

# Supplemental Material: Functional and Social Team Dynamics in Industrial Settings

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## S1 Data

In Figure S1 we present the complementary cumulative distribution of companies according to their life-span measured in months. We define life-span as the time interval between a company's first and last log records in the management-software platform. The figure shows that about 70% of companies are active over one year.

## S2 Networks

### S2.1 Functional

In Figure S2 we show visualizations of functional communication networks from all enterprises. Nodes are users colored by their role (red is executive, dark blue is manager, orange is supervisor, light blue is operator), and directed edges are work-orders. We used the Fruchterman-Reingold force-directed algorithm to position nodes.

In Figure S3 we show adjacency matrices of functional communication networks from all enterprises. Color intensity indicates the log value of the weighted number of edges. Horizontal and vertical lines divide matrices into labeled, role-specific sections. Diagonal squares are areas of intra-role communication and others are areas of inter-role communication.

### S2.2 Social

In Figure S4 we show visualization of social communications networks from all enterprises. Distinct networks represent different enterprises. Nodes are users colored by their role (red is executive, dark blue is manager, orange is supervisor, light blue is operator). Directed edges are messages.

In Figure S5 we show adjacency matrices of functional communication networks from all enterprises. Color intensity indicates the log value of the weighted number of edges. Horizontal and vertical lines divide matrices into labeled, role-specific sections. Diagonal squares are areas of intra-role communication and others are areas of inter-role communication.

### **S3 Aggregate Behavior**

Figure S6 shows the distribution of enterprises' aggregate median score over the whole observation period. The distribution is bimodal, with a peak just below zero and another, more prominent peak between zero and one. In Table S1 we show the correlations of the average behavior over the last year of activity. Negative correlation indicates an improvement of efficacy and a positive correlation shows a deterioration.

### **S4 PCA**

We applied Principal Component Analysis (PCA) of enterprises based on functional and social network features including score. The PCA begins by constructing a matrix where rows are enterprises and columns represent the monthly network features. Components are ordered by the amount of explained variance. This analysis enables the observation of the manifold in a reduced set of dimensions. Figure S7 shows the first versus second component colored by each original feature. The colors indicate each of the features after normalizing by subtracting the mean and dividing by the standard deviation (from blue to red).

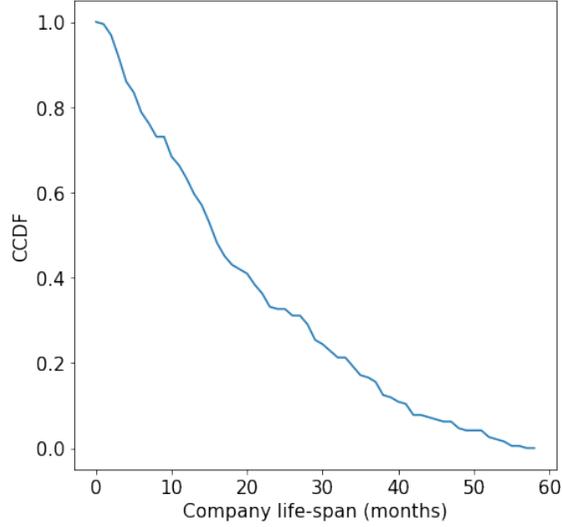


Figure S1: Complementary cumulative distribution (CCDF) of companies' life-span measured in months.

	Network	
	Functional	Social
No. of Users	0.29	-
No. of Communications	0.31	-
Average Clustering	-	-
Degree Assortativity	-	-
Job title Assortativity	0.29	-
Gini Coefficient	0.24	-
Density	-	-0.26

Table S1: Correlation coefficients of functional and social communication average network features with efficacy average score. Positive coefficients indicate that the feature correlates with a worse score. Negative coefficients indicate that the feature correlates with a better score. Number of users and communications are in logarithmic scale. Correlations coefficients are significant ( $p < 0.05$ ). Not significant coefficients are not shown in table.

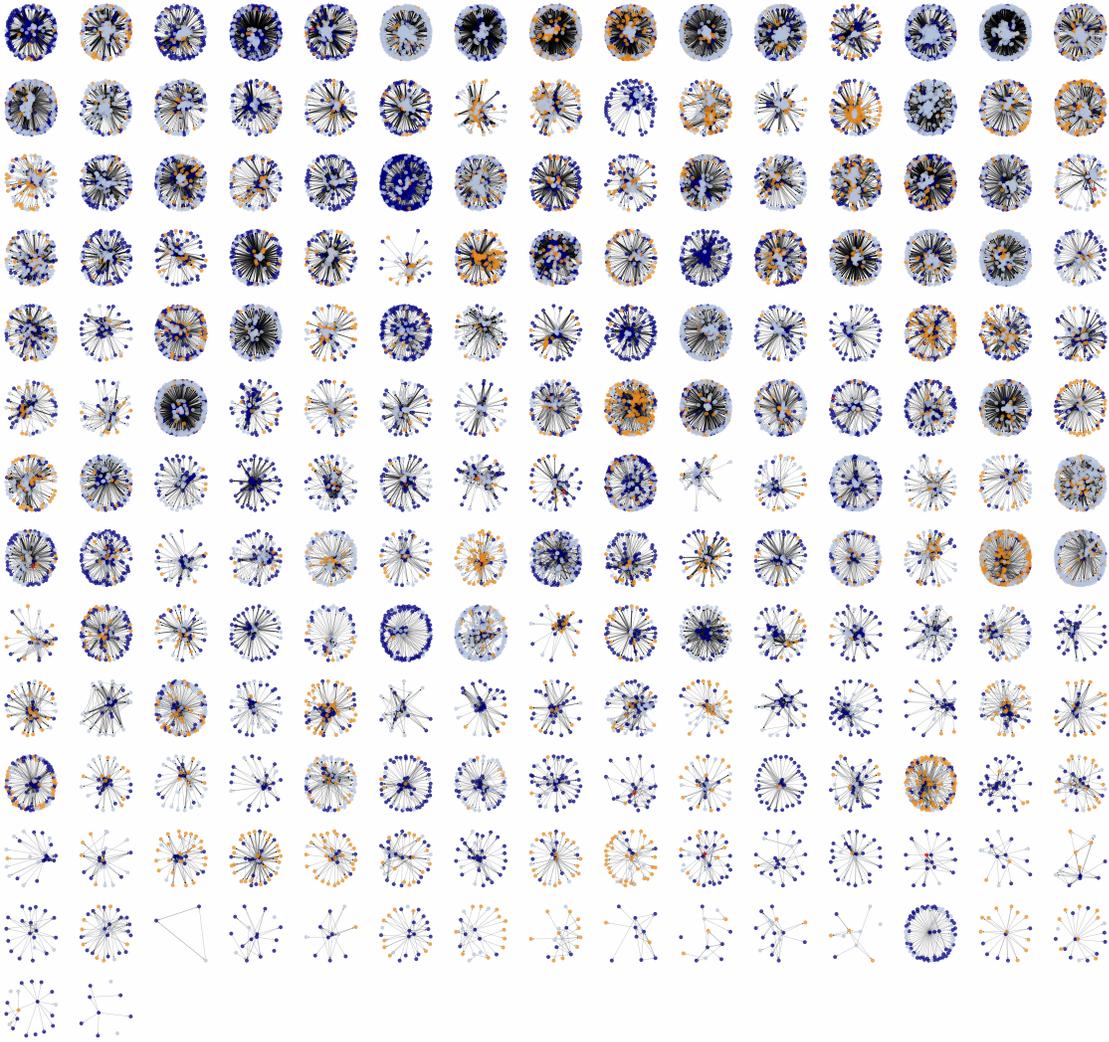


Figure S2: Visualization of functional communication networks from all enterprises. Distinct networks represent different enterprises. Nodes are users colored by their role (red is executive, dark blue is manager, orange is supervisor, light blue is operator). Edges represent work-orders and are directed from the source to the target.

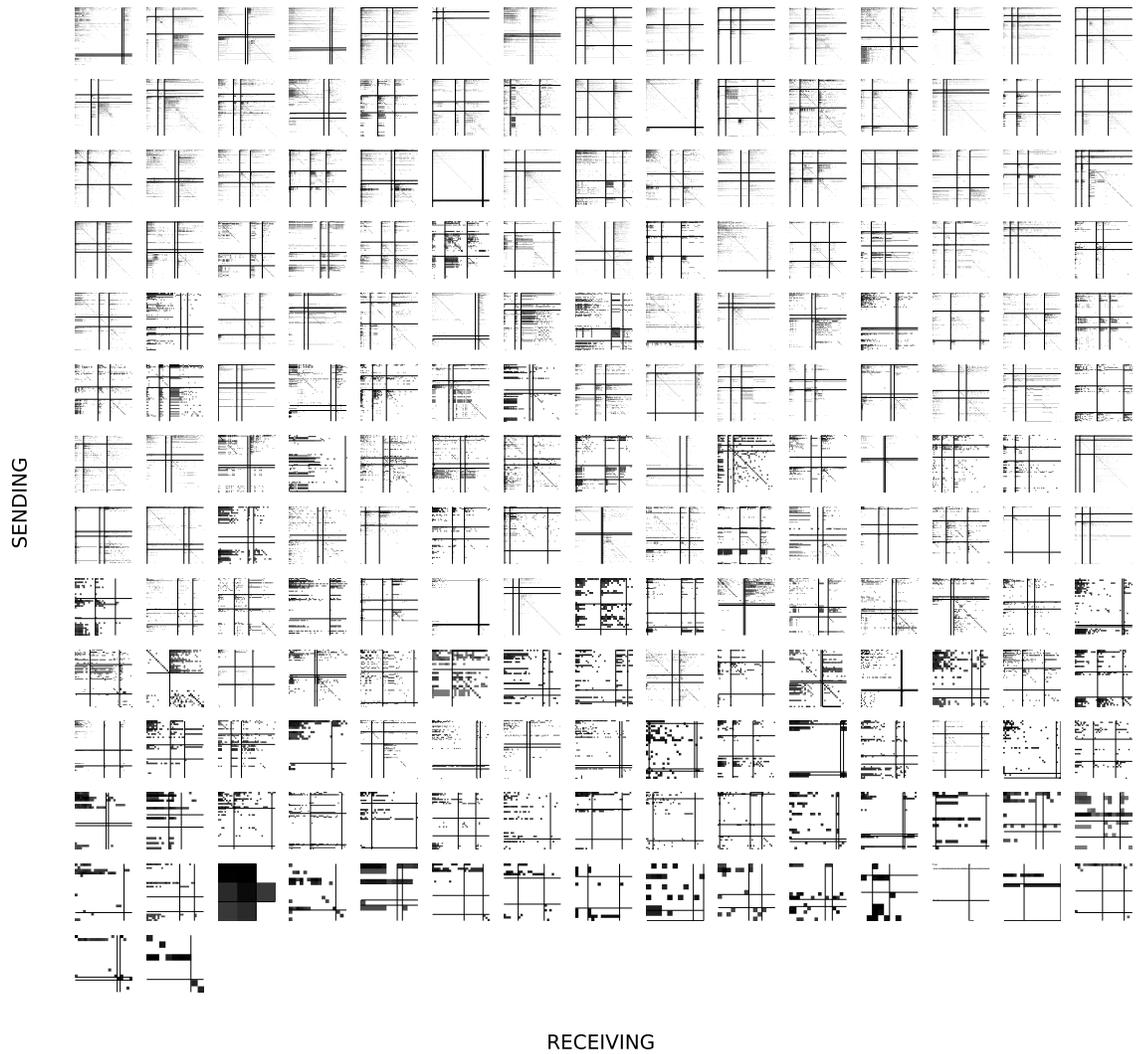


Figure S3: Adjacency matrices of functional communication networks from all enterprises. Color intensity indicates the log value of the weighted number of edges. Horizontal and vertical lines divide matrices into labeled, role-specific sections. Diagonal squares are areas of intra-role communication and others are areas of inter-role communication.

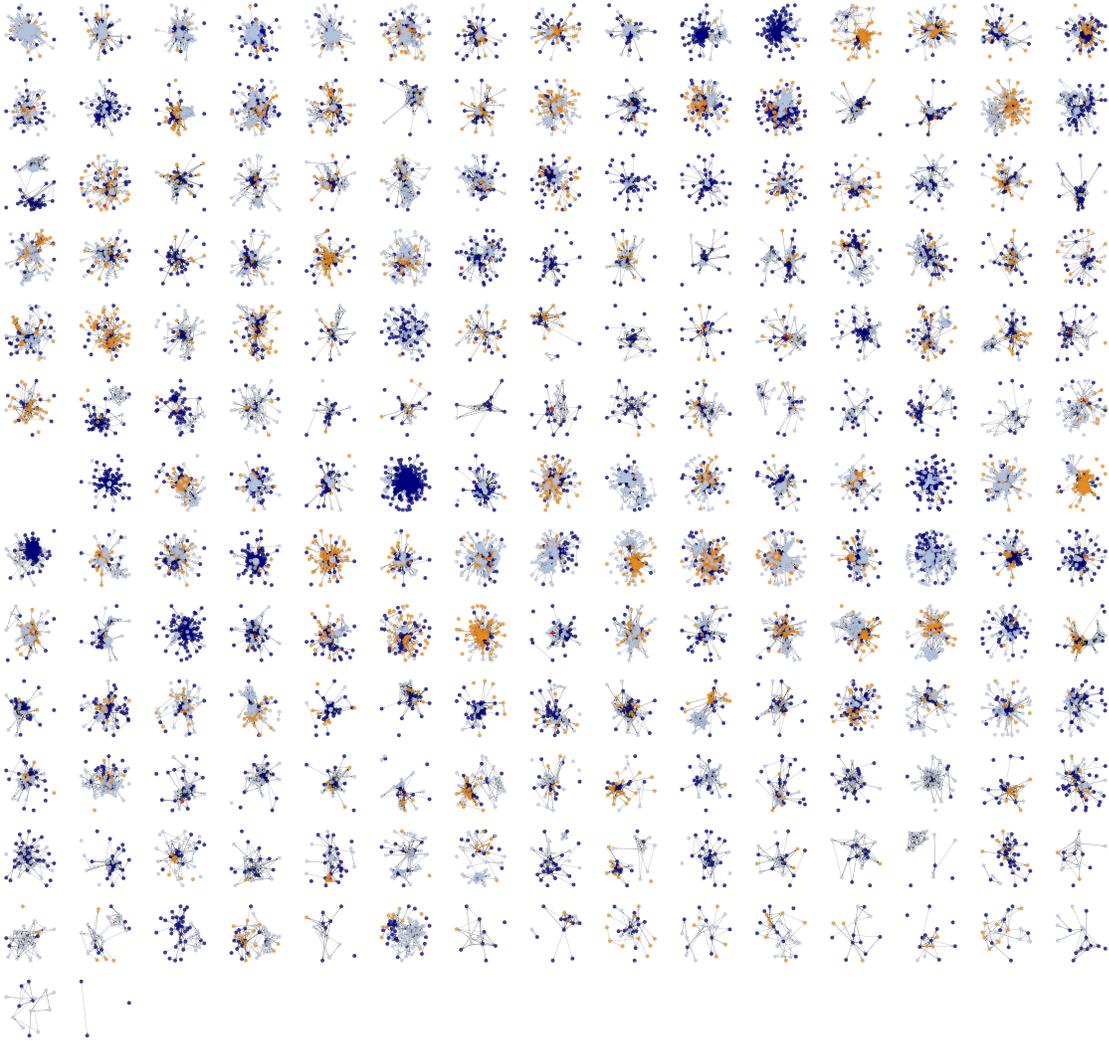


Figure S4: Visualization of social communications networks from all enterprises. Distinct networks represent different enterprises. Nodes are users colored by their role (red is executive, dark blue is manager, orange is supervisor, light blue is operator). Edges are directed and represent messages from online chats.

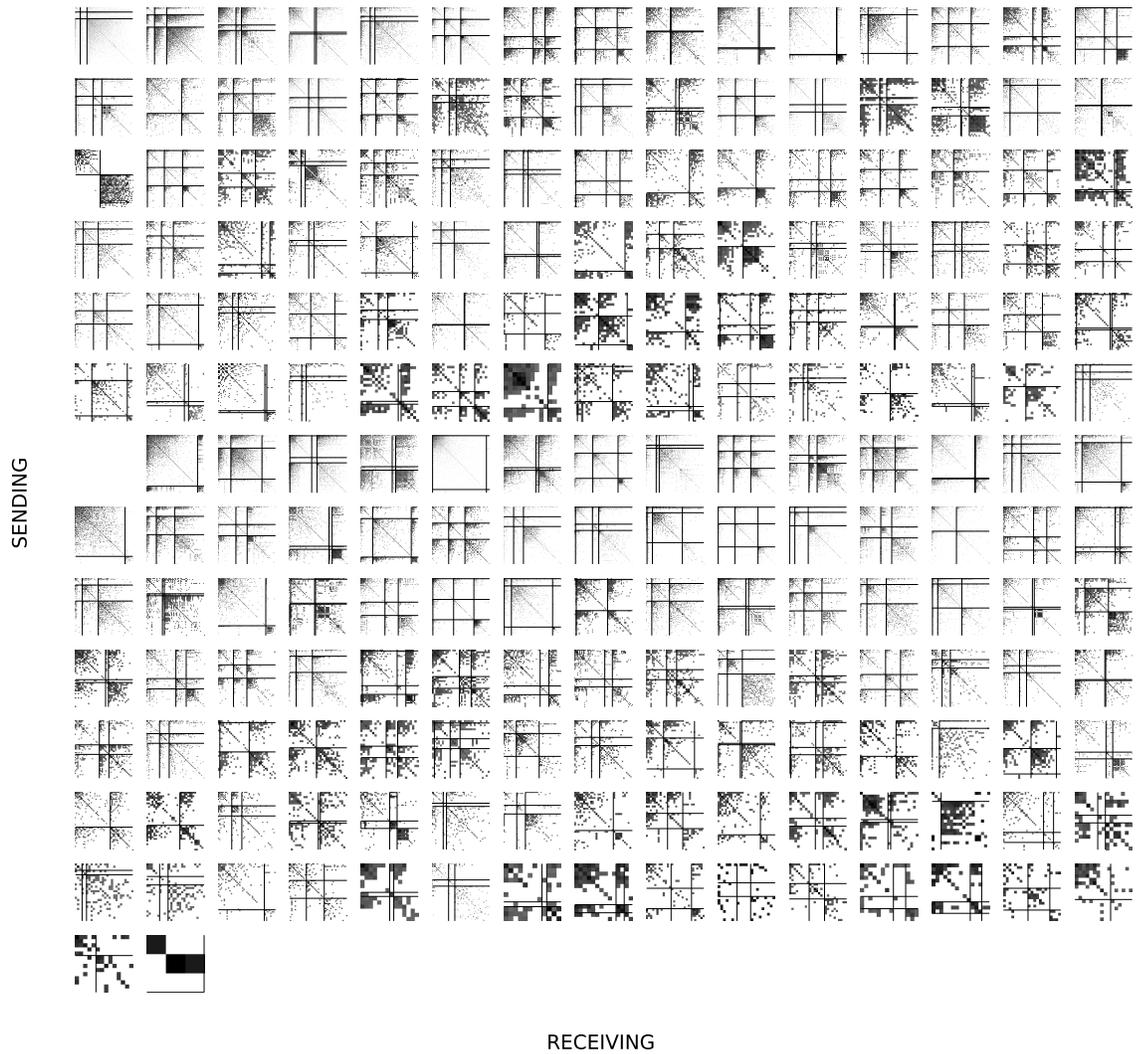


Figure S5: Adjacency matrices of social communication networks from all enterprises. Color intensity indicates the log value of the weighted number of edges. Horizontal and vertical lines divide matrices into labeled, role-specific sections. Diagonal squares are areas of intra-role communication and others are areas of inter-role communication.

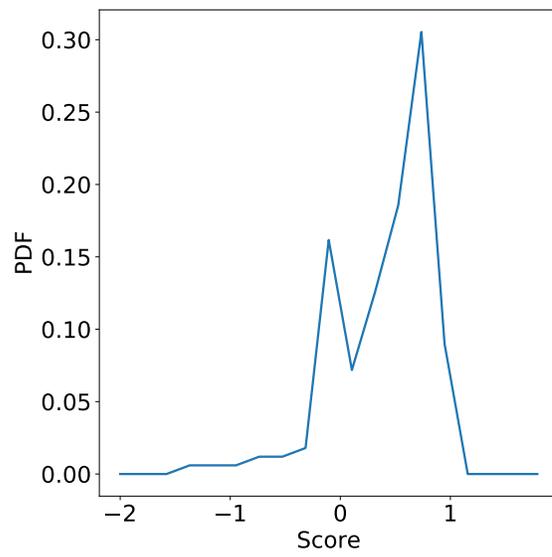


Figure S6: Distribution of the efficacy score for all enterprises. Lower scores indicate better efficacy.

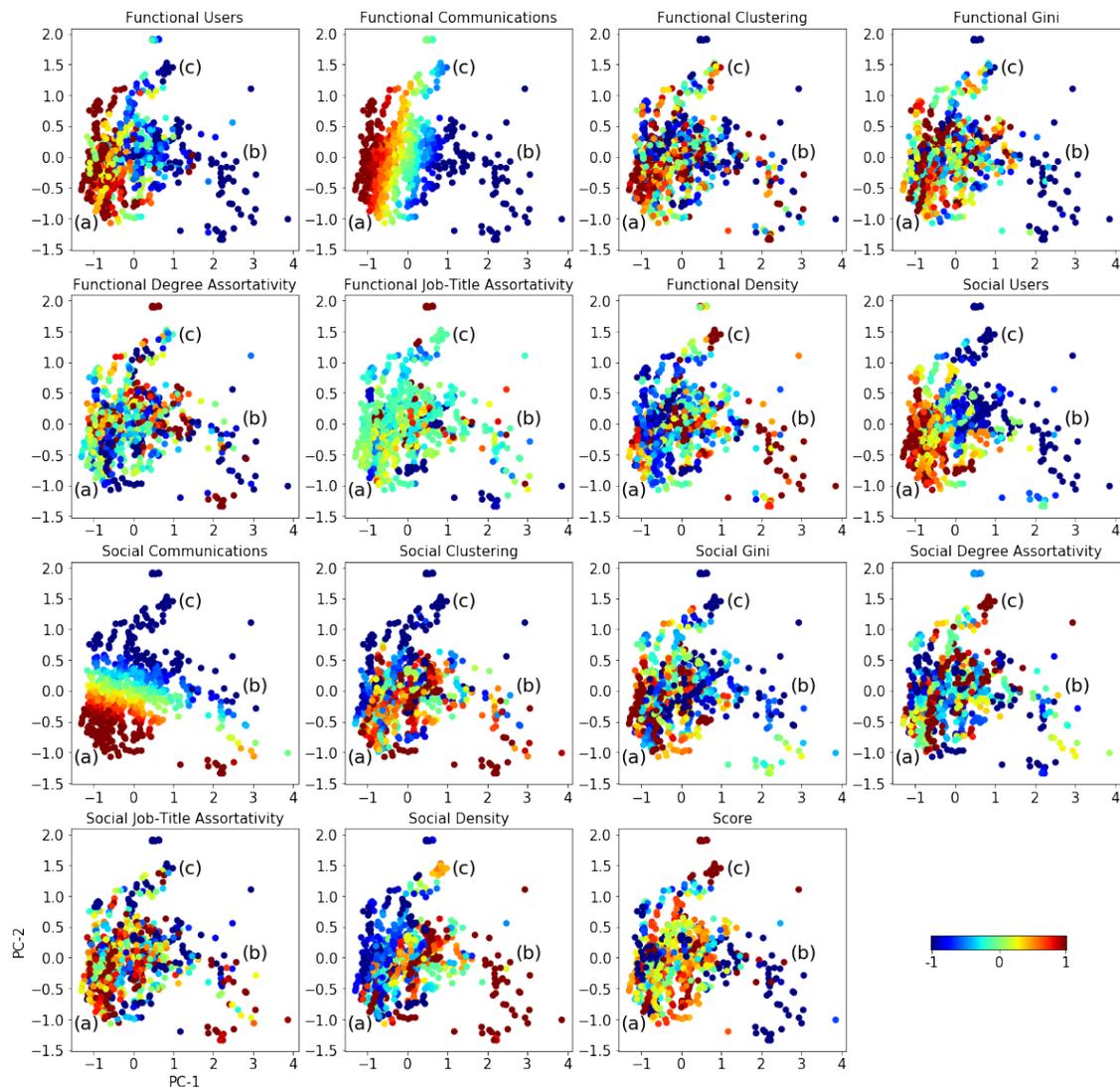


Figure S7: Principal Component Analysis (PCA) of enterprises based on functional and social communication monthly network features including the corresponding efficacy score. Dots represent individual companies at particular months. Their location in the scatter plots show the dot product of the company's feature vector and the corresponding component (PC-1 in the x-axis and PC-2 in the y-axis). Panels are colored by different features (see titles). Features have been normalized by subtracting the average and dividing by the standard deviation (scale on figure). Regions (a), (b) and (c) indicate the location of big, effective and ineffective companies respectively. Number of functional and social communications are in logarithmic scale.