in organizations. The main focus is the study of performance evaluation as a concept and various theories, frameworks and models of performance evaluation, the approaches or methods already available and the latest high end research.

The employee performance evaluation since 1960's to till date, the different trends and changes in the discipline of employee performance evaluation. The main focus is on the impacts of information technology among the working strata of the Indian population and the Psycho-Social changes due to that in the society.

As there is a dearth in research studies done on the "Impact of computer science, sociology and psychology in human resources management", the researcher has dealt with related literatures from other countries and the literatures have also been sourced through books, website, and conferences.

**Findings**

**Major Findings**

There were several findings in the current study that provide insight into the impact of social network mining in employee performance. There was no significant correlation between performance attitudinal dimensions and the social network dimensions.

These finding provide us with an opportunity to translate validated ICT based e-mail, mobile and web blog communication behaviors to effective identify employee performance.

The behavior may look different but it is classified under performance dimensions, proven to be core to employee performance efficacy. Regarding outcome differences between the two groups, based on mean, standard deviation, correlation, symmetric analysis, chi-square and t-test statistics, employees shown significantly higher levels of performance behaviors especially performance improvement using Domain Driven Data Mining (D3M) approach.

A single item measure with Demographic Variables such as gender, age, marital status, religion, nativity, language, education, experience, working region, size of the branch (no. of employees) and monthly turnover, was also investigated with key performance indicators (KPIs).

There was a significant difference with key performance indicators of data, domain, human, network, and social intelligence due to these demographic variables. Social network roles are classified depending upon how an employee impact behavior-criterion relationships with their employees.

Performance characteristics are classified as Star Performer, Expertise, Experienced, Specialist, and Generalist based upon the results of Domain Driven Data Mining approach using 360 degree assessment, e-mail social network mining, E-mail social network mining, mobile social network mining and opinion mining.

Researchers have used different means to identify social network roles in performance studies. ANOVA designs, median split samples with simple correlation coefficients and regression are the main methods found in the literature.

Research indicated that these approaches yield different information. To avoid overcoming the issues and made the attempt very perfectly, a machine learning classifier using support vector machine (SVM) was used to combine the results of data intelligence, domain intelligence, human intelligence, social intelligence and network intelligence in the form of ubiquitous intelligence. It is an advanced technique nowadays used for classification problems

in computer science. SVM feature vector help to identify situations where an increase in performance behavior is likely to yield an increase in employee performance.

Hypotheses 2 were supported however on network roles and performance characteristics and integration produced significant main effects when regressed on performance grade or style.

Maintaining a closely knit group and keeping the group working together as a team is increasingly difficult when the Demographic Variables are different. Hypothesis 3 is supported but did show main effects for Key Performance Indicators of data, domain, human, network and social intelligence and demographic variables, when regressed on performance grade. Attitudinal dimensions, domain attributes, e-mail network behaviors, mobile network behaviors blog opinions are critical in the virtual work environment in order to treat both remote and non-remote employees with respect and encourage teamwork. Tactical support was described as the company providing remote employees with the appropriate tools and technology to be successful at managing remotely.

More research is required for both of these scales in order to apply them to remote environments. Overall the best practices fell into 3 performance characteristics: Generalist, Experienced, and Specialist Grades. The analysis and interpretation of the data on e-mail social network mining, E-mail social network mining, mobile social network mining and Opinion Mining and opinion mining have provided the following major findings:

• While social networking does not always increase Employee performance, research shows that network participants perform better at their jobs than "isolates."

• In terms of employee dynamics, central network positions and links with people outside the work group are associated with power.

• For successful recruiting, widespread weak ties are more advantageous than strong ties; for promotions, men benefit most from weak ties and women from strong ties.

The analysis and interpretation of the data on statistical analysis tool have provided the following major findings:

• There is a positive correlation between Employee's social network dimensions and Employee's attitudinal dimensions and hence Employee's social network roles will be predictive to Employee performance characteristics.

• Employee's data intelligence will be correlated positively to employee's performance grade and thus the employee performance grade will be predictive to star performer style.

• Employee's domain intelligence will be correlated positively to employee's performance grade and thus the employee performance grade will be predictive to expertise performance style.

• Employee's human intelligence will be correlated positively with Employee's performance grade and thus the employee performance grade will be predictive to specialist performance style.

• Employee's network intelligence will be correlated positively with Employee's performance grade and thus the employee performance grade will be predictive to generalist performance style.

• Employee's social intelligence will be correlated positively with employee's performance grade and thus the employee performance grade will be predictive to experienced performance style.

The study of all the above dimensions will influence a functional dimension in identifying employee performance characteristics.

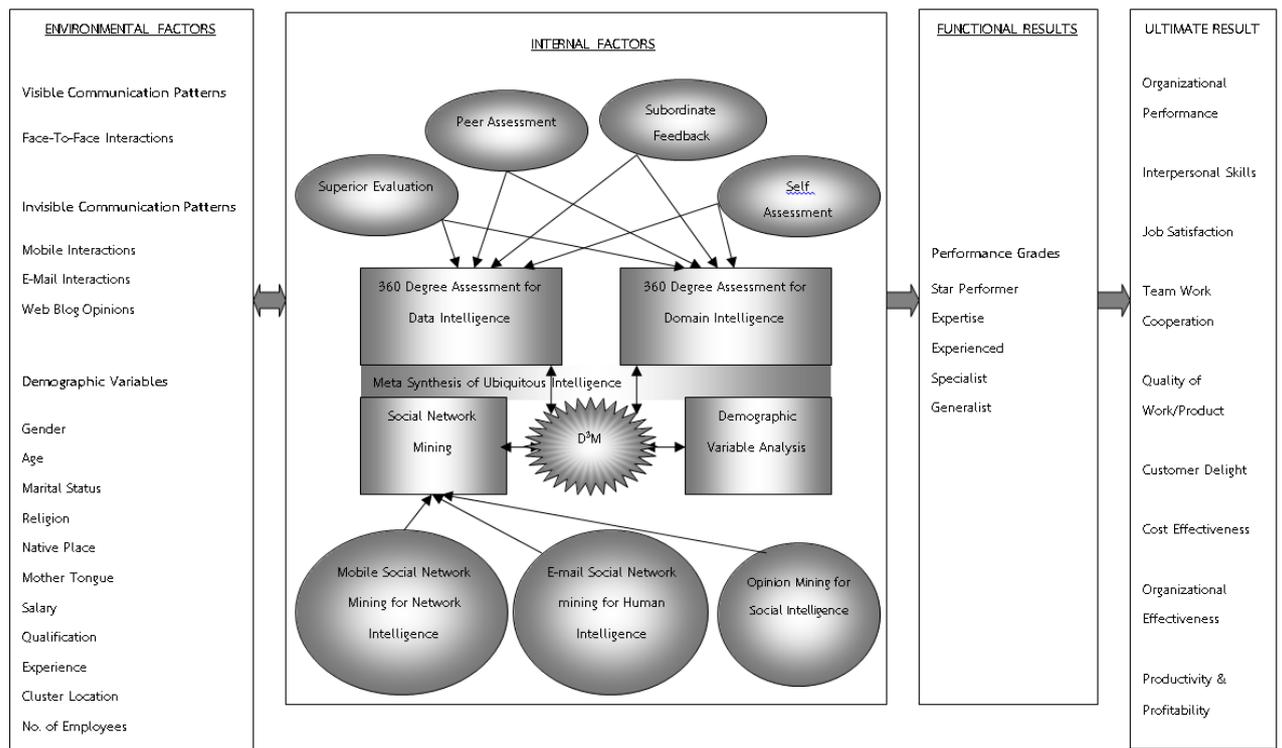**Exploration of the Research Study**

In order to understand the best performance practices using 360 degree assessment, E-mail, social network mining, mobile social network mining and opinion mining, an exploratory analysis of the results was conducted.

The overall sample and clustered samples were analyzed to provide data on agreement between employees of various working regions and clusters. The top ten improvement priorities in Employee performance for all the samples were admiration as a role model, managing stress and anger, influencing people by communication, performance towards goal, multi-tasking ability, change management, independent and strategic thinking, innovative ideas, willing to share ideas, and cheerful and very happy in the working place. An analysis was conducted on the employee sub-samples with mobile based social network mining.

A majority of the employees expressed that as they observed the following behaviors and may be considered as improvement priorities for the organization. The five behaviors observed least by employees during e-mail social network mining E-mail social network mining, mobile social network mining and Opinion Mining were: out degree centrality, Eigen vector centrality, responsiveness, week ties, structural equivalence, influence centrality, structural holes and opinions in the web blog being ahead of competing groups.

Quantitative research is needed to draw additional conclusions regarding relationships between these items. Employee's data was analyzed in virtual teams separately to determine what areas they believe are most important for the company to address in improving performance effectiveness. The topics employees believed were most important to address were: rewards and recognition, providing tools and technology to employees for ICT based SNM, communication/ acknowledgement to provide responsiveness, informal ways for employees to learn and develop best practices, employee's training and mentoring. All these problems can be concentrated for further research work to extract the cause and relationship among the above issues in detail for providing effective virtual performance.

## The Proposed D$^3$M Performance Evaluation Model



The new D3M performance evaluation model as shown is proposed as a standard model for implementing performance evaluation using 360 degree assessment Level-I for data intelligence, 360 degree assessment Level-II for domain intelligence, E-mail social network mining for human intelligence, mobile social network mining for network intelligence and Opinion Mining for social intelligence. The following are the major contributions of this research to the society:

• This is the first tool that applied advanced E-mail social network mining, mobile social network mining and Opinion Mining for assessing Employee performance grades such as star performer, expertise, experienced, specialist and generalist.

• It has been found that 360 degree feedback provides not only a valuable self-assessment tool, but a baseline for improved development of performance style.

• This D3M performance assessment tool has been widely accepted as a performance development tool by managers and employees of virtual organizations.

• It serves as a mirror and an opportunity through surveys to gather the perspectives of the people and provides tremendous personal benefit to employees and executives, as they see how they are perceived by others.

• The problems such as leniency, severity, partiality, halo, uniformity bias, overrate, underrate, superior bias, personal bias, blind spots, difference in ratings, less motivation, 'retaliatory' ratings, frustration, negative behavior, emotional reactions, conflicting feedback, educated guess, careless feedback, unknown remote employees, nil effect, questionnaire conflicts, guidance, and follow-ups are eliminated using social network mining and opinion mining for progressive checkup and verification.

• It provides a more accurate, reliable, precise, balanced, and credible information that creates self-awareness, assesses strengths and weakness, more rapid development and improvement in interpersonal communication, confidence, trust, empowerment, team spirit, group cooperation, performance style, enhanced effectiveness.

**Implications**

The study of 360 degree feedback with social network instrument support prior research and provide some implications for both best practices and future research. Support was given to the employee performance style and network roles.

In future, these scales need to be investigated further and refined to provide more information on the nature of these constructs. Once reliable valid measures are created, research can be extended to construct validity. Researchers should continue to examine performance behaviors in the context of D3M using 360 degree assessment for direct interaction and E-mail social network mining, mobile social network mining and opinion mining for indirect interactions.

Investigating the relationship between social network performance and Employee performance characteristics may prove fruitful in multiple settings. Researchers may also want

to explore impacts of support for E-mail social network mining, mobile social network mining and Opinion Mining such as mobile and various justice measures.

An organization's values and culture may conflict with domain driven data mining approach setting so researchers should study deeper for understanding how certain values that can drive results in Employee performance and how these values materialize.

The time lapse since companies transitioned to an ICT (mobile) based work environment might be a contributing factor to obtain certain outcomes. The target company was already trained and equipped at interpreting leader behavior at a distance.

Potentially, these new ways of communication could offer the possibility to measure relations in a dynamic way, with the possibility given from SNM to offer some description of how networks work and evolve. If a group communicates by computer mediated instruments, the analysis of role structures could permit the study of complex structures that define the group and have not been yet studied. To the core, there are no studies using Social Network Mining perspective to explore Internet or Computer Mediated Communication with the aim to study the Employee performance of an employee as described in previous chapters.

This is maybe due to the fact that these kinds of tools are significant only in the case of a multi-relational network. It has been found that role algebra could be a powerful tool to explore the difference and the structures of networks where actors use different communication instruments to relate to each other.

A relation would be constructed on the basis of the used instrument. As outlined in this research, possibilities also arise from a mutual exchange between SNM and ICT: new fields of applications imply the possibility for SNM to improve the empirical applications of the theoretical findings, with the aim to study different and more common kinds of networks.

New ways of exhibiting these behaviors may be necessary using ICT based technologies. Including key mobile based social network mining behaviors in 360 degree performance appraisal will help drive accountability in performing these behaviors and will promote employee self-awareness and productivity of the organization.

Selection of employees for this type of work environment using the findings in this study could be applied in the future. The Employee support for developing Employee performance is a starting point to understand how to adequately encourage and support Employee performance, minimize downtime, and heighten productivity.

The importance of Employee performance could be conveyed by having a consistent senior management message across the organization to avoid receiving conflicting

messages about the importance and ability to participate in mobile communications. Companies can use these findings to enrich HR services, Employee performance and drive improvement for targeted workgroups. An organized site on the internal web for access to tools, information, training, best practices, and success stories would be helpful. Mentoring may prove useful in up-skilling employees. Structural holes in the social network should be monitored carefully to ensure employees/employees are not at a disadvantage concerning promotions and new opportunities. Creating them may be desirable in situations, where employees are being transferred in and out of jobs in order to support leader influence, when employees are unable to consistently exert it.

**Limitations**

This research is designed for small networks and are not suitable for analyzing large networks. Effectively and efficiently analyzing large social networks is an emergent task which introduces new challenges. The most fundamental and critical challenges are long processing time, large computational resource requirement, and graph dynamism.

Based on theoretical performance analysis, the advantages of this approach for analyzing social networks based upon the mobile communication have been shown. This system was tested on the mobile communication graphs with various branches and employees with various performance characteristics.

Experimental results demonstrate that the system overcomes the issues of 360 degree performance evaluation and effectively improves Employee performance. By this experiment, it has been validated that SNM methodology in 360 degree performance evaluation approach has the ability to effectively and efficiently analyze Employee performance behaviors.

It is important to understand that the measures employed in the current study were self-report in nature. Because of this, social desirability is of concern. Ideally, observing the behavior transactions between employees would have been the most accurate method but was impossible due to the logistics involved.

It would have also been beneficial to look at individual relationships and within group dynamics. The content based mining in email interactions between employees was excluded from this study. On reflection, this measure would have been beneficial to include. The target company in the current study used mobile contacts constantly in both remote and collocated environments. It was quite common to have two people sitting in offices next to

each other calling by mobile or emailing back and forth instead of talking face to face. Due to this, mobile and email was considered a communication tool that would not vary in different environments.

If included, the research could have investigated communication patterns more accurately. Employee performance style reliability was low, causing interpretation issues for correlations among attitudinal dimensions and network dimensions. Level of analysis was also an area of concern.

Leader-subordinate relations have previously been explained in two ways. The first assumes that employees interact with all subordinates in a similar fashion, and variation in subordinate perception is due to measurement error, not differences in treatment. The second explanation states that employees have unique interactions with subordinates and do treat them differently at times, depending on the situation. The methodological approach to research is different depending on which explanation the researcher supports. Researchers supporting the similar treatment theory would employ group level analysis, averaging subordinate perceptions of the leader, whereas those supporting the latter approach would treat each perception individually using raw scores. Previous performance studies have not consistently shown, whether performance behaviors should be operationalized at the individual or group level.

Biases can be occurred in subordinate, when giving feedback to 360 degree performance evaluation questionnaires that the respondent is asked to recall leader behaviors over the previous year. Behavioral descriptions provided by subordinates may be biased by response tendencies, stereotypes, implicit theories, and attributions while leader self-reports are vulnerable to social desirability and implicit theories.

This research has found that subordinates provide more accurate descriptions of leader behavior than employees. It has been found that ratings of manger performance were correlated significantly with subordinate descriptions of behavior, but not with self-reported behavior from the employee. Level of analysis has also been questioned in performance research.

The way in which behaviors are described in the questionnaire may also drive the decision to analyze the data at a certain level. Behavior may be described as dyadic (toward the individual) or group-directed. Averaging group directed behavior descriptions may improve measurement accuracy, while doing the same for behavior that may differ across subordinates may reduce accuracy.

Examining whether the criteria were predicted better by behavior descriptions from subordinates than by leader self-reports is required. It has been found that independent ratings of performance effectiveness were predicted better by subordinate descriptions than by leader self-report. It was also found considerable convergence in results for different levels of analysis.

Subordinates' responses to performance are more closely related to their perceptions of leader behavior than to objective measures or measures of someone else's perceptions. Regarding the work environment in which the sample was obtained for E-mail social network mining, mobile social network mining and Opinion Mining, several factors may have impacted results. Perhaps top employees have a stronger relationship with their employee which in turn creates a more pleasant work environment leading to higher satisfaction. There could have been some bad feelings about how people were or were not selected to move environments. This may have influenced employee's responses about their employee. The business environment at the time of data collection was extremely volatile.

**Suggestions**

Future research may focus on how small changes in network connections can transform the flow of performance throughout the whole organization, where performance flow is understood to include influence patterns, reputation, and status. Because of the interconnected nature of performance influence, a connection between disparate actors within the organization can result in resources moving through new conduits, bypassing formal employees and local clusters.

In bringing a network perspective to carry on performance, it has been suggested to draw attention to the importance of social relations both by the vertical dyad linkage model or the leader-member exchange approach. The network approach, allows a more macro focus on the full repertoire of network relationships in performance research.

The network approach also incorporates actors within the network who may or may not be connected with the leader, but whose actions, in creating new ties, for example, can affect leader outcomes by changing the structures within which the leader operates.

The network approach brings its own distinctive set of mathematical tools and limitations. The network perspective in its emphasis on social relations, Embedded-ness, social capital, and social structure, both incorporates strands emphasized within previous performance research, and points in new directions.

Employee performance focuses on planned performance and improvement over time. Employee performance focuses on the year-end rating made by an employee that reports directly to him or her. The word performance can direct many characteristics of employees and the way they carry out their job. The ratings should focus on criteria that are job-related. The more typical criteria focus on activities, behavior, and personality traits. The unstated goal is to confirm that the individual is having a performance style or not. Researchers have studied how performance rating judgments are made and how those decisions can be improved. The ratings indicate the employee performed better (or worse) than expected.

Research has shown there can be serious problems of rating accuracy. Human judgments are sometimes biased, and the goal of researchers has been to reduce or control those biases. Studies have been done on the impact on rater bias of the purpose of the performance promotion, the relationship between the rater and the ratee, and the demographics of raters and ratees, as well as the impact of training, control systems, and other interventions. Self-ratings are now commonly included as additional input. This has led to the use of 360° or multi-rater approaches, in which additional raters provide input.

The other major thrust in performance evaluation research in practice has been the search for the perfect rating format. Arguments have raged in over rating versus ranking, the number of scale levels that should be used, negatively versus positively stated scales, and other psychometric esoterica.

There are three ways of measuring Employee performance. Generally applied measures are Productivity, Employee Effectiveness, and Employee Ranking. The three most popular sets of criteria for Employee performance are individual task outcomes, behaviors, and traits. Cause analysis is the process of determining the root cause of past, present or future performance gaps. It remains to be seen from which level analysis is carried out-whether it is the Employee level, the work or process level or the individual performer level. It may be made possible with the help of social network mining.

In the individual performance level, the analysis is carried out about the employees and how they are carrying out their work activities. A good leader is considered to be the cause for the organization's performance and crisis. The cause for performance and crisis can be analyzed if social network mining is setup and monitored. Six characteristics consistently appear in the management and communication literature as a measure of relationships—trust, understanding, credibility, satisfaction, cooperation, and agreement—and all of them are

applicable to crisis public relations. This research may be enhanced with crisis and performance monitoring. Organizations perform well because of intense training, open communication, fierce loyalty and dedication, and the ability of 'cogs' to make 'big wheel' decisions. Most organizations consist of people in separate categories: big wheels, cogs, and specialists like accountants or chemical engineers.

This study suggests that motivation to change Employee performance behavior following 360 degree feedback is related to personality. It has been found that individuals with high levels of core self-evaluations will be most motivated to change behavior when they receive discrepant feedback and those with low levels of core self-evaluations will be most motivated when others' ratings are most similar to their own.

The potential value of coaching to assist individuals to understand their potentially complex feedback and to increase motivation to set developmental goals. After conducting 360 degree assessment survey, follow-ups and guidance for improving performance behavior by a coach are very important in making a change in the performance behavior.

Based on this one year enhanced 360 degree feedback evaluation study with SNM, it is possible to make some suggestions for best practice to ensure that awareness from the enhanced 360 degree multi-rater feedback process is converted into improvement in Employee performance:

• Hold participant's superiors, peers and sub-ordinates accountable for meeting with their direct reports to discuss and finalize a professional development action plan with the employees.

• By analyzing the mobile communication based social networks once in every month by considering the activities targeted, the progressive check-ups and follow-ups can be made possible for that activity by a top-level employee.

• Utilize either an internal or external consultant to facilitate the interpretation of the enhanced 360 degree feedback report and minimize any negative reactions that might occur as a result of the feedback assessment and reassessment.

• Utilize an enhanced $360^{\circ}$ feedback with E-mail social network mining, mobile social network mining and Opinion Mining that allows for both quantitative and qualitative results.

• Some attempt is made to evaluate the reaction and impact of the enhanced 360 degree feedback intervention from multiple perspectives including ICT.

• The deviation in 360 degree behavior and social network mining behavior may be analyzed further to identify the impact of SNM on 360 degree assessment.

• The limitations of 360 degree performance evaluation may be completely resolved by mining ICT based social network communications as well as information processing among employees during work environment.

**Conclusion**

In summary, the social network perspective has traditionally avoided a focus on specific individuals, preferring to examine systematic patterns of interaction. Bringing performance research into the picture requires a new integration of network theory and methods to account for not just structural patterns, but also the focused activities of powerful individuals. Social Network Analysis (SNA) software allows for the empirical estimation of traditional SNA variables to capture information at the individual level, dyad level, or group level. These variables have substantive meaning, and have potential for use as either dependent or independent variables in analysis of mobile and email communication for identifying performance qualities.

Performance requires the management of social relationships. Starting with the cognitions of the leader concerning the patterns of relationships in the ego network, the social network, and the inter-Employee network, social ties are formed, initiatives are launched, and through these actions and interactions, the work of the leader is accomplished.

Performance research from a network perspective has the opportunity to progress a new understanding of the interplay between the psychology of individuals and the complexity of the networks through which actors exchange information, affect, and other resources. Performance research also has the opportunity to renew our understanding of how patterns of informal performance complement or detract from the work of formally appointed employees.

This research on designing a tool for identifying human relationship and performance behavior using social network analysis presents a first step towards addressing this problem. What it provides is a look at how one could design a tool to support email and mobile, that social information brings salient employee relationships. Team members' relations are important to the Employee's performance. Stronger relational links are associated with higher task performance and the effectiveness of information exchange. So this research has aimed at fulfilling such objectives as developing an online social network analysis and discovering interaction patterns of teams for Employee performance in concerns.

The social network evolution trend thus enables the employees and participants to maintain track of the team development status. The display of the whole network illustrates a global view of the activity and relationship among team members. After implementing the system, most people were satisfied with the system in four evaluation criteria. Employees and assistants have higher satisfaction than general team members.

It implies that the system conforms to the cognition of employees and assistants, since employees and assistants interact frequently with team members in leading the team. Moreover, this work has unveiled future design possibilities for email and mobile applications that utilize social accounting meta-data. While it has been informally observed which metrics generate interesting and useful indicators for employee performance.

## References

Kelley  D  Watson. (2007). "Remote  Management: Traditional  Leadership  Behaviors  in  a
 Comtemporary  Work  Environment".  Ph.D. Dissertation, Kansas  State  University,
 Manhattan, Kansas.

Howard  Risher,  Charles  H. Fay. (2007). "Managing  for  Better  Performance: Enhancing  Federal
 Performance  Management  Practics". Human  Capital  Management  Series, IBM Centre
 for  the  Business  of  Government,  International  Telecommunication  Union.,
 http://www.itu.int.

Law,  S.K.,  Wong,  C.,  Chen,  X.Z. (2005). The  Construct  of  Organizational  Citizenship  Behavior:
 Should  We  Analyzed  after  We  Have  Conceptualized?  IN.D.L. Turnipseed  (Ed.),
 Handbook of organizational citizenship behavior. New York: Nova Science Publishers.
 (Page. 47-65)

K. Khazaei, A. Khalkhali and N. Eslami. (2011) "Relationship Between Organizational Citizenship
 Behavior  and  Performance  of  School  Teachers  in  West  of  Mazandaran  Province".
 IDOSI Publications. World Applied Sciences Journal 13(2): 324-330

Kenneth  M. Nowack. (2005). "Longitudinal  Evaluation  of  a  360  Feedback  Program: Implications
 for  Best  Practices", Proceedings  of  20th  Annual  Conference  of  the  Society  for
 Industrial and Organizational Psychology, Los Angeles.

Tanya  Verniece  Dugat  Wickliff. (2005). "An empirical study of the relations between leadership,
 social  support  networks,  task  autonomy  and  emotions  in  a  technical  work
 environment", 'Dissertation  for  degree  of  doctor  of  philosophy, Texas  AandM
 Universit.

Brass,  Daniel. (2003). "A  Social  Network  Perspective  on  Human  Resources  Management",
 In Rob Cross, Andrew Parker, and Lisa Sasson (eds), Networks in the Knowledge
 Economy, Oxford University Press, New York, Page. 283-323

Tracy  Cox. (2003). "Creating  Business  Value  Through  Social  Network  Analysis",
 TrainingOutsourcing.com-TI-Biz  Webinar,  Raytheon  Professional  Services"
 Performance Consulting Group.

Van Velsor, E., Brittain Leslie, J., and Fleenor, J. W. (1997). "Choosing 360, a guide to evaluating
 multi-rater feedback instruments for management development".

Knowledge@Wharton (2006), "Connecting  the  Corporate  Dots: Social  Networks  Reveal  How
 Employees  and  Companies  Operate", PARS  International,  Page. 212,  221-9595x407,
 http:// knowledge. wharton. upenn. edu.