Resilience in Enterprise Social Networks

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Abstract: The goal of human resource management is to ensure an effective company environment. Crucial for a good corporate culture is a comfortable atmosphere and positive social relationships between the employees. The interactions of the people and groups working in the company define their relationships and are reflected in the company's social network. Projections of such networks are Enterprise Social Networks which are more and more integrated in companies. These social networks can be a powerful tool to analyse the structure of a company and indicate potential problems. This extended abstract poses research questions to identify and quantify mechanisms that have an impact on the social network of a company to ensure resilience. To address these questions we make assumptions based on real-world observations for a subsequent model.

1 Introduction

Business and social processes are causally connected. Human resource management (HRM) treats the business value of the strategic management of the workforce. The goal of HRM is to ensure an effective company environment, by enabling high productivity due to satisfied employees, creative development, low operational expense and staff cost, short personal failure and high flexibility due to changes in the market. Furthermore HRM tries to identify and support talents to create reliable long term resources.

Crucial for a good corporate culture is a comfortable atmosphere and positive social relationships between the employees. The relationships in a company depend on how people and groups interact with each other. These interactions are reflected in the company's social network. Projections of such networks are Enterprise Social Networks (ESNs) which are more and more integrated in companies. A person is a node in the ESN graph. A link indicates interaction between two nodes. An ESN can have different purposes. First it can serve as an easy accessible knowledge base, second it can help employees to collaborate by offering features that let you exchange documents or schedule events. But social networks are also a powerful tool to analyse the structure of a company. Previous work in sociology and social psychology studied cascading processes in institutions and social networks [Gra78, CR97]. Software projects have been studied and the impact of node failures [SZSS+12]. However, there are still open questions regarding the structure of real

companies and the mechanisms that provide a robust structure of the ESN.

Here, we address the social resilience of an ESN, defined as its ability to withstand external stresses and disturbances as a result of environmental changes [Adg00]. These disturbances can be of many kinds, such as failures of important nodes or changes in work methodology, leading to systemic threats that can only be identified when analysing the network and its dynamics as a whole.

2 Questions Addressed by Social Network Analysis

In this talk, we will show whether social network analysis may be beneficial to identify problems in the enterprise in advance and to react accordingly. Further on, we identify and quantify mechanisms that have an impact on the social network of the company to ensure resilience, effectiveness and job satisfaction. We address the following questions:

1. Model enterprise social networks for problem identification: First, we need to define and model the social network structure of enterprises to identify the problems in such networks. A company may be organized in many different ways. The structure and size of the company, but also the social abilities of the individuals forming the company determine its social network structure. The question is which social network structures are beneficial for a company. In every company there are persons which are more or less important for the connectedness of the organization. Central nodes are important to connect persons from different departments and to spread information. If such an important person leaves the company, is ill for several weeks or is moved to a different department, it can have bad consequences for the company. How to identify these important nodes in the network? Which existing network metrics are relevant to find important nodes? To what extent are such important nodes also bottlenecks that slow down the progress of connected communities? Will the absence of the central node result in further separation of nodes?

2. Assessment of enterprise social networks: Second, we need to quantify the value of different network structures. Therefore metrics to quantify the value of the network are necessary. If an enterprise has capacities to employ new workforces, the question is how new nodes are integrated, i.e. to which persons they are linked in the network? It might be more cost-effective to integrate three cheaper persons instead of a single very good person. Facilities like staff rooms support the dialogue of department members which are not directly working together. Creativity often arises when people of different disciplines get together. The question is how such facilities like staff rooms enable serendipity in a company? Crucial for an effective enterprise social network is also the mixture of personalities. A company does not only need workers that are very targeted and finish one task after another. A company also needs workers that spend time socialising, finding new contacts and connecting people. Such workers are essential for an efficient social network. Which mixture of personalities is best for the company?

3. Evaluation of mechanisms and human resource actions: Third, we investigate mechanisms that might have a beneficial impact on the company's social network structure. Therefore we need to understand if the social network can be influenced. If personal interests and preferences of the employees are dominant and cannot be influenced, the network

structure is fixed. If the latter is not the case we need to determine the influence of different mechanisms. Team building activities and social events bring people together and might add random links to the network. New employees can be considered as nodes that could be placed appropriately to improve the value of the network. Instead of just processing the plenty of requests, central nodes could forward requests to different communities. Such load is taken of the central nodes and collaboration is enabled between the communities by direct links. Hence the question is, if delegating responsibilities helps to relax busy persons and to connect clusters of the company?

4. Limitations of the model and ethical issues: Finally ethical issues have to be considered. Can a person be judged by the structure of his/her social network projection? Some relevant users may not use ESNs, but different communication or collaboration channels that are not reflected. For example, someone who prefers face-to-face communication might not be captured in the social graph. Are people not taking part in social network actions discriminated?

3 Research Methodology and Modelling Assumptions

Due to business regulations and privacy concerns it is hard to get data of real enterprise social networks. Therefore, we develop a model to answer the above questions. We build the model based on real-world observations. In real-world, we find several limitations on the capacities of workers in an enterprise. First, there is a limited number of active contacts, a person can have. According to Dunbar [Dun98] the cognitive capabilities of a human allow only up to 150 active contacts. Second, the amount of work a person can do on a daily basis has limits. Changes in the network can result in further degradations or enhancements. For example, a worker leaving the company can result in a cascade with other workers leaving, because it has been an important contact. They might follow the important person or lack fun and social aspects. The social sharing of emotions in a network [CR97] is of special importance, as emotional communication can lead to cascades of dissatisfaction that threaten the ESN. This kind of collective behaviour can be modelled by threshold models [Gra78], simulating how the collective state of an organization influences the individual decisions of leaving it.

Based on the real-world observations, we make the following model assumptions. A person is a node in the ESN graph. A link indicates interaction between two nodes. The degree of interaction / value of that link for the company is given by a link weight. A person has a limited capacity for both interaction and own work. The quality of a worker determines the capacity of the worker. High quality workers have higher cost. There exist different types of workers. Workers that use their capacity to interact with people to connect different communities and propagate information throughout the social network. We refer to these workers as mediators. The other extreme are workers that are more isolated and use their capacity to finish tasks and such contribute to the company's workforce. We refer to these workers as autonomous workers. Every worker in a company has characteristics of both types with different emphasis. The benefit a person produces for a company depends on both, interaction and own work. We believe that a good balance of media-

tors and autonomous workers leads to a high value ESN. In order to quantify resilience or the performance of networks, we need to define a value of the network. The value of the network can be related to interactions, i.e. it increases with the collaboration potential in the company. It can also be related to the storage of knowledge, which is based on the quality of workers. The value of the ESN can then be defined as a function of the network graph. This function can be calculated by the output of the network, or on its topological structure and its relation to resilience. As an example of the former, the number of open bug reports has been used [SZSS+12] to evaluate the value of open source software development communities. A recent work on social network sites quantifies resilience based on a rational model of user departures, computing the k-core decomposition of the social network [GMS13]. Mean or maximum k-coreness are candidates for computing the value of an ESN from a topological perspective. As long as it has not been proven wrong, we assume that business methods have an impact on the network structure. For example, random links can be added to the network by team building activities. By adding links, the capacities of nodes have to be considered that means existing links lose weight accordingly. Merging two discussion forums in the ESN might merge the two social groups. By forwarding tasks to employers and connecting people by referring to them, new links are generated. These links add redundancy and take loads off the affected existing links. We assume a dynamic network with changing capacities and link weights over time.

Based on the model we address the above research questions using various methods. We analyse existing data sets, i.e. real-world measurements from open source platforms, which reflect large companies with a natural hierarchy. We have access to e-mail threads in departments, reflecting smaller companies. We analyse interesting network topology snapshots indicating potential problems. To obtain network topologies we generate synthetic networks, simulate dynamic network evolution or take real-world networks. We quantify "resilience" and "value of network" by network metrics from communication networks as well as online social network metrics.

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