Dynamic Inter-Organizational Communication Network in a Post-Merger Integration

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***Abstract*—During a Post-Merger Integration, the communication structure of an organization changes profoundly.**

Effective communication and personal interaction are crucial for the success of Mergers and Acquisitions, as many such endeavours fail to achieve their targets. Mergers and Acquisitions involve the combination of two organizations to create a new entity. Creating personal networks across organizational boundaries can build bridges between several organization entities to create a cohesive, adjustable and resilient holistic organization and leverage synergies.

However, little actual network data on communication and network structure during Post-Merger Integration is available. Our results are based on two merged organizational units with approximately 3,800 employees in total and a collective sum of around 250,000 email connections from an actual Post-Merger Integration data set.

We show that various communication networks stabilize over time in Post-Merger Integration and, that homophily is partially reflected in the informal social network. We also find that homophily occurs on a department level but somewhat less on an organizational level and that some critical departments communicate less than expected.

Our results indicate that the formal merger is reflected in the communication and ego-network structure. We expect that our findings will add insights into Post-Merger Integration research and how networks are adapting, since the findings are based on actual organizational network data.

***Index Terms*—Dynamic Networks, Network Stabilization, Communication, Homophily, Mergers & Acquisitions, Post-Merger Integration**

I. Introduction

Mergers and acquisitions (M&As) have been a crucial part of strategic organizational decisions and business expansion since the late 1800s and can be seen as the consolidation of organizations [1] [2] [3]. Companies often use M&As to strengthen their market position, enter new markets and regions, benefit from economies of scale, achieve synergies and expand their product portfolio [4] [5] [6] [7] [8]. Despite the fact that nearly half of all M&As fail to achieve their desired goals, it is still a prevalent strategic choice for decision-makers because the potential rewards can outweigh the risks involved, when successful conducted [4] [9] [10] [11].

Organizational structures have a significant impact on the performance of the merged organizations [10] [12]. Previous studies propose that the lack of cultural, structural and communicational integration, lowers financial and operational performance and leads to various organizational dysfunctions, such as employee turnover, interpersonal conflicts, organizational communication ineffectiveness, as well as collaborative and hierarchical misfits [4] [9] [13] [14]. Therefore, a solid integration of merged organizations is one of the critical success factors, also seen as the paramount phase to successfully conduct a merger or acquisition [15].

Because so many M&As fail to fulfil planned objectives, research has shifted to the human side of M&A to understand the sociological, psychological, and behavioural aspects of M&As and the effects of the post-merger integration on employees [10]. Quantifying and analyzing human relationships through organizational network analysis provides a profound understanding of human interactions, social networks and communication patterns based on the relations they form [16]. Human relationships in organizational structures can be represented as a network where individuals are connected by interactive relationships, exchanging and communicate information throughout the organization [17].

We investigated the changes in the dynamic inter- and intra-organizational communication structures in a post-merger integration scenario. This is done through the help of data obtained from an actual merger of two large organizations in the sector of advanced technology solutions. Our research aims to answer the following questions:

1. Does the communication social network of a post-merger integration become more stable (cohesive) over time? We explore how the initial network communication stabilizes across various organizational departments and across organizational boundaries over time. We propose an approach to evaluate the relative phase rise difference of initial communication.

2. Are individuals more inclined to engage and communicate predominantly with others from the same organizational department, regardless of the legacy organization? We analyze indications of homophily and E/I-Indices between departments, and their presence across organizational boundaries. Additionally, we investigate which departments are expected to be among the first and most important ones to form communication inter-company bonds.

This paper is organized as follows. Section II provides an overview of related work, while Section III introduces our dataset and gives a formulation for data modelling. We address network stabilization in Section IV, and cross organizational interaction in Section V.

II. Related Research

A. Mergers and Acquisitions

Mergers and Acquisitions have been extensively studied during the last decades [1] [2] [7]. A merger is a combination of two organizations to form a new entity, while an acquisition is when one company purchases another through stock or asset acquisition. [5]. Many researches have investigated aspects of social network aspects and M&As within an organizational context. Woehler et al. 2021 [2] examined the changes organizations and individuals, processes, and structures undergo in a merger indicating that increasing cross-legacy social connections among employees can reduce turnover after a merger. Öberg et al. (2007) [18] investigate how mergers and acquisitions reshape business networks, emphasizing shifts in managerial cognition and networking behaviours in post-transactions. Additionally, Seo et al. (2005) [10] evaluate several theories to explain challenges in organizational change of managing mergers and acquisitions, creating a framework that identifies sources of problems, their effects on employees such as stress, illness, turnover, layoffs, and loss of know-how and competencies.

B. Post-Merger Integration

The Post-Merger Integration (PMI) is the most critical phase in a M&A process to ensure a successful venture, covering all relevant cultural, communicational, organizational and procedural aspects [19] [4] [3]. Graebner et al. (2017) [3] examine previous research on the integration phase after a merger. They suggest focusing on the understanding of the processual dynamics, particularly in the areas of temporality, decision-making, practices, and tools within the PMI. Fabac (2011) [8] promotes employing social network analysis to understand network development and proposes PMI leveraging mixing communication patterns to enhance integration success, underscoring the importance of the organizational design. Utilized insights from social networks Marmenout et al. (2015) [11] examining the impact of brokerage and communicational contagion mechanisms on organizational function and detailed HR interventions across different stages of the PMI process. Furthermore, Franzt et al. (2009) [20] apply a contemporary approach to study the effect of organizational complexity on PMI, finding that performance during this period is influenced by the pre-existing complexities of the merging organizations and the number of work groups. In another paper, Frantz et al. (2012) [15] investigate the pivotal role of internal individual social networks within organizations, the disruption of individuals‘ social networks during the PMI and its strive for re-stabilization towards a solid number of ego-ties. Yamanoi et al. (2012) [13] explore how cultural integration emerges from social interactions among individuals in a PMI, influencing individual turnover, interpersonal conflict, and organizational communication effectiveness.

C. Organizational Communication and Ego-Networks

Analyzing the changes in inter-organizational communication through organizational network analysis requires the dissection and evaluation of the ego networks of individuals reflecting organizational communication on the most profound level [15]. Nurek et al. (2020) [16] explore how analyzing employee email exchanges and forming an informal social network can reflect and potentially reproduce the organizational structure. They demonstrated the revealing nature of communication email metadata in social network construction. Zenk et al. (2010) [21] promote that the change organizations are undergoing is represented in the communication structure. However, email communication has its limitations. Personal communication and interactions may not be reflected in email exchanges or other communication forms, such as messaging apps or text messages. Therefore, it is essential to consider that a dataset of emails may only provide a partially comprehensive understanding of the connections between individuals [16]. Nevertheless, Heo et al. (2002) [17] promote that individuals need to build both formal and informal connections with knowledgeable people from other parts of the organization in a PMI scenario. Additionally, Gelardi et al. (2021) [22] emphasized that investing time in building or reinforcing new social relationships with someone may come at the expense of neglecting relationships with others, creating a stabilized ego-network structure with an equilibrium of ego-ties over time. This is also supported by the findings of Frantz (2012) [15], indicating that an individual can maintain an average of social relationships between 150 and 290 individuals resulting in the stabilization of ego-networks.

D. Homophily

One of the critical factors for a successful deal is the existence of reciprocal interest between the decision-makers, indicating that people are more likely to build social ties that last longer, with people with similar interests, exhibiting higher homophily [23]. Henning et al. (2012) [24] depict homophily as a fundamental sociological concept indicating that individuals will be more likely to bond and associate with similar others. Burt (1987) [25] found that individuals resembling network positions in organizations behave alike, and further that individuals who occupy strucutral equivalence in a network usually have similar attributes, which explains why they are placed in specific positions. According to Vaidya et al. (2020) [14], M&As are more likely to happen when there is a higher level of homophily. They found similar characteristics, such as age, gender, and education level of CEOs have enhanced, the post-merger performance and shareholder value. Therefore, the study highlights the importance of matching CEOs based on homophily. Frantz et al. (2009) [20] promote that people tend to seek advice or opinions from those who perform similar tasks or possess similar knowledge in an organization. Furthermore, Lawrence (2020) [26] propose joint interactions of multiple attributes create associated trust and bonding effects, indicating a sense of similarity leading to homophily.

III. Data and Modeling

A. Description of dataset

For this research, we utilize a data set from an actual PMI, comprising information from a company (hereinafter mentioned as Acquirer) in the field of advanced technology solutions that has acquired a company (hereinafter mentioned as Asset) in the same industry sector. The data set encompasses email metadata collected over a period of six months subsequent to the acquisition day, referred to as Day One. The Acquirers organization consists of 1,983 individuals, while the Assets organization consists of 1,824. The individuals of both organizations are spread across U.S. and India.

Collectively, the dataset encapsulates 254,405 email-based connections between the individuals, where these interactions are presented in an interval compression data set of a temporal network. That is, each interaction between two individuals is associated with: the initial time point of communication between them, the final time point of communication, and the cumulative frequency of communication exchange during that designated period.

Additionally, the data set comprises additional information about the individuals, such as their affiliation to the respective department of their primary organization. In total, the organization is divided into 18 departments. These are: Executive & Administrative Support (E&AS), Communications, Facility & Real Estate, Finance (FI), General Management (GMgmt), Human Resources (HR), Information Technology (IT), Legal & Patents (L&T), Marketing, Operations, Procurement, Quality, Research & Development (R&D), Sales, Security, Strategy, Supply Chain and Sustainability).

B. Data Analysis

In our scenario, complete temporal network data as a list of temporal edges is unavailable due to data protection and privacy reasons. Instead, the only available data comprises a list of edges, in which each edge is associated with a timestamp of the first and last interaction, as well as the frequency of interactions. That is, each connection between two individuals u_1 and u_2 is associated with a triple $\langle t_i, t_f, f\rangle$, where:

- t_i: the initial time point of communication between u_1 and u_2,
- t_f: the final time point of communication, and
- f: the cumulative frequency of communication exchange during that designated period.

However, since our aim is to understand the effects of PMI by investigating the network's temporal evolution and potential stabilization, we focus only on the initial point where the communication of two individuals takes place (i.e., edge activation). For the analyses of this paper, we adopt week as temporal, in order to simplify the analysis and keep the focus on the big picture.

Thus, the communication network can be represented as a temporal graph $G(\mathcal{V}, \mathcal{E}, \omega)$ where $\mathcal{V}$ is the set of nodes (individuals), and $\mathcal{E}$ is the set of edges, $\mathcal{E} \subseteq \mathcal{V} \times \mathcal{V}$, and $\omega : \mathcal{E} \to \mathcal{T}$ is a function that associates each edge (u, v) with its timestamp $\omega(u, v)$ (defined as the initial connection on a weekly basis). Here $\mathcal{T}$ denotes the time-span under study (six months) composed of 23 weeks.

Moreover, individuals are associated with their affiliation to the respective department of their primary organization. Let $\mathcal{O}$ be the set of organizations, i.e., $\mathcal{O} = \{O_1, O_2\}$, where O_1 is the Acquirer and O_2 is the Asset organizations. Let $\mathcal{D}$ be the set of departments, e.g., HR, R&D, etc. Individuals' affiliation is defined by two functions:

- Organization affiliation function: from the set of individuals to the set of organizations: $\gamma : \mathcal{V} \to \mathcal{O}$,
- Department affiliation function: from the set of individuals to the set of departments: $\delta : \mathcal{V} \to \mathcal{D}$,

Thus, the affiliation of an individual $v \in \mathcal{V}$ is jointly specified by her/his organization $\gamma(v)$ and department $\delta(v)$.

Additionally, the set of individuals of department d of organization o is denoted as $\phi(o, d)$, and given by:

$$\phi(o, d) = \{v \in \mathcal{V} \mid \gamma(v) = o, \delta(v) = d\}$$

These departmental sets of individuals defines a partition of the whole set of individuals, that is:

$$\mathcal{V} = \bigcup_{o \in \mathcal{O}} \bigcup_{d \in \mathcal{D}} \phi(o, d)$$
$$\phi(o, d) \cap \phi(o', d') = \emptyset, \quad \forall (o, d) \neq (o', d')$$

From the joint organization-department point of view, we consider four kinds of dynamic temporal networks (as illustrated in Figure 1:

***Intra*-Organizational Networks**

- **Same Organization, Same Department — SOSD** This network encompasses the communication of individuals within the same organization and the same department (e.g. all communications in the Asset's HR department).

$$\mathcal{E}^{\text{SOSD}} = \{(u, v) \in \mathcal{E} \mid \gamma(u) = \gamma(v), \delta(u) = \delta(v)\}$$

- **Same Organization, Different Department — SODD** This network encompasses the communication of individuals within the same organization and all other departments (e.g. all communications between the Asset's HR department and every other department of the Asset).

$$\mathcal{E}^{\text{SODD}} = \{(u, v) \in \mathcal{E} \mid \gamma(u) = \gamma(v), \delta(u) \neq \delta(v)\}$$

***Inter*-Organizational Networks**

- **Different Organization, Same Department — DOSD** This network encompasses the communication of individuals between the organizations of the Acquirer and the Asset but between the same department (e.g. all communications between both HR departments of the Acquirer and the Asset)

$$\mathcal{E}^{\text{DOSD}} = \{(u, v) \in \mathcal{E} \mid \gamma(u) \neq \gamma(v), \delta(u) = \delta(v)\}$$

- **Different Organization, Different Department — DODD** This network encompasses the communication of individuals within one department of one organization

(e.g. the Acquirer) with all other departments of the other organization (e.g. all communications in the Acquirer's HR department with every other Asset's department)

$$\mathcal{E}^{\text{DODD}} = \{(u, v) \in \mathcal{E} \mid \gamma(u) \neq \gamma(v), \delta(u) \neq \delta(v)\}$$

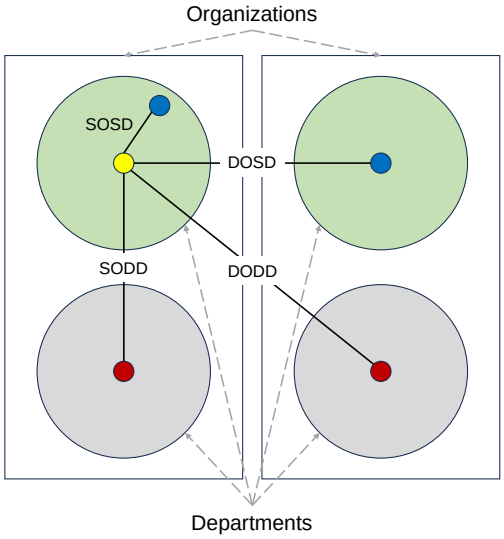

Fig. 1. Four types of networks, between same/different organization, and same/different department.

One needs here to bear in mind, that if we consider only an organisational point of view, the SOSD and SODD networks cover *internal* networks within one organization, while the DOSD and DODD networks cover *external* communication bridging organizational boundaries.

Since the data is only available in interval-compression format (initial- and final points, plus the frequency), we can either approximate the individual timestamps of each edge; or simply work with accumulative networks [27]. In this paper, we opt to follow the second option, i.e., accumulative networks, in order to avoid approximation and its potential inaccuracies.

That is, for a given week $k \in \mathcal{T}$, we construct an accumulative network that comprises all connections occurring from Day One up to, and including, week k.

$$\mathcal{E}_k = \{(u, v) \in \mathcal{E} \mid \omega(u, v) \leq k\}$$

Clearly, this kind of temporal accumulative networks can be constructed at different granularity levels:

- Global level: comprising all connections entirely.
- Organization level: separately consider intra-organization connections (SOSD and SODD together) and inter-organization connections (DOSD and DODD together).
- Department level: separately consider the four kinds of networks: SOSD, SODD, DOSD and DODD.

IV. Network Stabilization

In order to seek answers to our research questions about the stabilization of the post-merger communication networks, we opt to separate the initial timestamp interactions into two phases (periods) covering the near and far frames of the entire time span:

- Phase 1: covering week 1 until 9, and
- Phase 2: covering week 14 until week 23.

This way, studying the network stabilization is reduced to merely comparing the network growth rates between these two phases.

For each phase, we consider how the network changes in size – number of connections – in every week in the phase. Thus, each network can be represented as two curves for the two phases respectively depicting the evolution of the network. That is, let $\mathcal{T}_1 = \{1, \cdots, 9\}$ and $\mathcal{T}_2 = \{14, \cdots, 23\}$ denote the two (near and far) phases, respectively; then the two fluctuating curves are:

- $Y_1 = \{|\mathcal{E}_k| \text{ for } k \in \mathcal{T}_1\}$
- $Y_2 = \{|\mathcal{E}_k| \text{ for } k \in \mathcal{T}_2\}$

Remarkably, these fluctuating curves tend to be linear in the different kinds of networks as shown in Figure 2, and Figure 3. The immediate consequence of this observation is the following: the network steadily grows in a given phase, and this growth is different between the two phases. This enables us to analyze the trends in network development over time and to assess the stabilization of the network. Moreover, the linearity of these curves allows us to use linear regression to express each curve as a straight line, which can be easily specified in terms of its intercept and slope.

Our approach involves fitting each fluctuating curve with linear regression, not only to compare the various networks with each other but also to analyze the trends observed.

We are investigating the stability of a dynamic network by comparing the linear regression of the network during its first (near) phase to that of its second (far) phase. This comparison helps us determine whether the network has reached stability or not. Furthermore, we can determine whether the network has stabilized by assessing the slopes of both intervals. The slope of the linear regression represents the growth rate of the network, that is the increase in number of communications per unit time (here: week). We use regression analysis to evaluate the network's stability and compare each regression's slopes, which allows us to investigate the network's stabilization over time and determine its current stability status.

At organizational level; Figure 2 depicts the network growth fluctuating curves, along with the linear regression fit, specifically for the internal (within the same organization) and external (between the two organizations) organizational networks. We can see that, as expected, the internal network is more dense than the external one. However, when we compare (in each network) the two phases, we observe that the first phase has a higher growth rate (slope) than the second phase.

At department level; Figure 3 depicts the network growth fluctuating curves, with linear regression fits, for all four networks: SOSD, SODD, DOSD and DODD. Here again, we observe in all networks, that the first phase has a higher growth rate than the second phase.

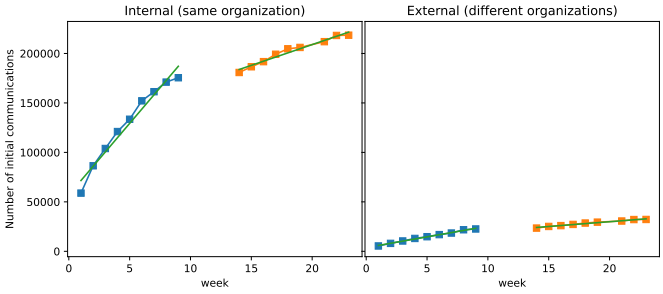

Fig. 2. Accumulated initial communications at Organization Level

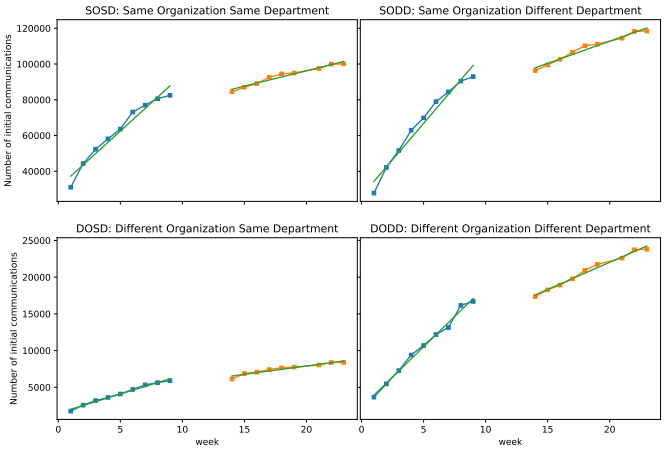

Fig. 3. Accumulated initial communications at Department Level

If the slope of the first phase is higher than the slope of the second phase, it indicates that the network has reached a stable state over time. For a network, having a higher growth rate in the first phase than in the second phase is in fact a strong indication of the stabilization of the network. Actually, this means that the network has stabilized and reached most of its magnitude by the first phase, and has reduced its growth rate in the second phase. Remarkably, this applies for all the networks at organization- and department levels.

In order to verify and to assess to which extent the network is stable, we compare the growth rates of both fluctuating curves for each network.

To quantify the stabilization of the network, we use the relative difference of the slopes of the two phases. We call this quantity: the "Reduction Ratio of fluctuating Growth Rates" (RRFGR for short), which mainly measures the reduction in growth rates within different phases.

Let S_1 and S_2 be the slopes of the linear regression (growth rates) in the first and second phases, respectively. Then, the Reduction Ratio of fluctuating Growth Rates is given by the following formula:

$$\text{RRFGR} = \frac{S_1 - S_2}{S_1} \times 100 \qquad (1)$$

Where we mainly take the difference of the slopes (how much the first phase is reduced at the second phase) and normalize it by the slope of the first phase. We then multiply the result by 100 to get a percentage, which helps us measure the relative change between the two slopes.

Table I presents for all networks, at organization and department levels, the growth rates (slopes) of the two phases, as well as the Reduction Ratio of fluctuating Growth Rates (RRFGR) as a stabilization measure.

TABLE I
REGRESSION SLOPES, PHASE RISE DIFFERENCE (PRD) AND SHARE OF OVERALL COMMUNICATION

Organization Level					
Network	Slope 1	Slope 2	RRFGR	Share 1	Share 2
internal	14435.4	4197.5	70.92 %	88.59 %	87.15 %
external	2165.45	966.6	55.36 %	11.41 %	12.85 %
Department Level					
Network	Slope 1	Slope 2	RRFGR	Share 1	Share 2
SOSD	6316.55	1721.58	72.74 %	41.66 %	39.91 %
SODD	8118.85	2475.91	69.50 %	46.94 %	47.24 %
DOSD	519.55	226.33	56.44 %	8.43 %	9.50 %
DODD	1645.9	740.28	55.02 %	2.98 %	3.35 %

We first observe on an Organizational Level a larger RRFGR for internal networks (70.92%) than for external networks (55.36%). A higher RRFGR indicating a reduction of initial communication resulting in a more stabilized network communication. Furthermore, we observe a slight shift regarding the share of total communication with an decrease of internal communication from 88.59% to 87.15% and a increase of external communication share from 11.41% to 12.85%. Implying the initial internal communication was already established before the Day One but the share of total communication is shifting across former organizational boundaries.

Secondly, we observe a continuous concentric decrease of RRFGR from SOSD (72.74%), SODD (69.50%), DOSD (56.44%), to DODD (55.02%) reflecting the findings of the Organizational Level.

Remarkably, the share of internal communications decreases in favor of an increasing share of external ones. As shown in Table I, on one hand, the communication within SOSD network is reduced from 41.66 % in the first phase to 39.91% in the second one (decrease by 1.75 %). On the other hand, the share of communications have increased within the three other networks: SODD increased from 46.94% to 47.24% (by 0.3%), DOSD increased from 8.43% to 9.5% (by 1.07%), and DODD increased from 2.98% to 3.35% (by 0.37%), indicating a significant tendency of making more new external communications and consequently the integration of the two organizations reflecting the formal merger in the informal communication network.

V. CROSS ORGANIZATIONAL INTERACTION

Examine the collaboration of individuals within and across the organisation and to answer the question of homophily between the same departments, we proceed as follows: We create the E/I index for all departments, in both organisations. The E/I index provides information on how successful the merger was

in linking the two organisations' social networks. We compare the accumulated initial communication of all departments and look at the top 5 departments in detail under the premise that there are specific departments that are more important for a successful integration than other departments, which should be reflected in the level of initial communication at the beginning of the integration phase [28]. We analyse the communication patterns of the top 5 departments (for both organisations) within the four networks to identify possible differences and to evaluate whether the formal merger is also reflected in the informal networks. Furthermore, we also analyse which of the other specific departments the top 5 departments communicate outside their own network gaining a holistic perspective on organizational department communication.

A. E/I-Index

Our objective is to investigate whether the formal merger process and, specifically, the PMI is conducted successfully and whether they are reflected in the network data. To measure the degree to which both organizations are integrated, we consider an E/I-Index as the central measure. A high E/I-Index indicates successful integration, while a low index may indicate challenges or obstacles in merging the networks. The E/I-Index after Krackhardt (1998) measures the ratio of external and internal connections and normalizes this to a value range between -1 and +1 [29].

We calculate the E/I-Index as follows:

$$EI = \frac{E - I}{E + I}$$

where E represents the number of external connections and I represents the number of internal connections.

We focus on the E/I-Index from a departmental point of view, where internal connections I are within the same department of the same organization (SOSD), whereas external connections E are between the different organizations but still in the same department (DOSD). Thus, for a given department $d \in \mathcal{D}$, the E/I index is calculated using the specific internal- and external indices of that department:

$$I_d = |\{(u, v) \in \mathcal{E} \mid \delta(u) = \delta(v) = d, \gamma(u) = \gamma(v)\}|$$
$$E_d = |\{(u, v) \in \mathcal{E} \mid \delta(u) = \delta(v) = d, \gamma(u) \neq \gamma(v)\}|$$

We propose that homophily (and therefore a successful PMI) will be reflected explicitly through a high E/I-Index in this network.

The results of the E/I-Index of the DOSD Network can be seen in Table II. We observe a broad range of results, reaching from -1.0 up to 0.73, indicating almost the entire spectrum of homophily and heterophily. Departments like R&D, Marketing, Operations, and Supply Chain are similar in their substantial negative E/I-Index. While other departments like Sales, Human Resources, Executive & Administrative Support, Procurement, Legal & Patents and Sustainability show moderate reciprocal differences. Additionally, we observe that the departments Quality, Facility & Real Estate and General Management diverge substantially. This implies that the first group seems to have a heterophil network, while the second group indicate homophily in several departments in both organizations. At the same time, the last group of separate departments shows signs of homophily partially.

We can further see that for the five departments with the most communication sharing, the departments with mutual communication exchange share connections with similar departments. All five departments have ties with E&AS, HR, Marketing and R&D. All departments are among the top five departments, except Executive & Administrative Support, indicating a central role in the integration of all departments.

TABLE II
E/I-INDEX PER DEPARTMENT IN DOSD NETWORK

Department	Asset	Acquirer
Research & Development	-0.93	-0.74
Quality	0.18	-0.87
Sales	0.30	-0.35
Marketing	-0.60	-0.55
Information Technology	-0.25	-0.16
Communications	NaN	-1.00
Human Resources	0.51	0.00
Executive & Administrative Support	0.58	-0.09
Finance	-0.10	-0.25
Facility & Real Estate	0.71	0.09
Operations	-1.00	-1.00
General Management	-0.11	0.70
Supply Chain	-0.94	-0.87
Procurement	0.18	-0.05
Legal & Patents	-0.19	0.62
Sustainability	0.14	-0.50
Security	NaN	-1.00
Strategy	-1.00	NaN

B. DOSD Network

Fuhrer et al. (2017) [28] have shown, that some departments are essential to long-term integration success. Conversely, this fact should also be reflected in the initial communication across organizational boundaries. Because only through communication can a corresponding exchange of information take place. Therefore, we analyze the initial communication of the first nine weeks (first phase) over all departments to determine if the following departments are represented [28]: Integration Management Office (Executive & Administrative Support and General Management), Human Resources, Finance, IT, Marketing & Sales, Legal & Compliance and Operations.

Figure 4 illustrates that the departments can be grouped into three categories based on their initial communication levels. The first group includes departments with a number of initial communication less than 250, such as Executive & Administrative Support, Finance, Legal & Patents, Quality, Procurement, Supply Chain, General Management, Facility & Real Estate, and Sustainability. The second group includes departments with an initial communication between 250 and 1000, namely Sales, Research & Development, Marketing, Information Technology, and Human Resources. Finally, the third group only includes the Sales department, with an initial communication level exceeding 1000.

Focusing on the groups with the highest initial communication numbers, we identified five departments. Resulting

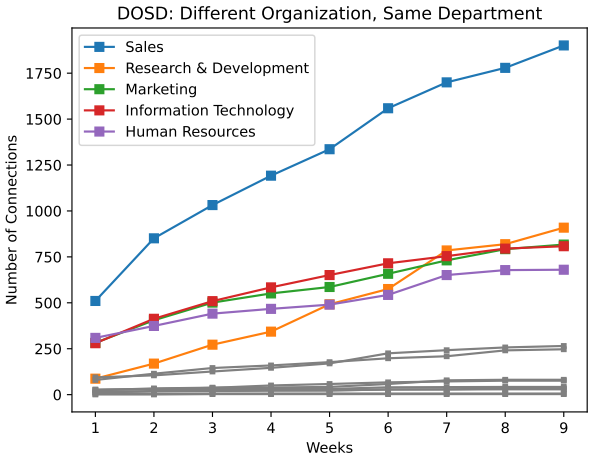

Fig. 4. Initial Communication Top Five Departments

in a difference of organizations of Integration Management Office (General Management and Executive & Administrative Support), Finance, Legal & Compliance and Operations.

One can notice here that we looked at the absolute number of connections, while another option is to take into consideration the number of individuals and thus looking density. However, we opted to consider the absolute number of connections because it is more reflecting the magnitude of communications between two departments.

C. Top Five Departments Network patterns

Furthermore, we investigate if the top five departments illustrate similar patterns of communication respectively in both departments due to their similarity in size and if the formal merger is reflected through an steep increase of communication in the DOSD and DODD networks.

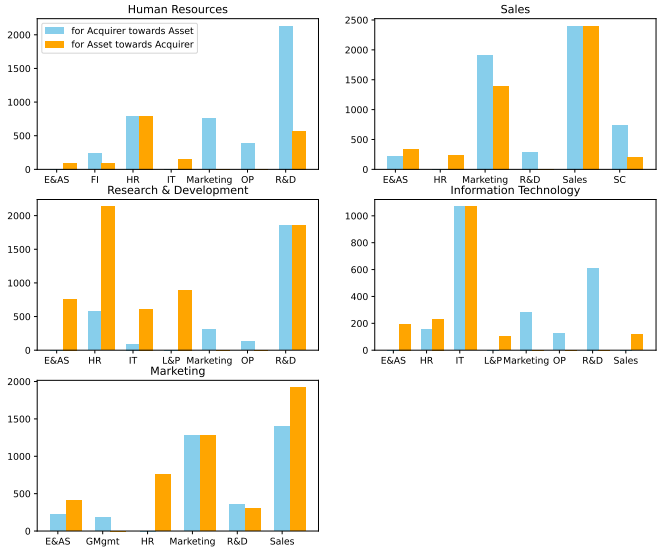

Fig. 5. Top 5 Department Communication in all networks

We observe that the most prominent curve can be identified as the initial communication within the SODD network. The R&D department of the Asset is the only department in which the internal communication is more prominent than the communication within the department indicating a substantial need for alignment. Remarkably the communication curve of the R&D department of the Acquirer shows a significant lower communication curve within the SODS and SODD network, compared with the department of the Asset.

D. Additional Department Communication

Our goal is to get a holistic view of the communication of the PMI and to see if it is reflected in the data. Therefore, we analyze the communication distribution of the top five departments towards departments of the other organization as shown in Figure 5.

We observe a high quantity of communication between the HR department of the Acquirer and R&D department of the Asset. Indicating the following:

- Ensuring that new employees are adequately integrated into the organization. This includes defining roles and responsibilities, restructuring teams, and adapting employment contracts if necessary.
- Talent Management, particularly regarding critical employees in the R&D department responsible for the organisation's success and knowledge transfer. The HR department has to ensure that these talents are retained and integrated into the culture and values of the new organization.

A second observation is that the Marketing and Sales departments have the second largest inter-department initial communication quantity.

- This highlights the importance of coordination between the two departments' product strategies and positioning during a merger. It is necessary to have an understanding of each other's products and strategies. Furthermore, it may be necessary to consolidate customers and harmonize product pricing and marketing strategies to target specific groups.
- Marketing is responsible for customer acquisition and retention, while the Sales Department is responsible for direct customer contact and revenue generation. By working closely, the Marketing and Sales departments ensure seamless customer care and support each other's efforts.
- The supply chain department is responsible for procuring raw materials, producing goods, and distributing them to customers. Sales must work closely with the supply chain department to ensure on-time product availability to satisfy customer demand.

VI. Conclusion

In this paper, we investigated a dynamic temporal network of two organizations in a PMI with a data set of aggregated network data. Our goal was to verify the two questions: whether the network stabilised over time and if the

aspects of homophily of similar groups were reflected in the predominantly exchanged information within similar groups. Nevertheless, it has to be taken into consideration that email communication is limited. Our approach is based on initial communication interactions between individuals, cumulating the communication over time reflected in linear regression. Our main findings concerning temporal networks within post-merger integration scenario are the following:

- Network stabilization: Over time, communication within the networks stabilizes, which indicates an increasing cohesion of the networks and the establishment of communication channels as well as the informal communication reflection of the formal merger.
- Intensive initial communication: Within organizations and departments communication increases sharply immediately after a merger, indicating an intensive networking phase. However, it has to be taken in consideration that some communication was conducted before the data set was recorded, which is not reflected in the data.
- Homophily and share of communication: Homophily aspects are reflected in the results but is not fully supported by the data, indicating complex integration dynamics. Analyzing the percentage shares of communication shows that the homophily aspect is also reflected here. The share of communication is decreasing the further the network reaches from its origin.
- Critical departments: Certain departments which seem to be crucial for the PMI have less initial interaction as expected. Additionally, communication patterns vary between internal and external interactions and between different departments and organizations.
- Interactive departments: Based on the results HR seems to be the most essential department regarding cross department communication, reflected in a high amount of communication. Furthermore, R&D and IT as well as Marketing and Sales are also among the top five intra-organizational communication departments.

This present research has the potential for further expansion in different directions: First, future research should consider different data sets to validate and generalize current observations in comparison with similar data sets. Second, other attributes of the data set (e.g. hierarchy, gender, and others) and their behaviour of interaction, reflected in the data, should also be investigated, including other measures like centrality, betweenness, and density within the network. Third, further investigation should be considered regarding the departments, which are essential to conduct a lasting post-merger integration.

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