How does leadership manage network-level tensions in a turbulent environment? A case study on the Antwerp Fire Service Network Leadership during the COVID-19 Pandemic

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Abstract. A crucial topic is how network leadership recognizes and responds to network-level tensions. However, when we focus on how leadership manages these tensions, we favor a one-sided view by focusing predominantly on how leadership manages tensions within the network, implicitly adopting a closed system assumption. In this article, we propose that why a specific network-level behavior is enacted can (partially) be explained by how network leadership is embedded within an organizational field and how environmental and population dynamics shape network tensions. The Social Network Analysis showed that the Antwerp Fire Service crisis response network developed from a core-periphery network to a smaller, denser network. Based on the thematic analysis, we provide insights into network leadership practices to recognize and respond to network tensions that arose during the first wave of the COVID-19 pandemic due to internal network characteristics and the organizational field's environmental and population dynamics. (146 words).

MAD statement. This article aims to *Make a Difference* (MAD) by positioning the notion of network tensions and network leadership at the core of leadership theory and practice. This is done by introducing network tensions before suggesting that network leadership needs to respond to and manage network tensions shaped and constrained by an organizational field's environmental and population dynamics. The contributions show how leadership dealt with network tensions, and as a result, the article may help inform leadership practice and scholarship on how to deal with multiple network memberships, overlapping network involvement, and broader network-environment relationships that characterize collective goods. (98 words).

Keywords: Network Leadership, Network-level tensions, Network Management, Network Governance, Fire Service, COVID-19 pandemic.

Introduction

Organizational networks are increasingly employed to address global challenges seemingly intractable for any organization to handle independently. Inherent to this organizational form is the premise that outcomes like ending poverty, protecting the planet, and improving the lives and prospects of people in our communities are interdependent on the effort of organizations participating in networks (Human & Provan, 2000; Provan & Milward, 2001; Provan et al., 2007; Provan & Kenis, 2008).

Despite a great deal of progress that has been made in recent years in understanding why networks form, what they are capable of accomplishing, how they are managed and governed, and how they can function effectively, many topics are not well understood (Provan et al., 2007; Provan & Lemaire, 2012; Popp et al., 2014). One topic is the impact of multiple network memberships, overlapping network involvement, and broader network-environment relationships on creating network tensions (Provan & Lemaire, 2012; Nowell et al., 2019; Nowell & Albrecht, 2023). To inform scholarship and practice on this topic, public management scholars have recently examined organizational networks from an external network perspective (Nowell et al., 2019; van den Oord et al., 2020; Yang & Nowell, 2021). In this view, organizational networks are part of a network population ecology operating within organizational fields (Nowell et al., 2019; van den Oord et al., 2020; Yang & Nowell, 2021). In such fields, organizational networks comprise three or more organizations, often from various organizational domains, which determine task environments creating interdependencies and interconnections among network members (Nowell et al., 2019). In other words, this implies abandoning a closed systems perspective focusing on internal network characteristics and adopting an open systems perspective in which we draw on the idea that organizational networks are shaped and constrained by their

environments and internal and external interactions (van den Oord, 2023). Employing such an external network perspective on organizational networks can be fruitful for explaining network dynamics, mainly when multiple networks and organizations compete over scarce resources (Nowell et al., 2019) or deal with collective action problems in turbulent environments (van den Oord et al., 2020). Moreover, it can help explain network development about environmental change (Provan et al., 2011) or the co-evolution of networks and their environment (Koza & Lewin, 1998; 1999; cf. Tasselli et al., 2015). However, adopting such a perspective also carries implications for examining network leadership (Müller-Seitz, 2012) since this presumes that we must treat organizational networks as open systems rather than closed systems with multiple network memberships and overlapping network involvement, potentially evoking contradictions through interactions among networks and their members (van den Oord, 2023). Competing demands due to this pose challenges that require network leadership to bargain power (Saz-Carranza et al., 2016), oscillate between modes of governance (Berthod et al., 2016), bridge differences, frame basic agreements and procedures, and contribute to enhancing the capacity of multiple networks and its members (Saz-Carranza & Ospina, 2011).

This study aims to draw attention to how network leadership manages network-level tensions shaped and constrained by environmental and population dynamics of the organizational field in which networks and their members are embedded. Suppose we accept that organizational networks are inherently full of conflict and tensions (Berthod & Segato, 2019; Lemaire, 2020) and are multilevel and multifaceted in nature (Rethemeyer & Hatmaker, 2008; Moliterno & Mahony, 2011; Nowell & Kenis, 2019; Lemaire et al., 2019; Carboni et al., 2019). In that case, a contradictory logic can be aggravated due to internal network interactions or shaped and constrained externally (cf.

Das & Teng, 2000). In both situations, network leadership must recognize and respond to network tensions to manage the network (Provan & Kenis, 2008; Saz-Carranza & Ospina, 2011). Nevertheless, to date, we favor a one-sided view of network tensions by focusing predominantly on how network tensions internally come to be (Das & Teng, 2000; Provan & Kenis, 2008) – "contradictory, yet interrelated elements that exist simultaneously and persist over time" within the boundary of the organizational network (Smith & Lewis, 2011, p. 382) – even though population dynamics and interdependencies in an organizational field may drive network tensions as well (Provan & Milward, 1995; Provan et al., 2007; Nowell et al., 2019).

Consequently, we propose reconsidering 'where network tensions may come from' and studying how network leadership identifies and leverages opportunities and threats within and across messy network boundaries over time (Lewis et al., 2014; Lemaire & Provan, 2018). Only by examining networks as open systems in conjunction with their environment can we fully understand how network-level tensions arise, what role network leadership may play, how networks can recognize and respond to them, and whether their origin matters.

We conducted a single case study of the Antwerp Fire Service (AFS), which like many others, was confronted by the COVID-19 pandemic. We combined Social Network Analysis (SNA) and After-Action Review (AAR) to examine (1) with whom the leadership team of the Fire Service and the Fire chief affiliated during the first wave of the pandemic and (2) what network-level tensions arose in the larger, complex organizational field of the province of Antwerp. We describe how the network of the AFS leadership team developed and present which network tensions they addressed retrospectively in dealing with the institutional crisis of the COVID-19 pandemic.

We have structured the article as follows. First, we conceptualize network-level tensions and position ourselves in the leadership literature. Next, we present our research design, methods used, and the AFS case study findings. We close by outlining how network leadership dealt with network-level tensions and present implications for future research.

Network-level tensions

In network studies, tensions are often conceptualized as competing logics insofar as a collaboration between individuals, organizations, or networks is concerned (Vangen et al., 2015). On the network level, this translates to paradoxical challenges for those that are concerned with the functioning of the network (Vangen et al., 2015), while at the organizational level, this involves interactions between organizations (individuals that represent organizations) and their orientation towards the network and their host organization (Vangen & Winchester, 2014). For instance, in a longitudinal case study of a biotechnical alliance, de Rond and Bouchikhi (2004) illustrate network tensions as a coevolutionary interchange of design and emergence, cooperation and competition, trust and vigilance, expansion and contraction, and control and autonomy. Hence, network studies addressing tensions in one way or another point to balancing multi-level and multi-faceted contradictions through various properties and processes (Klaster et al., 2017), necessitating a response by network (management) behavior (Provan & Kenis, 2008; Saz-Carranza & Ospina, 2011).

Provan and Kenis's network tensions

To conceptualize network tensions, we draw on the previous work of Provan and Kenis (2008), in which they define three network tensions: efficiency-inclusiveness, internal-

external legitimacy, and flexibility-stability (see Berthod & Segato, 2019 for an overview of other network tensions). We first describe these network-level tensions and then conceptualize them from an external network perspective to argue their implications for network leadership.

Efficiency-inclusiveness

The network tension of efficiency-inclusiveness involves the contradictory logic of "the need for administrative efficiency on the one hand and the need for member involvement, through inclusive decision-making on the other" (Provan & Kenis, 2008, p. 242). The previous literature underscores trade-offs in involving network members in the decision-making processes of the network. For instance, Moynihan's (2009) study of incident command systems raises concerns about the short-term coordination costs of adding new network members and finds that the bias against inclusiveness may increase under (a) conditions of mission urgency and (b) when the emergent component is relatively large. In other words, cultivating the tension between efficiency-inclusiveness resolves around the arrangement of network members. The more extensive the network, the more time-consuming and resource-intensive governance processes tend to be (Provan & Kenis, 2008). Moreover, Ansell et al. (2012) pointed out the negative consequences of having a solid lead organization in the network. Although a lead organization can reduce the demands on network members (read: increase efficiency), it can also lead to less commitment and reinforce informal coordination among network members.

Internal-external legitimacy

The tension of internal-external legitimacy refers to the generalized perception from in-

and outsiders that a network's actions, activities, and structure are desirable and appropriate (Suchman, 1995; Human & Provan, 2000). Network legitimacy encapsulates the status and credibility of the network and its activities as perceived by network members and outside constituents (Human & Provan, 2000). Cultivating legitimacy involves finding and maintaining a balance between different in- and outsiders. The challenge is twofold; To build network legitimacy internally and externally and address the potential tension between them (Human & Provan, 2000; Provan & Kenis, 2008; Raeymaeckers, 2016).

Accepting a network by both in- and outsiders can lead to cognitive support and commitment to resources from stakeholders. This determines whether the network can endure as a viable organizational form to accomplish a common purpose (Human & Provan, 2000; Provan & Kenis, 2008). But this may also depend on the innate characteristics of networks and in which political-administrative culture network legitimacy is established—as notions of why actors perceive network interactions as meaningful can be culturally biased to some extent (Hermansson, 2016) and explain why "network members will generally care about their extra-network reputation since they depend upon resources from political actors, and so may be willing to engage in blame avoidance strategies that undermine their intra-network reputation" (Moynihan, 2012, p. 585).

Flexibility-stability

The tension of flexibility-stability entails the competing logic that, on the one hand, "a network needs to ensure rapid network responses in ways that meet changing stakeholders' needs and environmental demands, while, on the other hand, developing consistent responses to stakeholders and being dependable in requisite demands over

time" (Provan & Kenis, 2008, p. 245). According to Ansell et al. (2012), dealing with this tension requires long-term interaction and commitment. Networks are often heralded for being flexible, although flexibility might also reduce their stability, create uncertainty, and increase differences between network members, which can minimize trust among actors (Willem & Lucidarme, 2014). Cristofoli et al. (2019) find that stability is conducive to network effectiveness. According to them, more attention should be paid to behavioural features, such as deliberate and persistent network management activities that support and reinforce long-term relationships. Network managers' capacities to stabilize and consolidate the relationships among network partners seem to be ongoing activities for the network manager. "Stabilizing relationships is critical both in early-stage and mature networks, in the presence of as well as the absence of trust, and connected and dispersed networks" (Cristofoli et al., 2019, p. 1794).

Conceptualizing network tensions

Except for the internal-external legitimacy and flexibility-stability tension, the beforementioned studies examine network tensions from an internal perspective (Provan & Kenis, 2008). It seems we have favored a one-sided view by focusing on how the network manages tensions within the network. We argue, however, that we need to adopt Nowell, Hano, and Yang's (2019) external network perspective and focus on how network leadership faced with contradictory demands makes sense and enacts a collective solution across messy boundaries in an organizational field (Nowell et al., 2019; van den Oord et al., 2020; Yang & Nowell 2020; Nowell & Albrecht, 2023). Adopting such a view implies that environmental and population dynamics in an organizational field can drive network tensions requiring us to conceptualize the

environment-network relationship.

Organizational fields consist of an "assemblage of networks, which individually may be regarded as operationally and managerial autonomous subsystems but are part of a larger, complex organizational field by many types of connections and flows" (van den Oord et al., 2020, p. 881). From an external network perspective, we define network tensions as competing logics that can arise from internal and external network interactions (van den Oord et al., 2020; Nowell & Milward, 2022) and propose why network-level behavior is enacted can (partially) be explained by how networks are embedded within an organizational field (Nowell et al., 2019; van den Oord et al., 2020; Yang & Nowell 2020; Nowell & Albrecht, 2023). If we adopt an external network view on network-level tensions, that is, they are multilevel and multifaceted and can result from an interplay of environmental and population dynamics as well as internal network characteristics, we consequently need to study how network leadership recognizes and responds to them and whether the origin of network dynamics matter.

Network leadership

In Müller-Seitz's (2012) systematic literature review, network leadership is differentiated into two forms: hierarchical and heterarchical network leadership (cf. Gulati et al., 2012). In hierarchical network leadership, decision rights are concentrated in one or a few network members, whereas heterarchical network leadership shares this among network members (Provan & Kenis, 2008; Gulati et al., 2012).

As suggested by Müller-Seitz (2012), we move beyond this dichotomous conception of hierarchical and heterarchical network leadership and, in this article, position network leadership as an emergent property of purpose-oriented networks (Provan & Lemaire, 2012; Lemaire & Provan, 2018; Sedgwick et al., 2022). Such

networks share five common features, which are "a multiagent system of three or more legally autonomous organizations that are not bound by authority based on employment relationships but characterized by a distinct identity derived from a particular boundary and membership arrangement and network-level goals toward which the constituent organizations' efforts are expected to contribute (van den Oord, 2023, p. 27)." Purpose-oriented networks are inherently full of conflict and tensions since their members differ in means and ends (Lemaire, 2020). We define in this article network leadership as "the collective pursuit of delivering on purpose" (By, 2021, p. 35; By et al., 2023). From a general point of view, purpose can be understood as "an aim that guides action (Kempster et al., 2011, p. 321)." This is sometimes also addressed with *telos* (meta-goals) to differentiate between internal and external goods to help us make sense of fulfillment and achievement (Kempster et al., 2011; By, 2021; By et al., 2023). In other words, purpose involves "the pursuit of a worthy idea and activity, the outcome of which goes beyond the individual or an individual organization" (By, 2021, p. 34; By et al., 2023; cf. Jasinenko & Steuber, 2023). Organizational networks guided by purpose poses challenges that require leadership practices that emphasize collective doing, moving away from the idea of leaders (By, 2021) to network leadership (Bartelings et al., 2017; Cristofoli et al., 2019; Cepiku & Mastrodascio, 2021; Brugghemans et al., 2021).

One challenge is dealing with the membership of organizations in multiple networks (cf. Nowell et al., 2019) since this can give rise to what has been coined "the two hats problem" (Milward et al., 2016). Especially in the case of overlapping network involvement by organizations, individuals can have diverged interests in their networks and the organizations they partake in.

Another challenge for network leadership is dealing with agency dilemmas when "one" network can make decisions or act on behalf of other networks in the organizational field. Principal-agent problems can easily arise among networks because principal-agent relationships are ill-defined due to network-environment relationships following network boundary and membership arrangements (Gulati et al., 2012) and the causal texture of the environment (Emery & Trist, 1965). Especially in circumstances where either networks or their members are motivated to act in their own best interests, principal-agent relationships are different compared to vertically integrated organizations simply because network representatives – individuals acting in the network representing various organizations – do not personify the network as a whole nor do they always act collectively interested (Fama, 1980; Eisenhardt, 1989; Provan & Milward, 2001).

To examine how network leadership deals with competing logics across messy network boundaries, we must draw on "collectivity" as an alternative theoretical lens through which leadership resides in complexity and systemic dynamics (Uhl-Bien & Arena, 2018; Ospina et al., 2020). Such an understanding is critical because 'leadership in organizational networks is not grounded in bureaucratic notions of hierarchy, authority, and control derived from employment relationships (Gulati et al., 2012). Its understanding is based on the relational capability derived from network members' present or absent relationships that grant access to resources and capabilities to influence without apparent exertion of force or direct exercise of command (Provan & Kenis, 2008; Paquin & Howard-Grenville, 2013).

Network leadership relies on "informal authority based on expertise, reputation, status, gatekeeping privileges, or control over key resources or technology" (Gulati et al., 2012, p. 573). This leverages network leadership, developing a "process of social

283 influence through which emergent coordination and change are constructed and
284 produced" (Uhl-Bien, 2006, p. 668). Network leadership accordingly "should not only
285 be seen as a position of authority but also as an emergent, interactive dynamic—a
286 complex interplay from which collective impetus for action and change emerges when
287 heterogeneous agents interact in networks in ways that produce new patterns of
288 behavior and new modes of operating" (Uhl-Bien et al., 2007, p. 299).

289 **Case study design and methods**

290 This study's unit of analysis is the AFS crisis response network, for which we use the
291 AFS leadership team as the observation unit. This network pursues the joint goal of
292 planning and actions to address natural and artificial disasters, crises, critical incidents,
293 and tragic events (Moynihan, 2009). Table 1 provides a pseudonymous actor list of the
294 AFS crisis response network.

295 --- Table 1 around here ---

296 Boundary specification and actor selection of the crisis response networks
297 followed the procedures outlined by Laumann et al. (1992). We applied the nominalist
298 sampling approach to bind the AFS crisis response network for which we consulted
299 AFS's policy plan 2020-2025, which lists all organizations with which the AFS
300 formally collaborates. We complemented this list of actors with agents mentioned in the
301 minutes of the crisis meetings of the AFS leadership team. In addition, we consulted the
302 Fire chief's agenda during that period.

303 We identified 102 unique actors that can be classified into different types of
304 agents active at various levels; agents ranged from individuals to groups (of
305 individuals), organizational units, organizations, or governmental agencies involved in

306 Antwerp municipality (local level), the province of Antwerp (regional level), the
307 Flemish region (Flanders), Belgium (federal level), and internationally.

308 We divided the first pandemic wave into four subperiods following the Belgian
309 chronology of the lockdown and reopening in 2020. For each subperiod, we compiled a
310 list of actors relying on the positional approach to assess who participated and affiliated
311 with whom (Laumann et al., 1992). This allowed us to investigate how the crisis
312 response network developed during the first wave of the pandemic. Following a
313 reputational approach, we discussed each list per subperiod with the Fire chief and the
314 Chief Technology Officer (co-authors) (Laumann et al., 1992). This previous step is
315 consistent with the realist approach and serves as a validity check.

316 ***Data collection***

317 We purposefully sampled data from 133 crisis management meeting notes over 20
318 weeks (27/02/2020—08/06/2020). This included data from AFS crisis management
319 meetings notes, the FAN boards used[1], the minutes of the provincial crisis center,
320 information gathered by the fire chiefs of the province of Antwerp, the Antwerp fire
321 chief's journal, and the minutes of meeting with the federal crisis center. Each entry
322 (n=349) was coded on the source, date (n=73), key issues, and actors. Network ties were
323 measured in terms of actors' participation in crisis meetings providing conditions under
324 which pairwise relations among actors become more likely and included based on key
325 issues concerning information-sharing, resource allocation, and coordination and

[1] A FAN board is a whiteboard (or a digital equivalent) in which "Facts," "Actions," and "Needs" are collected and updated during a crisis. This is a structured Incident Command System (ICS) to provide decision-makers with an overview of a crisis.

control of joint efforts of organizations across the network (Provan & Huang, 2012; Provan & Kenis, 2008). We triangulated these sources to develop a node list of actors' pairwise interactions sorted by date. Although the AFS is involved with more than 102 actors, only those actors with a recorded interaction (i.e., in- and outgoing ties) with one or more members of AFS were accounted for as part of the crisis response network. Accordingly, this study focuses on the "enacted" crisis response network (cf. Isett & Provan, 2005).

--- Table 2 around here ---

To capture and understand what network-level tensions[2] arose in the province of Antwerp's larger, complex organizational field, we applied an After-Action Review (AAR) of actions taken by AFS leadership in response to the pandemic. Through three focus groups, we aimed to retrospectively capture best practices, gaps, and lessons learned by reflecting with AFS leadership on their beliefs and experiences of the crisis response. We formulated two learning objectives: (1) assess to what extent the AFS

[2] In this study, we operationalize network tensions as a latent construct that can only be indirectly inferred from the network's structural and relational patterns of the crisis response network activity. While a crisis is often perceived as an exceptional or an unexpected event, Roux-Dufort (2007) analyzes crises as a process of incubation that starts long before the triggering event. Emphasizing the processual nature of crisis (Turner, 1976), the role of crisis management lies in a "surge of meaning that fosters organizational change and transformations" (Roux-Dufort, 2007, p. 110). This surge of meaning is based on the exchange of information within the network leading to collective enactment (Weick, 1993). In contrast, the leadership's role is to bring events and structures within the network and set them in motion (Weick, 1988).

crisis response was efficient and (2) determine whether the AFS crisis response was adequate. The AAR was limited to the first wave of the COVID-19 pandemic (Feb.-Jun. 2020). Participants were instructed to conduct an open and honest professional discussion to identify ways to sustain what was done well and develop recommendations on ways to overcome obstacles (WHO, 2019).

The three focus groups were held in April and May of 2021, each lasting two hours. In the focus groups, we reviewed (1) what was the strategy or plan of AFS and what risks were considered, (2) identified what happened, (3) examined why things happened, and (4) formalized the learning by asking: what AFS leadership take-away as a team was and what lessons learned must be shared with others (WHO, 2019).

Given the aftermath of the third wave of COVID-19, focus groups were held digitally. In the first focus group, we focused on the pre-lockdown phase (before March 16, 2020), in the second focus group on the lockdown phase (between March 16 and May 2020), and the third focus group revolved around the two reopening phases (May to June 2020). Participants of the focus groups were briefed on key events in each period of the first wave of the COVID-19 pandemic. We presented network plots for each period showing with whom the Antwerp leadership team of the Fire Service and the fire chief affiliated during the pandemic. We obtained and documented informed consent for each participant attending the focus groups.

Finally, we interviewed the AFS Fire chief for three hours in July 2021. On the one hand, this interview promoted the use of another data collection method, allowing us to explain different aspects of collaborative efforts in the AFS crisis response network. On the other hand, it provided us with the means to validate the results found in the social network analysis and the after-action review. In doing so, we attempted to develop a complete picture and cross-check evidence.

In Table 2, we present a summary of the types of collected data.

Data analysis

Data were analyzed following three steps. First, we conducted a social network analysis with whom the leadership team of the Antwerp Fire Service and the fire chief affiliated during the first wave of the pandemic. We constructed five 102 * 102 one-mode adjacency matrices for each pandemic's subperiod/phase of the first wave. Note that these matrices are largely unconfirmed because a present tie between a pair of actors was recorded based on secondary sources from the Antwerp Fire Service. This is a weaker standard for measuring the presence of relationships than treating a relationship as present only if both actors report a relationship (Huang & Provan, 2007a).

We opted for degree centrality as an egocentric measure of actor involvement in the crisis response network for each phase because we are interested in direct connections between and among actors (Huang & Provan, 2007b). For non-directional graphs, degree centrality is the number of links connected to that actor. Given that we are dealing with directional graphs, we opted for degree centrality by normalizing indices through division by the sum of all scores, viewing indices as percentage values (Baur, 2008: 36). We also computed a Herfindahl index / Blau's index to measure the composition of differences in levels among network actors (see table 1) to discern variety in hierarchical differentiation of actors in the AFS crisis response network (Harrison & Klein, 2007; Huang & Provan, 2007a; Gulati et al., 2012). Furthermore, we used network density as a network measure of network structure. Network density measures the overall connectedness among actors in a network (Wasserman & Faust, 1994; Provan et al., 2007); the higher the density score, the more connected the network.

We used Visone v.2.23 (Brandes et al., 2004; Brandes et al., 2006) to produce the network measures and visualize five network plots. Except for the network plot of the first wave (all periods), we used a centrality node layout using the degree of centrality as a value for nodes and the frequency of relationships as a value for ties. In the network plots of the four phases, node size is based on the degree centrality (%) measure. Network ties were manually classified into three categories indicating relationship strength based on frequency: category (1): 1-5 interactions, category (2): 6-10 interactions, and category (3): 10+ interactions. AFS actors are displayed in red, and other network actors are shown in cyan.

In the second step of the data analysis, we conducted a data-driven thematic analysis (Dixon-Woods et al., 2005) to analyze the After-Action Review of the focus groups. Focus groups were non-verbatim transcribed and coded (Corbin & Strauss, 1990). We first conducted open coding of the best practices, gaps, and lessons learned from the AAR by breaking textual data into discrete parts and labeling them accordingly. This yielded 20 codes for 172 coded buckets of text identifying various themes and insights from the focus group discussions on the (1) extent the AFS crisis response was efficient and (2) determine whether the AFS crisis response was adequate. Then, we applied axial coding to integrate, translate, and connect various codes representing textual data. Finally, we selectively integrated the different codes into four main themes reported in the findings: challenges, crisis modus, network tensions, and network management.

As a final step, we conducted a member check with the fire chief to determine the accuracy of findings on network tensions and network leadership practices. We triangulated the findings of the social network analysis and the thematic analysis using pattern matching to link found patterns with theoretical patterns (Trochim, 1989). To

build credibility, we presented the case study findings and asked the fire chief to affirm that the results reflected his views and experiences to validate the findings and enhance the credibility of the research by mitigating that the findings may be influenced by the researchers' own biases and interpretations. However, given the research design of a single case study and the unique circumstances of the COVID-19 pandemic, the case study findings reported cannot be generalized to other cases or populations, nor might the findings apply to other situations like non-crisis.

Case study findings

In figure 1, we plot the AFS crisis network for the first wave of the COVID-19 pandemic (20 weeks across all periods), and in figures 2-5, we present the network plots of each of the four phases of the first wave of the COVID-19 pandemic. In the network plot of Figure 1, we can distinguish the AFS leadership team in the core (red nodes), AFS actors in the marge of the network plot (red nodes), and non-AFS actors in the periphery (cyan nodes at the edge of the network plot).

--- Figure 1 around here ---

Comparing the network plots (figures 2-5), we find that the AFS leadership team intensively interacted with predominantly each other in the pre-lockdown phase and the lockdown phase (larger, red-sized nodes), but that this interaction became less intense in the two reopening phases since, during the summer months, the rhythm of crisis meetings became less frequent than the daily rhythm of crisis meetings prior. This corresponds with the three categories of tie frequency shown in Table 3. A possible explanation for this is that the first two phases in the first wave of the COVID-19 pandemic concentrated on taming the wicked problem requiring more interactions.

--- Figures 2-5 on a separate page around here ---

Network tensions

The focus groups reveal that the AFS's goal was to guarantee service delivery and continue business processes. Its focus was twofold: 1) to support society and perform its task as an emergency service, and 2) to keep its employees safe and healthy and guarantee business continuity. The AFS leadership team identified that COVID-19 infections among firefighters could threaten operational readiness. Its leadership, therefore, developed an operating model with minimum employees needed to execute public services to mitigate this risk. Operational continuity was determined based on the occupation of fire posts, emergency and non-operational vehicles, and safeguarding arrival times to deliver an adequate and fast response to a range of threats in the various areas of the Antwerp zone.

To accomplish its goal, the AFS leadership team relied on its crisis response network for joint planning and effort with other organizations to address the consequences of the COVID-19 pandemic. In doing so, they were confronted with network tensions that necessitated a response from leadership. We summarize the findings of the thematic analysis on network tensions and network leadership practices in Table 5.

--- Table 5 around here ---

Efficiency-inclusiveness

The AFS worked in a top-down structure during the first pandemic wave, with the strategic leadership team being the central apex of the fire service organization. From the onset of the pandemic, the fire chief involved all directorates (risk management, operations, logistics, human resources, innovation and technology, finance, staff, and policy cell), increasing differentiation in contributions to the crisis team meetings.

To safeguard efficiency in decision-making, the AFS leadership team followed an incident command system based on facts, actions, and needs (FAN). Officers in the leadership team with crisis experience helped less experienced staff members to get acquainted with this system. In addition, efficient decision-making was increased by tiering the AFS leadership team. The fire chief, supported by his deputy and policy staff from the policy cell, mainly focused externally on collaborative governance. In contrast, other directors in the AFS leadership team were primarily focused on the strategy and operations of the AFS.

Consequently, this meant that it was predominantly the fire chief who participated in external meetings, as shown in the network plots (Figures 2-5). The fire chief (AFS42_X)[3] is the most central actor during the first wave of the pandemic. Although other leadership team members mainly focused on the AFS, the network plots in Figures 2-5 show that a few AFS directors (larger, red nodes) did maintain contact with external partners (cyan nodes).

Note also that the "external" ties between the fire chief and non-AFS actors became more frequent in the lockdown and reopening phases (cf. Figures 2-5). During these two phases, the number of actors dropped in the AFS crisis response network from 70 to 53, while the number of ties remained almost similar. This suggests a tendency to include fewer actors from different policy levels in the AFS crisis response network and that the relationships between the fire chief and external actors grew more intense.

Internal-external legitimacy

Although the fire chief played an essential role as a broker of information within the

[3] With permission, we may disclose that AFS42_X is the fire chief.

AFS crisis response network throughout the first wave of the COVID-19 pandemic, another broker (FED39_O) appeared on the scene in the second reopening phase, interconnecting non-AFS actors. The second reopening phase's network plot shows that these brokers are not connected (AFS42_X and FED39_O). This illustrates a situation of bargaining power within the crisis response network (see Figure 6).

On the federal level, the federal crisis centre must coordinate and facilitate the crisis response system by law. However, during the focus groups, it became apparent that the AFS perceived them as needing to be more bureaucratic, focusing primarily on central coordination, and less willing to involve other partners like the fire services in the decision-making process. Although the federal crisis centre was daily in the news as they took the lead in the communication about the evolution and the consequences of the pandemic, they were perceived by the public media as being part of the federal department of health rather than the central coordinator of crisis management on a national level. According to some AFS participants in the focus groups, the federal crisis centre needed a clear general purpose and strategic foresight. This challenged the alignment of decision-making between the various policy levels of the (local) governments and provinces, creating the perception of an extra layer of red tape obstructing a swift decision-making process.

The AFS leadership team experienced that the fire services were only sometimes a priority at the Federal policy level. Understandably since initially, the pandemic was framed as a medical crisis on a global scale affecting an exceptionally high proportion of the population. However, this was different at the municipal and provincial levels, in which the AFS was an integral part of governmental bodies in developing and implementing a crisis response to deal with the pandemic. As a result, collaboration

among network members in the province of Antwerp increased, while cooperation with the federal crisis centre was initiated at a later stage.

In terms of legitimacy, the words and actions taken by the governor of the province of Antwerp received greater importance in the organizational field of the province of Antwerp (media, relationship with majors, local authorities, and the like) than those of the federal crisis centre. From May 2020 on, when the sanitary regulations were promised to be eased in Belgium, the governor's credibility was espoused by the decision to enforce additional provincial measures for the province of Antwerp on top of the federal measures on the 29th of July 2020 against the COVID-19 pandemic. This strengthened the governor of Antwerp's role as a network leader even more. At the same, this also gave birth to paradoxical challenges for those concerned with the functioning of other networks and organizations in the province of Antwerp and Flanders. Especially since this order was unique in Flanders, capturing (international) media attention and challenging the credibility of the Federal crisis centre.

Flexibility-stability

In the focus groups, it became clear that mixed signals were obtained across organizational boundaries from various policy levels: municipal, provincial, and federal. For example, within the AFS, it is common for employees to be volunteers at other fire departments allowing them to cross-check information and decisions from multiple sources. Most AFS crisis response network members know each other through prior crisis management, education, training, and crisis simulation exercises. On the one hand, this increased trust and familiarity with each other's work processes. Still, on the other hand, this also required that the AFS continuously needed to bridge differences between its members and others in the AFS crisis response network.

Another example that provided mixed signals was verifying information through news media. The AFS, like its employees, waited for the federal government to see what updates and changes in policy, rules, and regulations transpired. Consequently, all AFS crisis response network members continuously controlled noise from internal and external sources to make sense of the pandemic. This meant maintaining stability at the organizational, inter-organizational, and network levels due to uncertainty derived from limited foresight.

However, as the first wave of the pandemic evolved, AFS changed its approach to actively trying to make sense of its environment. Before reopening, they always abided by the federal government policy changes. During the reopening phases, they still scanned for signals but now implemented policy, rules, and regulations only when that made sense to them. To make such interpretations, AFS developed its colour signal system to translate new information and policy changes and bring out meaning to its employees on how to behave. The colour signal system provided stability during a disruptive change in the workplace, allowing the AFS leadership team to keep employees calm, act rationally, and adapt effectively as the situation evolved. Using this system, AFS found a way to overcome the need for a federal framework. Instead, it developed a modus operandi for understanding how to best deal with the current situation, allowing them to act proactively during the first wave. However, this also required the AFS leadership team to continuously frame basic agreements and procedures on sanitary actions in line with operational readiness since its colour signal system was not in accord with the federal government regulations that many members in the AFS crisis response network did adhere to.

The AFS leadership team aimed to create redundancies throughout the organization to improve flexibility. Based on the focus groups, the AFS loosened staff

working hours to reassure employees by affirming their roles and tasks rather than making eight hours daily. Moreover, the AFS set up a pandemic budget to secure resources, e.g., for spending on protective equipment for the workforce. Another example of building in redundancy was the AFS leadership team dividing itself into two groups (A and B) during the lockdown phase and assigning each director a replacement. This was either an officer or senior staff member given a secondary role in addition to its primary role within the AFS.

Externally, members of the AFS leadership team worked with partners across different policy levels to enhance the capacity of the crisis response network. For instance, all fire services in the Flemish region had to coordinate and compromise on what they were doing in terms of education, training, and exercise. Another example involved a close collaboration and alignment among the fire chiefs of the five zones within the Province of Antwerp – initiated and coordinated by the governor. On the municipal level, a continuous alignment tactically occurred between the AFS fire chief and the director of urban security of Antwerp, and a regular alignment on strategic and tactical decisions between the fire chief and the CEO of the Port of Antwerp. In each meeting, the fire chief needed to bridge differences and frame procedures of the AFS. A deviant procedure was allowing for exercise by firefighters before the reopening, even though federal regulations did not yet permit this. This meant the fire chief was continuously finding a balance between following measures, making compromises, and not causing too much friction among various network partners in the crisis response network without jeopardizing the AFS's goals.

Discussion

Where do network tensions come from?

This study aimed to draw attention to how network leadership manages network-level tensions shaped and constrained by environmental and population dynamics of the organizational field in which networks and their members are embedded. The case study findings provide insights into the three network tensions: efficiency-inclusiveness, internal-external legitimacy, and flexibility-stability. Although Provan and Kenis (2008) originally referred to these tensions as 'predominantly' internal network situations where two or more seemingly opposing forces or ideas simultaneously existed, the results indicate that external interactions influenced these network tensions.

We found that tension exists between the need for efficiency and inclusiveness in the AFS crisis response network concerning its tendency to include fewer actors from different policy levels over time to improve its decision-making. However, doing so led to unintended consequences for inclusiveness and support from actors in the broader organizational field. The case study also showed a tension between internal and external legitimacy at play in the Antwerp province. Based on the focus groups, it was established that multiple AFS and non-AFS actors continuously were identifying situations in which actors had the right to exercise power or authority over others and whether actions conducted were just, fair, and consistent with the current (newly) established norms and values of the COVID-19 pandemic. Finally, the flexibility-stability tension was also found in the AFS crisis response network referred to a situation in which, on the one hand, the network resisted changes. On the other hand, the network adapted to changes depending on which priorities were dominant at that

time. The AFS crisis response network was in constant turmoil to achieve stability and flexibility as new information required different trade-offs and design considerations.

This case study indicates that recognizing tensions requires not only an understanding of the different 'internal' network forces at play but also the ability of the network to identify situations where these forces conflict with each other. This aligns with Bryson et al. (2023) idea that collective goods or, in their words, *leading social transformations* require multi-issue, multi-level, multi-organizational, and cross-sectoral changes. But this calls for moving beyond conceptions of leadership that revolve around the individual leader (Brugghemans et al., 2021) to highlighting the plural of leadership (Sergi et al., 2023). The findings show that these situations originated internally in the AFS leadership team (the organization that participated in the AFS crisis network) and externally through interactions between the fire chief and non-AFS actors in and outside the boundary of the AFS crisis response network. To respond to network tensions, 'network' leadership needs to identify the underlying causes and develop strategies to navigate change and uncertainty within and across messy network boundaries.

Network tensions and leadership practices

The findings of the relational and structural pattern of the AFS crisis response network suggest that network leadership and members must understand as much as possible about whom to work closely with since competing logics can stem from different fields through joint efforts of organizations from different policy levels having multiple network memberships and overlapping network involvement. Lacking this understanding inhibits leadership to cocreate (Uhl-Bien, 2021). This calls for explanations of where network tensions come from (Berthod & Segato, 2019) and how network leadership practices can deal with network tensions (cf. Bartelings et al., 2017;

Cristofoli et al., 2019; Cepiku & Mastrodascio, 2021).

The efficiency-inclusiveness tension revolves around decision-making processes both within and between networks, a need to balance administrative efficiency, and member involvement (Provan & Kenis, 2008). To deal with this network tension, the AFS leadership team aimed to increase differentiation by expanding the team and increasing efficiency by employing an incident command system to cope internally. Moreover, the team functionally differentiated itself into two tiers, one focusing specifically on dealing with collaborative governance in various networks of which the AFS is a member. The implication for the AFS crisis network was that the AFS leadership team prepared itself to deal optimally with the COVID-19 pandemic. A future avenue of (network) leadership practices is how a network can cope with network members adopting different strategic and adaptive approaches in addressing efficiency and inclusiveness simultaneously and how a sense of urgency is created around when to address efficiency, inclusiveness, or both.

A suggested solution to mitigate the efficiency-inclusiveness tension is using multiple layers of vertical complexity within a network's governance structure (Vermeiren et al., 2021). Vermeiren et al. (2021, p. 16) argue that "a balance between inclusiveness and efficiency in the decision-making process can be established by a leading agent acting as a steward and mediator in the network, a core steering committee with decision-making authority and working groups." Applying such a solution means the network becomes stratified and hierarchically differentiated in roles reducing coordinative complexity and motivating members' participation (Gulati et al., 2012). From an external network perspective, the difference lies in the conception of the hierarchy of means-and-ends decisions to attain a purpose. Organizations participating in a network make decisions about courses of action to be taken for achieving a network

purpose; these decisions accordingly define the outcomes that other networks in the organizational field will seek to achieve by making their own decisions about actions to be taken, actions that in the aggregate will become the means to achieve higher-level (field) goals.

Consequently, there will be a need for a "balcony" to review and coordinate the decisions made by a population of networks in the field because of uncertainty surrounding field decision-making processes about which network purposes are more important and what resources should be used to pursue a given objective. In previous work, such a balcony has also been termed a "network of networks" (cf. Nowell et al., 2019; van den Oord et al., 2020). A vital network leadership practice involves developing a judgmental strategy of whom to assemble on the balcony; that is, the determination of exclusivity to decision rights in the organizational field. The more exclusive the access to the balcony is, the more efficient the decision-making processes will be by reducing the number of organizations, potentially limiting multiple memberships and overlapping network involvement. Contrarily, this will reduce the network of networks' influence in the organizational field.

Another implication of this case study is that network leaders and members must respond to and manage network-environment dynamics. The pandemic's first wave has shown that the nature and variety of institutional processes can manifest in network tensions. The AFS and other organizations have faced multiple institutional demands ranging from regulative, normative, or cognitive that prescribe what constitutes what is appropriate and what is not. Having numerous network memberships as an organization can impose different pressures than when organizations are involved in only a few networks. Especially if demands of in- and outsiders of networks are misaligned, a situation of institutional complexity is created that instigates different strategic

behaviours that organizations enact in direct response to the institutional and network processes that affect them.

Concerning network leadership, future research needs to establish what effective leadership practices reside in the complexity and systemic dynamics when we move from the organization unit of analysis to the network as a whole (Uhl-Bien & Arena, 2018; Ospina et al., 2020). In the latter case, the nature and variety of institutional processes will become manifold, requiring the need to communicate the importance of addressing tensions to employees and stakeholders. What strategic and adaptive network leadership practices are required to effectively manage opposing forces most likely derived from numerous network memberships and network involvement?

Regarding internal-external network legitimacy, network leadership must determine situational awareness given the general perception of in- and outsiders within and across organizational domains. This requires developing a relational capacity responsive to internal and external legitimacy needs (Provan & Kenis, 2008). Network leadership must be able to switch between different strategies to respond to competing logics without damaging its reputation (Human & Provan, 2000). The latter is essential, mainly if networks depend on in- and outsiders to provide access to scarce resources.

In addition, to considering under which circumstances network leadership assembles "on the balcony," it is also essential for network leadership to anticipate the composition of differences in lateral position and differences in the kind of resources held among network members since this can inform a particular choice in adopting a governance mode that can impact how networks function and develop over time (Provan & Kenis, 2008; Herranz, 2009; Provan et al., 2011) or what stabilizing activities networks need to employ to mitigate the trade-off between flexibility and stability (Cristofoli et al., 2019). For instance, assembling network members from

networks that differ in their inception (e.g., voluntary versus mandated), different developmental phases (e.g., emergence, transition, maturity, and sustainment or demise), and modes of governance (e.g., shared-participant, lead-organization, or network administrative organization) can reduce cohesiveness, trigger conflict and distrust, or even lead to withdrawal (Harrison & Klein, 2007). As such, this confronts network leadership to deal with power bargaining among a set of networks in an organizational field (Saz-Carranza et al., 2016), coalescing and oscillating different modes of governance between them (Provan & Kenis, 2008; Berthod et al., 2016), and responding to institutional complexity by bridging differences, framing basic agreements and procedures, and enhancing network competencies of this set of networks as well as with the broader network ecology in the organizational field (Saz-Carranza & Ospina, 2011; Nowell et al., 2019; Nowell & Albrecht, 2023).

Conclusion

The case study aimed to reconsider where network tensions come from and examine how network leadership identifies and leverages opportunities and threats across messy network boundaries over time. By examining the AFS crisis network in conjunction with other networks and organizations in the organizational field of the province of Antwerp, we aimed to understand how network-level tensions arose, what role network leadership played, how they recognized and responded to them, and whether their origin matters.

Based on Social Network Analysis, we showed how the leadership team of the Antwerp Fire Service and the fire chief affiliated during the first wave of the pandemic. The analysis showed that the AFS crisis response network developed from a core-periphery network to a smaller, denser network. The fire chief acted as the most central

actor in the network through the first wave of the COVID-19 pandemic. The case study furthermore found various indications of the three network tensions: efficiency-inclusiveness, internal-external legitimacy, and flexibility-stability. The case study findings indicate that external interactions influenced these network tensions. As such, this case study shows that network tensions require not only an understanding of the different 'internal' network forces that are at play but also the ability of the network to identify situations where these forces conflict with each other.

The case study design has limitations. First, our focus on a single network may limit the generalizability of our findings. A disadvantage is that we drew heavily on the recollections and views of the AFS leadership team involved in the After-Action Review, making our findings suggestive. Although we used several secondary data sources to analyze the AFS crisis response network, this data may need to be completed and need more accuracy. Furthermore, the data uncovered an overall pattern in relationship evolution that had to be interpreted. Despite that, we corroborated the results of the sampling approach and inferences of the case study. Future network research needs to collect full relational data, preferably over multiple waves of data collection (cf. Provan & Huang, 2012), and capture the views of different network agents. It requires an in-depth empirical analysis tracking the evolution of relational ties and network leadership practices (Berthod et al., 2017).

Considering these limitations, this study presents a first step in reconsidering network tensions. While further work is needed, we outline how network leadership dealt with network-level tensions across messy network boundaries. The theoretical contribution of this case study is that we draw attention to how network tensions are shaped and constrained by internal network characteristics and environmental and population dynamics of the organizational field in which networks and their members

are embedded. This provokes a reconsideration of organizational networks as closed systems, and future network and leadership theories need to consider that multiple network memberships and overlapping network involvement can potentially evoke contradictions through interactions among networks and their members.

From a practical perspective, this case study implies that the art of network leadership, whether we are dealing with network management in or network management of, requires investigation of where network tensions originate from and that multiple network memberships, overlapping network involvement, and broader network-environment relationships can influence how network leadership responds and manages network tensions. We hope our work will stimulate further research on network tensions and network leadership.

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Appendix

Descriptive analysis

Tables 3 and 4 present the comparative statistics of the AFS crisis response network during each period following the Belgian crisis phases of the first wave of the COVID-19 pandemic.

--- Table 3 around here ---

Table 3 shows that the number of actors in the AFS crisis response network declined from 75 to 40 over 20 weeks—concerning the pre-lock down towards the second reopening phase. The number of ties in the network remained similar for the first three phases (the pre-lockdown phase, the lockdown phase, and the first reopening phase) but dropped significantly in the second reopening phase. Table 3 also portrays low-density scores of the AFS crisis response network across the first wave of the COVID-19 pandemic, except for the first reopening phase.

--- Table 4 around here ---

Table 4 presents the number of actors and proportions for six levels in relation to the AFS crisis response network. The ratio of actors for each level is displayed in brackets. These levels are the Antwerp Fire Service level (AFS), the Antwerp municipality (ANT), the Province of Antwerp level (PRA), Flanders (FLA), and the federal level (FED), and the international level (INT).

In addition, we also display Blau's heterogeneity index as a measure of diversity with ranges from 0-1, with higher scores indicating more heterogeneity. The scores indicate the probability that two randomly selected actors from the AFS crisis network (N=102) belong to different levels. Table 4 shows the network composition of actors throughout the first wave of the COVID-19 pandemic and illustrates how the AFS crisis

response network's heterogeneity at different levels fell, indicating different network compositions of actors across the four periods in the first wave of the COVID-19 pandemic.

A recurrent theme in the focus groups with the AFS leadership team was the main challenges arising from the COVID-19 pandemic, including the supply of protective equipment, face masks, alcohol gel, and cleaning material. AFS did not have prior experience with a worldwide spread of a viral respiratory disease, so they were confronted with purchasing goods or services in new markets and dealing with suppliers. In addition, to setting up the procurement of goods and services, AFS was also confronted with implementing new rules and regulations to make work environments safe, and people behave safely. This created uncertainty because laws and regulations changed constantly. Moreover, employees were confronted with news updates at work and home, creating ambiguity.

Additionally, the AFS leadership team addressed the organization's transition to working from home in the focus groups. Although AFS already started with part-time working from home before the pandemic, the lockdown increased the pace of this transition tremendously. Working from home, however, stratified the fire services into two groups: firefighters and staff. Each group was confronted with different issues creating different routines, rhythms, and pressures within the organization. This resulted in various leadership challenges regarding coordinating tasks and cooperating between the two groups. Work activities like meetings and physical mail had to be digitized. Necessitating that leadership develops other ways to inform and motivate staff to execute tasks. Contrarily, firefighters were eligible to work at fire posts if fire brigades remained isolated, which created, on the one hand, a false sense of business, as usual, while on the other hand, conflicting working demands between firefighters and staff.

Tables

Table 1

Pseudonymous actor list of the AFS crisis response network

	UID	Category	Type of actor
1	AFS1_X	(1) Antwerp Fire Service	Individual
2	AFS2_G	(1) Antwerp Fire Service	Group of individuals
3	AFS3_G	(1) Antwerp Fire Service	Group of individuals
4	AFS4_G	(1) Antwerp Fire Service	Group of individuals
5	AFS5_X	(1) Antwerp Fire Service	Individual
6	AFS6_X	(1) Antwerp Fire Service	Individual
7	AFS7_G	(1) Antwerp Fire Service	Group of individuals
8	AFS8_U	(1) Antwerp Fire Service	Unit
9	AFS9_U	(1) Antwerp Fire Service	Unit
10	AFS10_U	(1) Antwerp Fire Service	Unit
11	AFS11_U	(1) Antwerp Fire Service	Unit
12	AFS12_U	(1) Antwerp Fire Service	Unit
13	AFS13_X	(1) Antwerp Fire Service	Individual
14	AFS14_X	(1) Antwerp Fire Service	Individual
15	AFS15_X	(1) Antwerp Fire Service	Individual
16	AFS16_X	(1) Antwerp Fire Service	Individual
17	AFS17_X	(1) Antwerp Fire Service	Individual
18	AFS18_X	(1) Antwerp Fire Service	Individual
19	AFS19_X	(1) Antwerp Fire Service	Individual
20	AFS20_X	(1) Antwerp Fire Service	Individual
21	AFS21_X	(1) Antwerp Fire Service	Individual
22	AFS22_U	(1) Antwerp Fire Service	Unit
23	AFS23_G	(1) Antwerp Fire Service	Group of individuals
24	AFS24_G	(1) Antwerp Fire Service	Group of individuals
25	AFS25_G	(1) Antwerp Fire Service	Group of individuals
26	AFS26_G	(1) Antwerp Fire Service	Group of individuals
27	AFS27_U	(1) Antwerp Fire Service	Unit
28	AFS28_U	(1) Antwerp Fire Service	Unit
29	AFS29_U	(1) Antwerp Fire Service	Unit
30	AFS30_U	(1) Antwerp Fire Service	Unit
31	AFS31_U	(1) Antwerp Fire Service	Unit
32	AFS32_U	(1) Antwerp Fire Service	Unit
33	AFS33_U	(1) Antwerp Fire Service	Unit
34	AFS34_U	(1) Antwerp Fire Service	Unit
35	AFS35_G	(1) Antwerp Fire Service	Group of individuals
36	AFS36_X	(1) Antwerp Fire Service	Individual
37	AFS37_U	(1) Antwerp Fire Service	Unit
38	AFS38_U	(1) Antwerp Fire Service	Unit
39	AFS39_U	(1) Antwerp Fire Service	Unit
40	AFS41_U	(1) Antwerp Fire Service	Unit
41	AFS42_X	(1) Antwerp Fire Service	Individual
42	AFS43_X	(1) Antwerp Fire Service	Individual

Note:

Table 1 – continued

Pseudonymous actor list of the AFS crisis response network

	UID	Category	Type of actor
43	ANT3_X	(2) Municipality of Antwerp	Individual
44	ANT4_X	(2) Municipality of Antwerp	Individual
45	ANT5_X	(2) Municipality of Antwerp	Individual
46	ANT36_O	(2) Municipality of Antwerp	Organization
47	ANT42_U	(2) Municipality of Antwerp	Unit
48	ANT43_X	(2) Municipality of Antwerp	Individual
49	ANT44_X	(2) Municipality of Antwerp	Individual
50	ANT51_O	(2) Municipality of Antwerp	Organization
51	PRA6_O	(3) Province of Antwerp	Organization
52	PRA14_X	(3) Province of Antwerp	Individual
53	PRA15_O	(3) Province of Antwerp	Organization
54	PRA16_O	(3) Province of Antwerp	Organization
55	PRA25_U	(3) Province of Antwerp	Unit
56	PRA27_O	(3) Province of Antwerp	Organization
57	PRA28_O	(3) Province of Antwerp	Organization
58	PRA29_O	(3) Province of Antwerp	Organization
59	PRA30_O	(3) Province of Antwerp	Organization
60	PRA31_O	(3) Province of Antwerp	Organization
61	PRA34_X	(3) Province of Antwerp	Individual
62	PRA35_G	(3) Province of Antwerp	Group of individuals
63	PRA40_O	(3) Province of Antwerp	Organization
64	PRA46_U	(3) Province of Antwerp	Unit
65	PRA48_O	(3) Province of Antwerp	Organization
66	PRA49_G	(3) Province of Antwerp	Group of individuals
67	PRA56_O	(3) Province of Antwerp	Organization
68	FLA1_O	(4) Flemish community	Organization
69	FLA2_O	(4) Flemish community	Organization
70	FLA41_O	(4) Flemish community	Organization
71	FLA52_O	(4) Flemish community	Organization
72	FLA54_O	(4) Flemish community	Organization
73	FLA57_X	(4) Flemish community	Individual
74	FLA58_X	(4) Flemish community	Individual
75	FLA59_X	(4) Flemish community	Individual
76	FLA60_X	(4) Flemish community	Individual
77	FLA61_O	(4) Flemish community	Organization
78	FED7_O	(5) Federal level	Organization
79	FED8_U	(5) Federal level	Unit
80	FED9_O	(5) Federal level	Organization
81	FED10_X	(5) Federal level	Individual
82	FED11_U	(5) Federal level	Unit
83	FED12_U	(5) Federal level	Unit
84	FED13_X	(5) Federal level	Individual
85	FED17_X	(5) Federal level	Individual
86	FED18_U	(5) Federal level	Unit
87	FED19_U	(5) Federal level	Unit
88	FED20_X	(5) Federal level	Individual
89	FED22_O	(5) Federal level	Organization
90	FED26_O	(5) Federal level	Organization
91	FED32_O	(5) Federal level	Organization
92	FED33_O	(5) Federal level	Organization
93	FED37_O	(5) Federal level	Organization
94	FED38_U	(5) Federal level	Unit
95	FED39_O	(5) Federal level	Organization
96	FED47_O	(5) Federal level	Organization
97	FED50_O	(5) Federal level	Organization

98	INT21_O	(6) International level	Organization
99	INT23_O	(6) International level	Organization
100	INT24_O	(6) International level	Organization
101	INT45_O	(6) International level	Organization
102	INT55_O	(6) International level	Organization

Note:

Table 2

Type of collected data

Meeting notes studied	N=133
AFS crisis meetings AFS (FAN)	57
AFS crisis management logs (Pandemic)	13
AFS Operational cell meeting	1
AFS council meeting with Mayors	7
Provincial crisis meeting	1
Flemish fire service network	46
Multi-logs Federal Government Belgium	5
Other meetings	3
Other documents studied	N=5
Policy decisions Governing Council AFS	2
Operational cell guidelines	2
Communication event	1
Semi-structured interviews	N=1
Focus groups	N=3
Time period	27 February 2020—08 June 2020
	73 events

Note:

Table 3

Comparative statistics for the AFS crisis response networks during the first wave of the Covid-19 pandemic

Crisis phases	Subperiods	Number of actors	Number of ties	Weak vs. strong ties			Density
				Cat 1. 1-5 ties	Cat 2. 6-10 ties	Cat 3. 10+ ties	
Pre-lock down phase	27feb. – 18mar.	75	442	295	99	48	0.08
Lockdown phase	19mar. – 15apr.	70	429	339	62	28	0.09
Reopening phase 1	16apr. – 17may.	53	424	378	29	17	0.15
Reopening phase 2	18may. – 06aug.	40	109	109	0	0	0.07
The 1st wave of the COVID-19 pandemic	27feb. – 06aug.	102	727	480	76	171	0.07

Note:

Table 4

Comparative statistics for the AFS crisis response networks during the first wave of the Covid-19 pandemic

Levels	Actors in crisis response network Pre-lock down phase	Actors in crisis response network Lock down phase	Actors in crisis response network Reopening phase 1	Actors in crisis response network Reopening phase 2
AFS	35 (0,47)	30 (0,43)	27 (0,51)	20 (0,50)
ANT	6 (0,08)	7 (0,10)	6 (0,11)	2 (0,05)
PRA	9 (0,12)	11 (0,16)	7 (0,13)	5 (0,13)
FLA	8 (0,11)	7 (0,10)	4 (0,08)	5 (0,13)
FED	13 (0,17)	14 (0,20)	8 (0,15)	8 (0,20)
INT	4 (0,05)	1 (0,01)	1 (0,02)	- (-)
Total actors	75	70	53	40
Blau's index	0,72	0,73	0,68	0,68

Note: The proportion of network actors for each level is in brackets. The maximum of Blau's index is 0,9. Blau's index for the first wave (overall periods) is 0,75 for 102 actors. AFS = Antwerp Fire Service level, ANT = Antwerp municipality level, PRA = Province of Antwerp level, FLA = Level of Flanders, FED = Federal level, and INT = International level.

Table 5

Leadership practices to recognize and respond to network tensions

Network tension in the AFS crisis response network		Examples of leadership practices by AFS leadership team
Efficiency-inclusiveness	Decision-making	• Expand the leadership team by including all directors to increase differentiation • Employ an incident command system (FAN) to improve efficiency • Divide the leadership team into an internal and external tier to differentiate the team and improve efficiency functionally
Internal-external legitimacy	Perception	• Communicate to bridge differences and frame basic agreements and procedures • Broker information • Bargain power together with local and regional actors
Flexibility-stability	Change	• Increase flexibility by loosening employees' working hours • Increase buffering capacity by setting up a pandemic budget • Building redundancy by cross-functionality of leadership team members • Enhance the capacity of the network and its members by pooling resources and sharing best practices

Figures

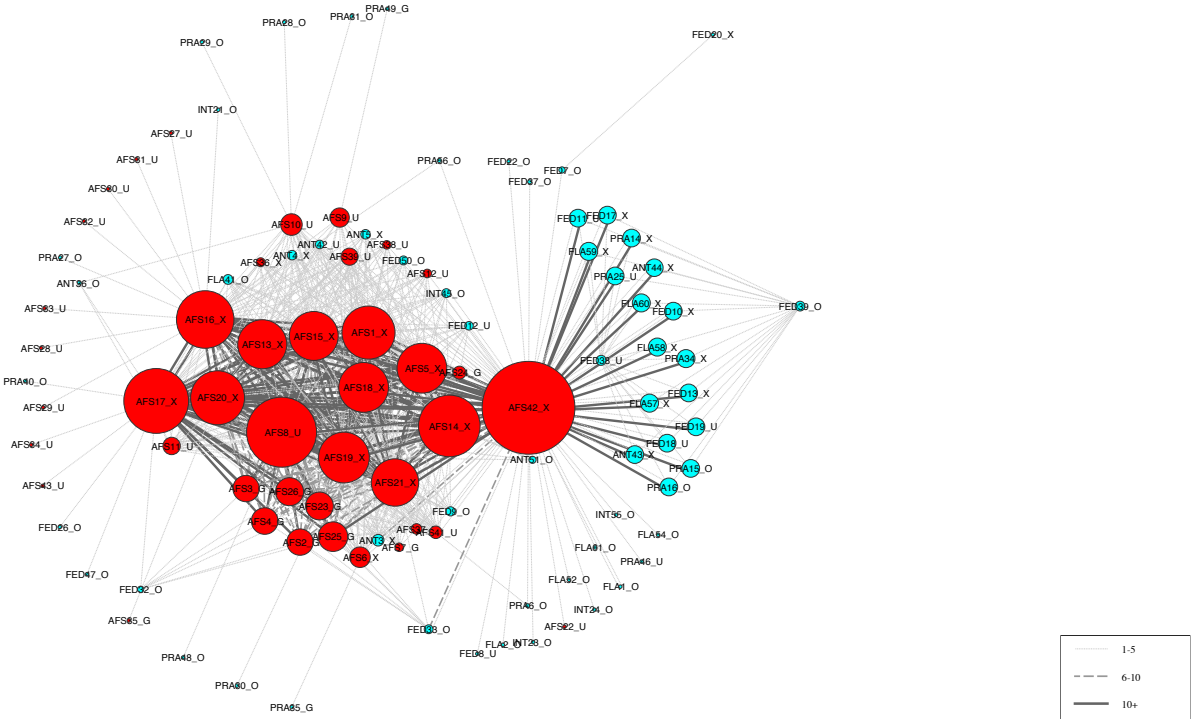


Figure 1: Network plot of the first wave, 27 Feb. – 06 Aug. 2020

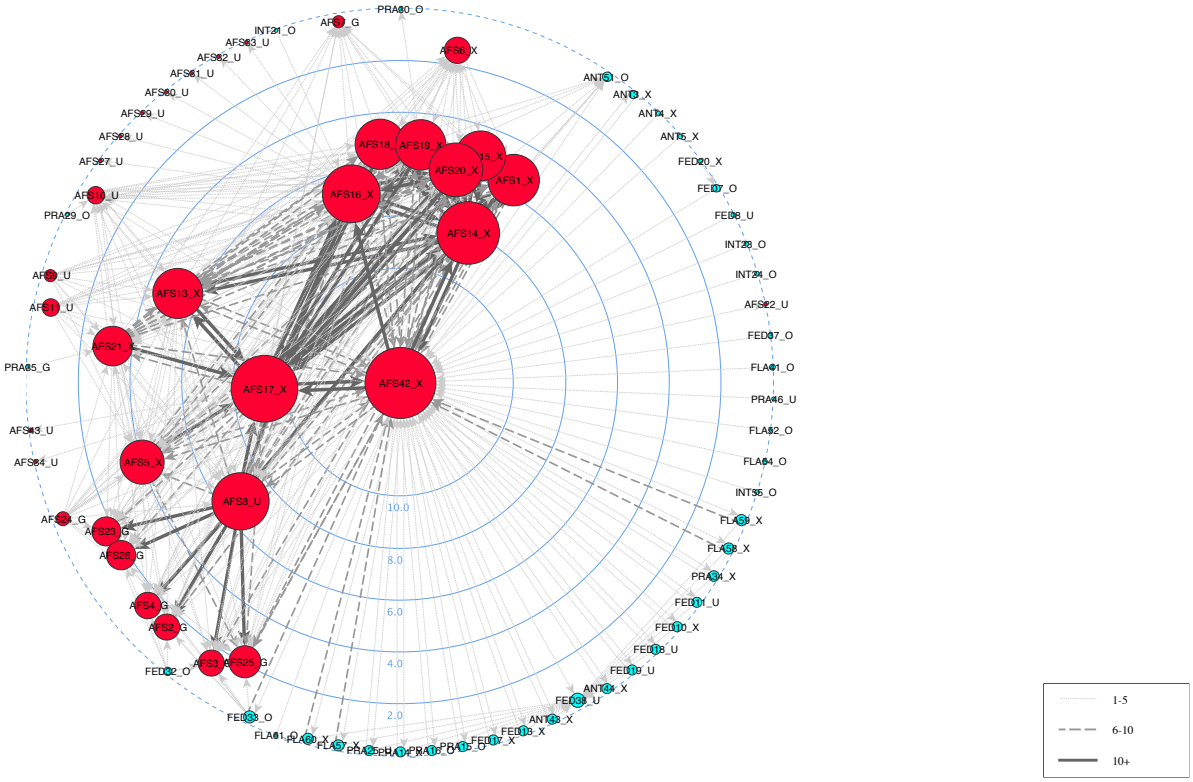
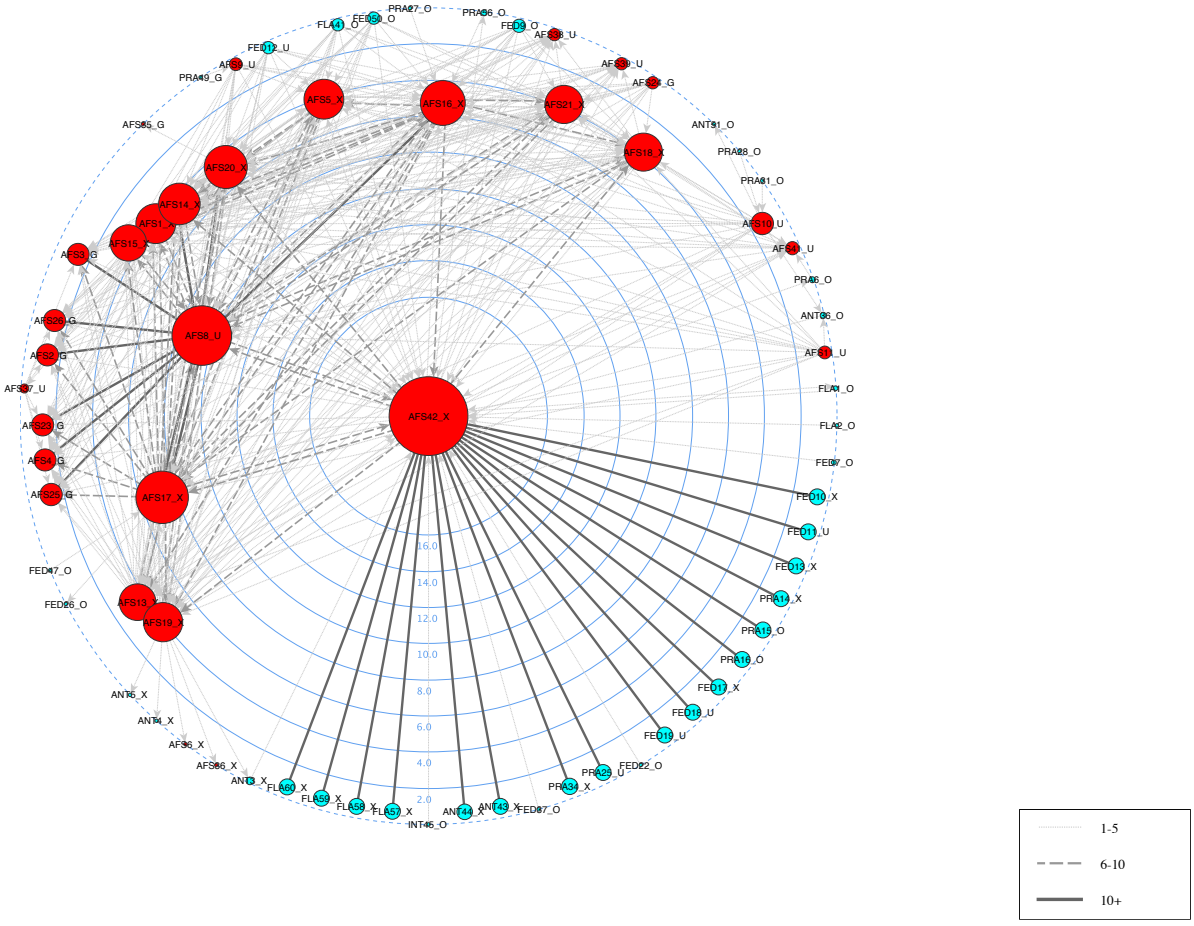
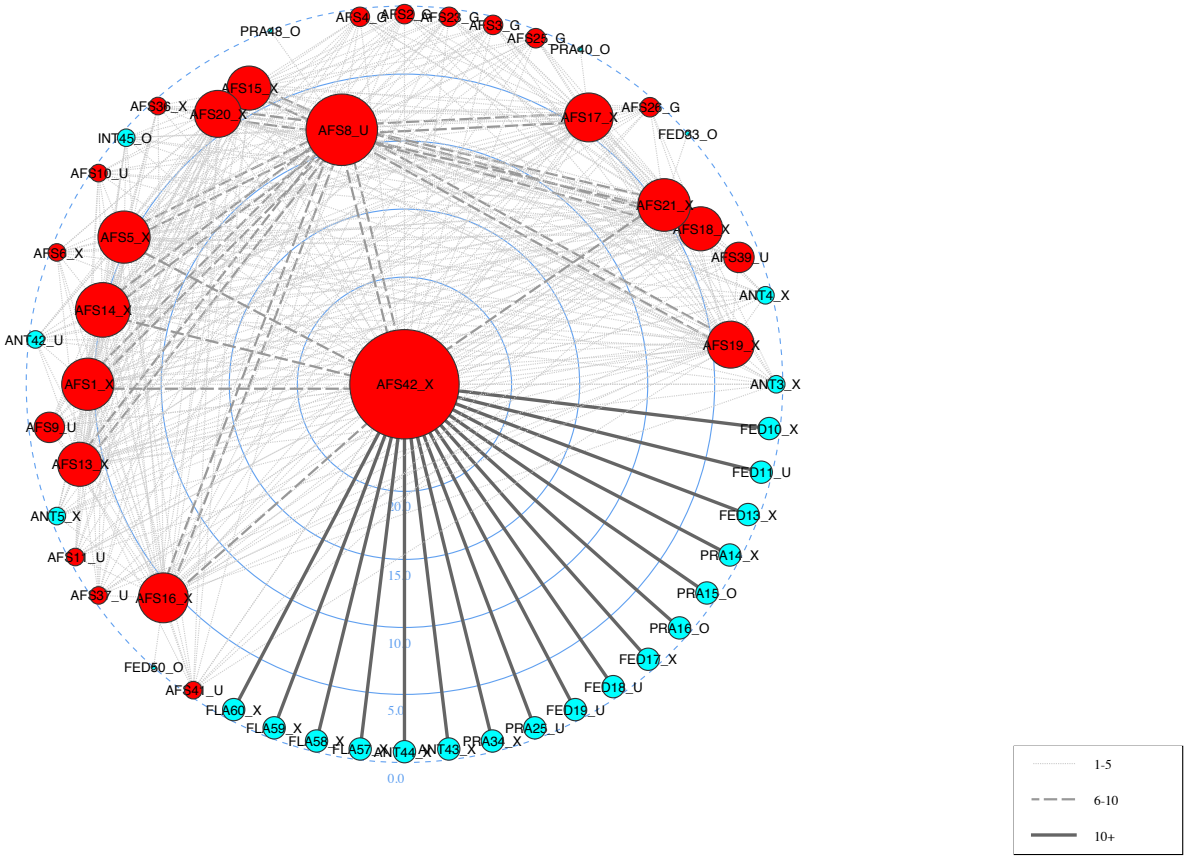


Figure 2: Network plot of pre-lock down phase, 27 Feb. – 18 Mar. 2020



1269

1270 Figure 3: Network plot of lockdown phase, 19 Mar. – 15 Apr. 2020



1271

1272 Figure 4: Network plot of reopening phase 1, 16 Apr. – 17 May. 2020

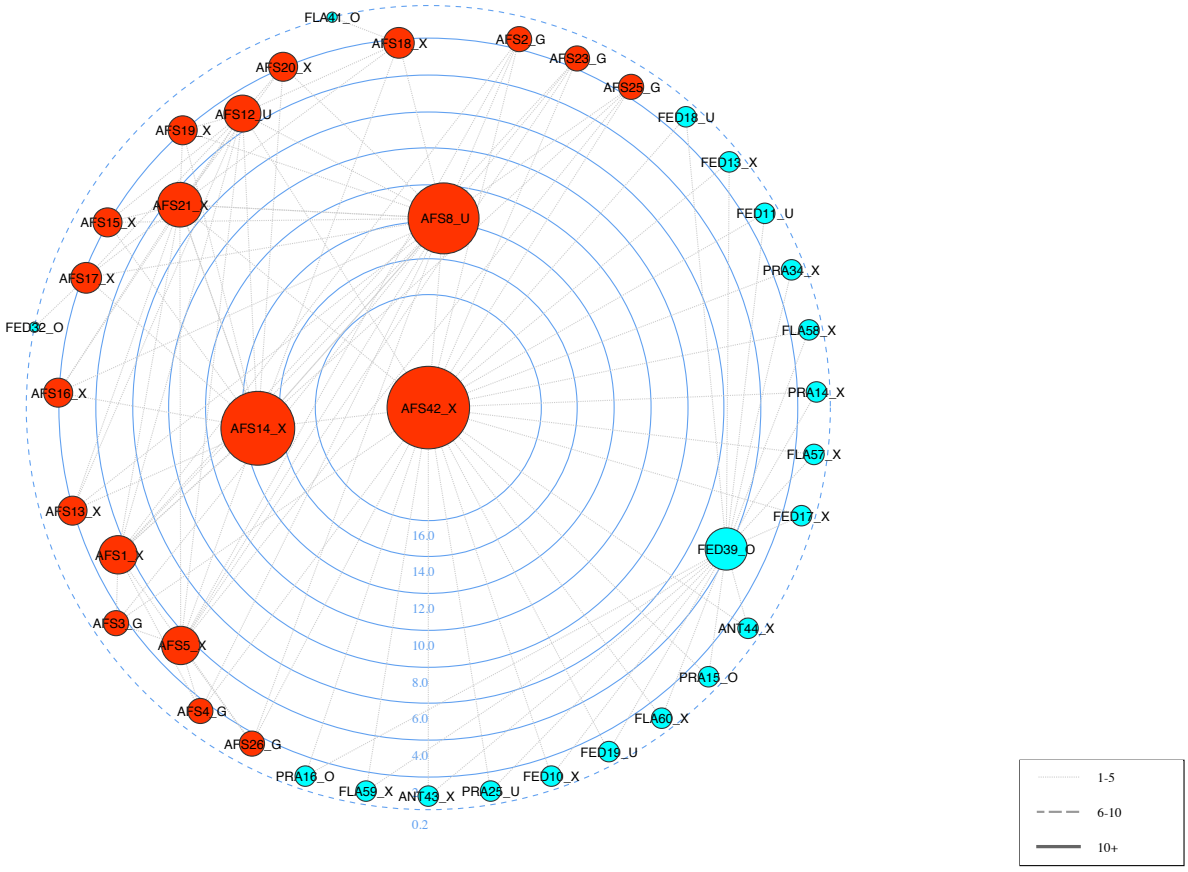


Figure 5: Network plot of reopening phase 2, 18 May. – 06 Aug. 2020

Network plots	Network descriptions
--- Figure 2 around here ---	Figure 2 plots the crisis response network in the pre-lock down phase. The network plot exhibits a cohesive, centralized group of AFS leadership actors. Except for actor AFS42_X, most of this core group interacts more frequently with each other than non-AFS actors. It is apparent in the plot that the leadership team is clustered in the center (AFS17_X) or the marge of the network (cluster of AFS actors in the top middle of the plot) with the AFS actor 17_X and AFS8_U occupying broker positions.
--- Figure 3 around here ---	The crisis response network in the lockdown phase is shown in figure 3. The crisis response network is decentralized, with most AFS leadership actors moving towards the marge-periphery of the network plot. Most apparent in this network plot is the central position and intensification of the interactions between AFS42_X and non-AFS actors (in cyan). In addition, the interactions between AFS17_X and others are less intense compared to the previous period.
--- Figure 4 around here ---	In figure 4, we display the network plot of the crisis response network in the first reopening phase. Most noteworthy in this network plot are fewer actors in the network. Nevertheless, we see a similar pattern during the lockdown phase in which AFS42_X occupies a central position interacting intensively with non-AFS actors and the AFS leadership actors being positioned in the marge/periphery of the network plot.
--- Figure 5 around here ---	Figure 5 shows the crisis response network in the second reopening phase. The crisis response network is decentralized, with only three AFS actors occupying a central position: AFS42_X, AFS14_X, and AFS8_U. Compared to the previous phase, this crisis response network is composed of fewer network actors as well as a lower number of interactions among network actors. What is clear is that the intensity of interactions in the network plot has become less frequent. Notice also that in the marge of the network plot AFS21_X and a non-AFS actor FED39_O are positioned, indicating their relative importance. Furthermore, we find that in the periphery of the network plot, the non-AFS actors FED32_O and the FLA41_O. Both network actors interact with an AFS actor, signaling a possible nomination of external influence.