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Organizational Networks, and Management of Disruptions in the Airline Ground Operation Process During Seasonal Crises

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Social embeddedness and social capital are important concepts for businesses that operate in a closed network like production and service districts (Staber & Morrison, 1999). These are also two basic concepts that shape the organizational networks theory (Sözen & Gürbüz, 2015). Granovetter (1985) with his rhetoric of social embeddedness argued that economic moves are embedded in long-term informal connections in a given network. Coleman (1988) also stated that there are long-term embedded informal relationships, which are called social capital, consisting of exchanges that are subject to connections between people who have the power to perform the desired action. Connections with whom one is linked, and exchanges via that connections thus become important (Christakis & Fowler, 2009, p. 27). Some of the exchanges, embedded in personal and business networks include information, ideas, advice, financial capital, and other resources (Baker, 2000, p. 1-2). Organizations aim to benefit from these exchanges through their managers' social capital. In this regard, the literature reveals that it is easier for organizations to access resources through social capital, and this has a positive effect on their economic performance and competitive advantage (Acquaah, 2007; Andrews, 2010; Chuang et al., 2016; Hoelscher et al., 2005; Westlund & Adam, 2010).

Airports are also service districts of the airline industry and companies operating in airports are actors in the closed networks of airports. The airline ground operation process that airports host entails the necessary services for take-off that airlines provide from suppliers within the limited time called the turnaround time between landing and taking off at the airport. This process involves independent actors performing different functions and working at the same time. The process becomes particularly complicated at non-scheduled airports and in cases of significantly sharp increases in the number of flights during peak periods in summer from the beginning of April to the end of October known as season term in the airline industry. The resources used in this process (slot, staff, parking position, staff, tools, equipment, etc.) are usually scarce and the actors are highly interdependent. This means that the informal relationships between actors are indispensable for the process to run effectively and efficiently (Fricke & Schultz, 2009, p. 1; Gittell, 2001). Otherwise, a possible disruption (flight delays and cancellations) means additional costs for actors that are already struggling with the high costs in the airline industry (Ball et al., 2010; Barnhart et al., 2010; Carlier et al., 2007). Actors that can easily access scarce resources using their informal relationships are less affected by the disruptions and the negative costs of the disruptions.

The aim of the study, in this context, is to investigate the formal and informal connections, and informal exchanges among the actors (airlines and the suppliers) in managing disruptions in the airline ground operation process during peak periods in summers that we called crisis times in this study. Network data were gathered from all actors (30 actors) directly operating in the airline ground operation process at Antalya Airport including airlines (10), representation and supervision companies (7), ground handlers (3), catering firms (3), fuel firms (2), airport security firms (2), MRO company (1), terminal

operator (1), and airport operator (1). Social network analysis was employed for the network data by benefiting from UCINET 6.0 software.

Studies on the airline ground operation process have received a lot of attention from researchers. The current literature mostly examined disruption management in terms of airline flight schedule redesign, parking position planning, gate planning, check-in counter planning, and such (Adacher et al., 2017; Khumboon & Isaradech, 2016; Lee et al., 2016; Malandri et al., 2018; Ornek et al., 2019; Qin et al., 2018; Tang, 2010). In addition, these studies mainly used several analytical models and decision support tools. However, we did not encounter a study investigating how airlines manage disruptions by using their informal inter-relationships with other actors in the ground operation process in the literature. We expect our study to fill this gap and provide significant contributions to the literature on inter-organizational networks and airline ground operation.

The rest of the paper includes the following sections. In the second section, we discuss the relating literature on organizational networks theory consisting of social embeddedness and social capital, and crisis management. In the third section, we explain our research methodology. While we present our findings in the fourth section, we conclude our findings, as well as explain limitations and suggestions for management practice and future studies in the last section.

Theoretical Background

The use of formal and informal connections by actors to achieve their goals is explained by the organizational networks theory (Zuckerman, 2014). These two structures within the organization, which are also reflected in the relations of the organization with other organizations, are inextricably intertwined. It is emphasized that the two structures should be investigated together to understand the nature of an organization and its connections with other organizations (Blau & Scott, 1962 as cited in Baker et al., 2002). At this point, organizational networks theory deals with connections established through social networks at the organizational level. Accordingly, organizational networks are informal networks of connections that managers establish in time with managers of suppliers or competitors. As managers get involved each other's social networks, overlaps occur in friendship networks and business connections. This makes the relationship between them more binding, more stable, and more predictable and reduces uncertainty. As a result, managers prefer people belonging to their social networks when they do their critical work (Pfeffer & Salancik, 1978, p. 146). Economic exchanges are not carried out between strangers but rather by individuals involved in long-term relationships (Granovetter, 1985).

At the core of the relationship between organizational networks, theory, and network theory is the purpose of actors in a network to benefit from each other's financial and human capital (Burt, 1992). Actors are expected to achieve these goals more in closed networks, with the assumption that strong connections can develop more between actors in a closed network (Coleman,

1988). On the other hand, an analysis of a whole network in which an actor is connected includes actors in the network, their connections, and the effects of network position on the actor (Provan et al., 2007).

Network theory claims that actors are positioned at the center of the network as the number of connections increases. In addition, as the actor gets closer to the center, the power and influence of the actor increase (Sözen & Gürbüz, 2015). According to another view, the strength (qualification) of the connections, as well as the quantity of connections, is also effective in the potential benefits that the actor could earn from the network. Duration of the relationship between the actors, the similarities/differences of opinions, the frequency of the communication, the emotional intensity, providing effective communication in complex and information-intensive tasks, the closeness based on mutual trust, and the mutual services characterizing the tie are effective factors on the strength of a possibly linear tie (Granovetter, 1973; Kapucu, 2005; Prell et al., 2009). The strong ties in the network facilitate the actor's access to information, resources, markets, and technologies (Inkpen & Tsang, 2005, p. 146). On the other hand, actors can obtain some innovative ideas and business opportunities from weak ties that they cannot obtain from strong ties (Granovetter, 1973).

Informal relationship networks are vitally important in overcoming crises (Comfort & Kapucu, 2006; Kapucu, 2009; Kapucu et al., 2010). Organizations use their informal networks rather than formal networks to find a solution as soon as possible in times of crisis (Krackhardt & Stern, 1988). This is because organizations want to access information and resources at such times in the fastest way possible. The supply of information and resources can be provided within the organization itself as well as from other organizations (Jung & Park, 2016). In the airline ground operation process as a part of airports, which can be maintained as closed networks, particularly in season periods, there are certain times that airline flights peak. In this study, we call these certain times as crisis periods since allowing the increase of disruptions in the process, which is already dynamic, complicated, and uncertain. Although airlines take measures such as adding slack in the flight plans, adding additional buffers to turnaround times, crew and flight tracking to manage disruptions before the crisis periods, these measures are not sufficient (Kohl et al., 2007, p. 151). Accordingly, managing disruptions through organizational networks is another and complementary approach employed by airlines during these periods. In the following sections, we analyze the informal relationship network and the exchanges between the airlines and suppliers in the airline ground operation process during crisis times through the network research by introducing the formal network among the actors first.

Research Methodology

In the study, network research was carried out to carry out the research aim. The network data were gathered through the network survey with face-to-face meetings. The data were analyzed employing the social network analysis via the UCINET 6.0 software. Social network analysis provides rich and

systematic tools for evaluating formal and informal networks by mapping and analyzing relationships between people, teams, departments, or entire organizations (Cross et al., 2001, p. 103). In the study, we focused on formal connections and informal connections among actors operating directly in the management of disruptions in the airline ground operation process during crisis times in the summer seasons. We also researched the exchanges of information/ideas/advice and mutual assistance based on the informal network relationship.

In this context, we selected Antalya Airport as the research area since it is a pioneer airport in terms of non-scheduled flights and international passengers during summer seasons in Turkey. As of March to July, the traffic of Antalya Airport can experience an increase up to almost nine times during summer seasons, when airlines operate flights at most and make money. Appendix A shows the amount of increase between months for the years 2015-2018. For instance, we can easily see the increase between March and July in 2018 is %860. During the normal season, airlines can overcome disruptions by using only their existing formal relationships. However, during peak times in the summer seasons, informal network relationships are vital to managing disruptions. In these periods characterized by uncertainty, complexity, and time pressure, actors manage the disruptions through exchanges based on informal relations rather than formal relations (Argote, 1982; Gittell, 2001; Gittell, 2002; Huber et al., 1975; Krackhardt & Stern, 1988; Leblebici & Salancik, 1981; Schmitt, 2010).

The data of the study were collected from high-level managers of companies directly involved in the airline ground operation process as much as possible. There are three main reasons for choosing participants as high-level managers as possible:

1- The study deals with peak seasons as crisis times including uncertainty and complexity (Fricke & Schultz, 2009, p. 1; Gittell, 1998),

2- As the uncertainty and chaos increase, the informal relationships gain importance (Kapucu, 2005; Rubinstein et al., 2016), and

3- The people most likely to use their social relationships for the interests of the organization are high-level managers (Gargiulo & Benassi, 2000, p. 183). Informal relationship networks between actors involved in the airline ground operation process play a key role to manage the disruptions and improving on-time performance during the season.

We collected the data in the period from 25 November 2019 to 9 December 2019 with the permission of the State Airports Authority in Turkey. We conducted the meetings as part of the list obtained from the State Airports Authority before the data collection process began. The list was updated with confirmations and feedback during the meetings. In this context, we reached all 30 firms directly involved in the airline ground operation and collected the data in cooperation with 34 managers. According to the promise of confidentiality, the demographic information of managers is intentionally presented in different tables as Table 1 and Table 2 to cover participants' identities.

Table 1

Position Information of The Participants

Position	Managers' Experience for the Company (Company's Operation Duration in Antalya Airport)	Managers' Position Experience	Managers' Airport (Station) Experience	Managers' Aviation Experience
Station Manager	2 (4)	1	2	17
Station Manager	10 (12)	6	11	11
Regional Manager	11 (11)	11	28	28
Operations Coordinator - Senior Chief	2 (7)	1	2	2
Shift Chief	21 (22)	15	25	25
Operations Manager	15 (15)	5	15	15
Station Manager	8 (18)	3	11	11
Duty Manager	12 (23)	7	12	17
Planning Manager	1 (7)	1	6	11
Facility Manager	3 months (24)	3 months	3 months	10
Security and Operations Excellence Manager	23 (22)	7	23	23
Station Deputy Manager	10 (27)	8	11	11
Regional Manager	4 (4)	4	31	27
Station Manager	10 (10)	10	32	32
General Manager	7 (7)	6	17	26
Operations Manager	4 (7)	4	25	25
Unit Manager	3 (8)	3	28	36
Station Manager	13 (14)	3	13	13
Facility Manager	19 (35)	1	19	19
Ramp Manager	13 (29)	2	10	13
Operations Manager	10 (10)	2	13	20
Station Deputy Manager	27 (27)	1	20	27
Station Manager	14 (22)	14	14	35
Operations Manager	17 (29)	1	20	20
Deputy General Manager	10 (12)	1	10	14
Station Manager	7 (12)	3	7	19
Station Manager	4 (14)	3	15	15
Duty Manager	20 (27)	1	20	20
Station Manager	5 (26)	5	25	25
Station Manager	15 (30)	11	15	15
Station Manager	14 (14)	4	14	17
Station Manager	8 (19)	8	8	15
Station Manager	17 (30)	4	17	17
Passenger Services Manager	11 (27)	4 ay	11	11
Average of Experience	**10,8**	**4,6**	**15,6**	**18,9**

Table 2
Demographic Characteristics of Participants

Age	Graduation	Sex
41-45	Bachelor	M
31-35	Bachelor	M
31-35	Bachelor	F
36-40	Bachelor	M
46-50	Bachelor	M
26-30	Bachelor	M
36-40	High-School	M
46-50	High-School	M
46-50	Bachelor	M
46-50	Bachelor	M
31-35	High-School	F
36-40	Bachelor	M
31-35	Bachelor	M
41-45	Bachelor	M
41-45	Bachelor	M
46-50	Bachelor	M
46-50	Master	M
36-40	Bachelor	M
56-60	Bachelor	M
46-50	Bachelor	M
41-45	Bachelor	M
51-55	High-School	M
41-45	Bachelor	M
46-50	High-School	M
46-50	Bachelor	M
41-45	Bachelor	M
56-60	Bachelor	M
56-60	Bachelor	M
36-40	Bachelor	M
36-40	Bachelor	M
36-40	Bachelor	M
41-45	Bachelor	F
51-55	Master	M
41-45	High-School	M

For collecting data, we formed the network survey consisting of a single question in two separate forms for airlines and suppliers as in Appendix B and Appendix C. We asked the question “Who do you contact to provide informal assistance in overcoming disruptions in the airline ground operation process?" to the managers of the airlines. We also asked the question "Who contacts you to provide informal assistance in overcoming disruptions in the airline ground operation process?" to the managers of suppliers. We asked managers to write the first five informal contact examples that came to their minds in response to the network question. In the study, we considered representation and supervision companies as airlines since instead of foreign airlines, contracted

representation-supervision companies carry out tracing the operation process of foreign airlines that do not have an office and a manager at the airport. Therefore, we also asked managers of representation and supervision companies to answer the network survey prepared for airlines. Last, in the analysis phase of network data, we referenced the contact frequency classification used by Granovetter (1971) to express the strength of ties. The classification is as follows: frequent = at least twice a week; occasional = more than once a year but less than two a week; rarely = once a year or even less.

Analysis of the Network

In this section, first, we revealed formal connections among actors involved in the airline ground operation process. Second, we uncovered informal connections and exchanges applied by the same actors for managing the disruptions in the process during crisis times in Antalya Airport. In this context, we collected network data from 30 companies and 34 participants. Results on formal connections and informal social relationships used in the management of disruptions are as follows sub-sections. Each data in the dataset, consisting of a total of 114 network data, represents a connection between actors involved in the informal relationship network. Other descriptive information about the dataset is summarized below:

- 98 relationships can be characterized as co-worker relationships, while 16 relationships can be characterized as close friendships.
- Co-workers contact on average 2.8 times a month.
- Those who have close friendship contact on average 3.8 times a month.
- Examining all relationships, actors contact on average 2.9 times a month.
- Examining the sources of acquaintance, it is seen that 106 of the 114 relationships are workplace-based, the rest are from outside the workplace as compatriotism (1), family friend (3), internship (1), university (1), and neighborhood (2).
- Those who have workplace-based relationships contact on average 3 times a month.
- Those who have outside the work relationships contact an average of 2.9 times per month.
- The average length of an acquaintance of actors in the network is 8.1 years.
- The contact frequency is in line with Granovetter (1971): 60% often, 44% sometimes, and %1 rarely.

Analysis of the Formal Network

The results of the calculated centrality analysis for the formal network are shown in Table 3. Accordingly, the formal network consists of 31 (3 actors are not directly in the airline ground operation process). The 31 actors are allocated as follows: airlines (11), ground handling companies (3), airport

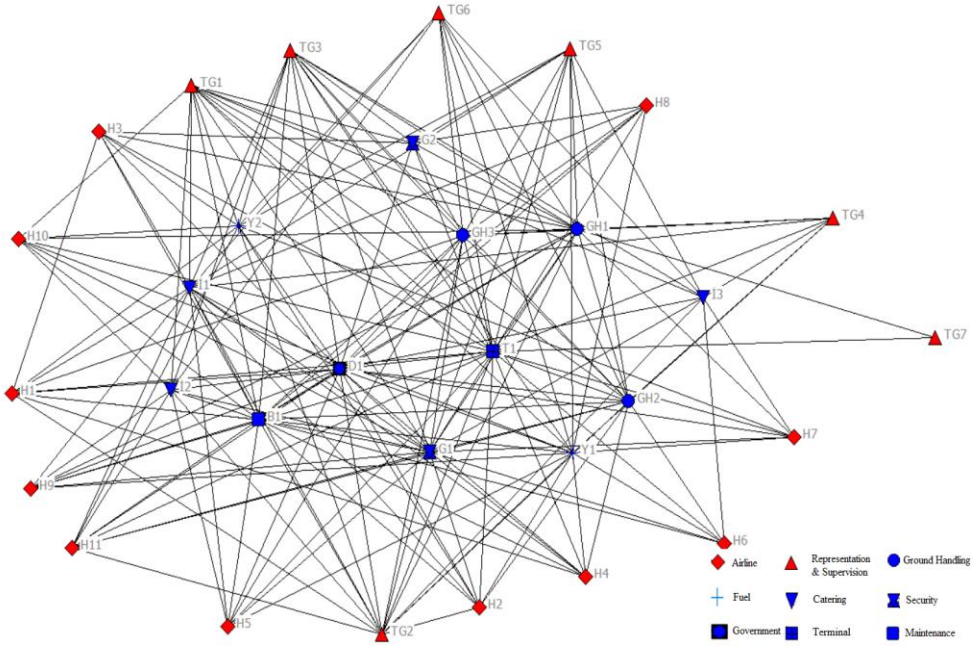
terminal operators (1), representation and supervision companies (7), catering companies (3), aviation fuel companies (2), aviation security companies (2), MRO company (1), and state institution (1). These actors are connected by 370 formal connections, while the average number of connections (degrees) per node is 11,935. The density of the formal network is about 40%. This means that actors are connected with about 40% of the possible formal connections in the network. More clearly, the density of the formal network is at 40%, since there is no formal connection based on a contract between companies that do similar work. In other words, network density is low as formal connections are mostly established among airlines and suppliers.

Table 3
Criteria and Values for Formal Network

Network Criteria	Value
Network size	31
Number of connections	370
Network density	0.398
Average rating	11.935

Figure 1 depicts the formal network between actors involved in the airline ground operation. Before examining the formal network, we should express that although H2 and H11 have operations centers at the airport, and TG2 is their contracted representation & supervision company of them. So, there is a formal agreement between them. The relationship between H10 and TG1 is also similar to the relationship between H2, H11, and TG2. Examining the formal network, we can understand that the relationships occur between airlines, representation and supervision companies, and suppliers. Airlines and representation and supervision companies are indicated in red, while suppliers are indicated in blue in the figure. The reason that representation and supervision companies are indicated in the red color is that they are responsible for serving airlines that usually do not have an operational base at airports as mentioned earlier. Hence, we accepted them as airlines in the study. Last, we expressed the formal network as 1 or 0 in the formal data matrix to carry out the analysis, since it is based on the existence of formal contracts between actors.

Figure 1
Formal Network



Evaluating the formal network, we can say that actors such as T1 (24), D1 (23), and B1 (20) which have more connections based on formal contracts in the airline ground operation process, are the central actors of the formal network as in Table 4. Another common feature of these actors is that they are suppliers. It is normal for suppliers to be at the center of the formal network, as they serve many companies. For example, the state airport authority serves all actors, or ground handling companies serve airlines while airlines just receive services at the airport. In addition, we revealed that the two lowest actors in terms of degree centrality are H6 and TG7. As seen in Figure 1, H6 and TG7 actors are far from the center of the network. This is since these actors receive services from a small number of suppliers at the airport.

Table 4
The Degree Centrality Values of the Actors in the Formal Network

Actor (ID)	Degree	Actor (ID)	Degree
B1	20.000	H10	8.000
D1	23.000	H11	9.000
G1	21.000	İ1	17.000
G2	9.000	İ2	11.000
GH1	18.000	İ3	10.000
GH2	16.000	T1	24.000
GH3	16.000	TG1	13.000
H1	10.000	TG2	15.000
H2	9.000	TG3	13.000
H3	8.000	TG4	7.000
H4	8.000	TG5	10.000
H5	8.000	TG6	9.000
H6	6.000	TG7	2.000
H7	7.000	Y1	16.000
H8	7.000	Y2	12.000
H9	8.000		

Analysis of the Informal Relationship Network

In this part of the study, we analyzed the informal relationship network. Table 5 shows the reasons for informal contact and their frequency. Accordingly, special requests such as demanding changes in the parking position during the peaks are the main reason for informal contact. Other reasons include delays in service provision, information/ideas/advice exchange, procedural disruptions, capacity constraints, other operational disruptions, and technical disruptions (equipment failures).

Table 5
Reasons and Frequencies of Connection

Reasons for Informal Contact	Frequency
Delays in service provision	21
Special requests	34
Knowledge /ideas/experience exchange	19
Personnel/equipment /vehicle exchange	4
Procedural disruptions	11
Technical disruptions	6
Capacity constraints	9
Other operational disruptions	9

Table 6 gives information about the network formed by informal connections established by actors involved in the airline ground operation process. Accordingly, the informal relationship network consists of 35 actors and 86 connections. Actors are allocated as follows: airlines (11), ground handling companies (3), the airport operator (1), representation and supervision companies (7), catering companies (3), aviation fuel companies (2), aviation

security companies (2), MRO companies (3), and government agencies (3). The average number of connections per node is 2,543 and the network density is about 8 percent. Accordingly, we can say that 8 percent of possible connections are used in the informal relationship network between actors. There are three main reasons explaining the low network density. The first two reasons are related to constraints on the method and data collection, while the other can be expressed based on the formal network between actors. First, participants shared the first examples that came to their minds about solving disruptions in the data collection stage. The second reason is that due to time and cost constraints, the researcher just aimed to meet the most senior managers as possible. Finally, we can express that the connections between actors are established primarily by formal connections. Actors can solve disruptions through their informal relationships even if they do not have formal relationships at the airport. In this context, the fact that the bilateral connections in the formal network mentioned in the previous sub-title largely meet the bilateral connections in the informal relationship networks at the firm level can be expressed as proof of this condition.

Table 6

Criteria And Values for the Informal Relationship Network Between Actors

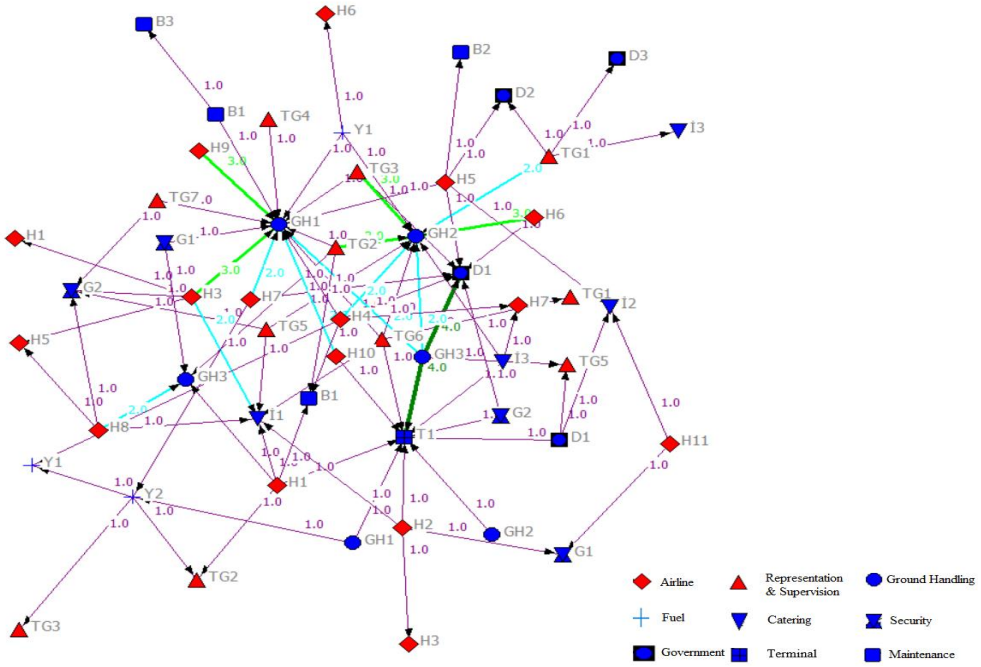
Network Criteria	Value
Network size	35
Number of connections	89
Network density	0.075
Average rating	2.543

Figure 2 depicts the informal relationship network between actors involved in the airline ground operation. When we examine the network, we can see that connections between some actors are expressed in 4.0, 3.0, 2.0, and 1.0, and as the number decreases, the thickness of the connection also decreases. These numbers represent the sum of the mutually established connections between two actors, as well as the strength of the connection between them. Accordingly, it is understood that the T1 and D1 connections of GH3 are the connections with the highest strength. In other words, we can state that GH3, a ground handling company, gets in contact with other suppliers (T1 and D1) to manage and solve disruptions. Here, GH3's relations with T1 consist of contacts established based on capacity constraints so that the airline they serve can operate efficiently. The relationships of GH3 with D1 are related to both the efficient operation of the airline that GH3 serves, and to overcoming several procedural constraints related to its employees. The connections in Fig. 2 are mainly due to the delay in service provision and special requests. Another issue addressed for the informal relationship network between actors is that connections mainly occur between airlines, representation, and supervision companies and suppliers. However, some informal connection pairs such as H1-H3, H2-H3, B1-B3, GH1-GH3, GH2-GH3, and Y1-Y2 were established

between actors doing similar work at the airport. Informal exchanges between actors doing similar work are information/ideas/advice and staff/equipment/vehicles exchange. Apart from informal connections between actors doing similar work, other informal connections seen on the network are between airlines, representation and supervision companies, and suppliers. As mentioned earlier, these connections constitute most of the connections in the network based on the airline-supplier relationship. Reasons for these informal connections are delays in service provision, technical disruptions, capacity constraints, and other operational disruptions that paralyze the airline's ground operation process. Airlines and representation and supervision companies try to avoid delays by resorting to special requests. As we can understand from here, horizontal informal connections between actors that do similar work in the airline ground operation process include several abstract and concrete shares, while vertical informal connections between actors that depend on their services include failures in the operation process.

Figure 2

Network of Informal Relationships between Actors in Solving Disruptions



When the degree centrality values of the informal connections between the actors involved in the airline ground operation process are evaluated, the actors with the most informal relations are GH1 (19.000), GH2 (16.000), and D1 (10.000) and T1 (10.000) as in Table 7. This is since these actors are among the most important business types in terms of the workload of the airline ground operation process. These actors, who take most of the workload, naturally host the areas where the most disruptions are experienced. The actors with the low

connections are B2, B3, D3, and H11, which are not involved in data collection, and TG4, which refuses to share network data. The first four actors are also those who are not directly involved in the airline ground operations process.

Table 7

The Degree Centrality Values of the Actors in the Informal Relationship Network

Actor (ID)	Degree	Actor (ID)	Degree
B1	5.000	H8	3.000
B2	1.000	H9	5.000
B3	1.000	H10	4.000
D1	10.000	H11	1.000
D2	2.000	İ1	7.000
D3	1.000	İ2	3.000
G1	4.000	İ3	4.000
G2	6.000	T1	10.000
GH1	19.000	TG1	5.000
GH2	16.000	TG2	6.000
GH3	8.000	TG3	4.000
H1	6.000	TG4	1.000
H2	2.000	TG5	5.000
H3	2.000	TG6	5.000
H4	4.000	TG7	2.000
H5	6.000	Y1	5.000
H6	7.000	Y2	5.000
H7	7.000		

The reasons for informal contact for actors located in the center are expressed in Table 8. Accordingly, we observed that the reasons for informal contact for GH1, which has the most central value, are most related to special requests, and delays in the provision of services. Also, the situation for GH2 and GH3 is similar to GH1. In addition, we detected that the informal contacts established for D1 are concentrated on special requests, while the contacts established for T1 are mainly related to capacity constraints. In addition, all actors in the center are suppliers. Moreover, we revealed that informal contacts established with these actors in Table 8 are (20 times) related to special requests at most. It can be said that the reason for this is that airlines want to increase their on-time departure performance during crisis times in a season. In addition, the connections established with T1 is terminal operator, are related to the capacity constraints. This is important proof that the terminal infrastructure causes disruptions during crisis times. Another important point is that the informal contacts established with the actor D1, a government agency, are regarding special requests. This result indicates that airlines and some suppliers use their informal connections with state institutions to manage disruptions.

Table 8

Actors (Contacted at most) at the Centre of the Informal Relationship Network and Reasons for Informal Contacts

	GH1	GH2	GH3	D1	T1	Total
Delays in service provision	4	3	2			9
Special requests	5	4	2	7	2	20
Knowledge / ideas/experience exchange	3	1	1		3	8
Personnel/equipment/vehicle exchange	2	2				4
Procedural disruptions	1	1	1	2		5
Technical disruptions		1			1	2
Capacity constraints	1	2	1		4	8
Other operational disruptions	3	2	1	1		7

Cliques are subgroups of three or more actors connected by strong ties within the network (Wasserman and Faust, 1994, s. 254). 34 cliques obtained within the scope of the informal relationship network and consisting of three actors are shown in Table 9. When the cliques are examined, we can see that GH1 is in 14 cliques, GH2 is in 9 cliques, GH3 is in 10 cliques, D1 is in 6 cliques, and T1 is in 9 cliques. While cliques including airlines (H) and representation and supervision companies (TG) belong to a formal relationship network, other cliques (with numbers of 4, 7, 8, 22, 23, 26, 34) belong to an informal relationship network. In addition, we can also state that these cliques emerge around special requests, exchange of information/ideas/advice, and exchange of personnel/vehicles/equipment. Cliques are made up of ground handling companies, government, and terminal actors in particular since these actors serve many actors through formal contracts in the airline ground operation process. As a result, it is possible to say that commercial relations evolve into informal relations in time.

Table 9

Subgroups (Cliques) in the Informal Relationship Network between Actors

No	Clique	No	Clique	No	Clique	No	Clique	No	Clique
1	TG3, Y2, GH1	**8**	GH3, GH1, T1	**15**	H1, GH3, TG2	**22**	GH3, D1, T1	**29**	H3, I1, H2
2	Y2, TG2, GH1	**9**	TG6, GH1, T1	**16**	H1, GH3, T1	**23**	D1, G2, T1	**30**	Y1, H4, GH2
3	Y2, GH1, H7	**10**	GH1, H10, T1	**17**	H1, H3, İ1	**24**	D1, İ2, H5	**31**	Y1, GH2, H6
4	Y2, GH1, Y1	**11**	GH1, H7, H4	**18**	H1, TG2, B1	**25**	D1, H7, H4	**32**	TG6, T1, GH2
5	H3, GH1, H5	**12**	GH1, Y1, H4	**19**	TG5, GH3, D1	**26**	İ3, T1, GH2	**33**	GH3, TG2, GH2
6	GH3, TG2, GH1	**13**	GH1, H4, B1	**20**	TG5, GH3, GH2	**27**	İ3, TG1, GH2	**34**	GH3, T1, GH2
7	GH3, G1, GH1	**14**	TG2, GH1, B1	**21**	TG5, D1, G2	**28**	TG6, TG1, GH2		

Analysis of Position Network

As part of the study, when we examine the network data collected from 34 managers on the management of disruptions encountered in the airline ground operation process, we can say that informal connections were established totally among 55 managers. In the informally position-contacted network in Figure 3, the position levels of managers contacted are indicated by orange squares. The different colors for connections also express the strength of the established connections at different levels. Connections in dark green (4.0) are the strongest connections in the network. For example, we can see that K4, a middle-level manager in a ground handling company, prefers senior managers in all connections he has established. Among actors having a dark green connection, we can say that K29, who is a middle manager in an MRO, gets in contact with senior managers to solve disruptions. Connections established by K28, a senior manager of a fuel company, K11, a senior manager of a security company, and K26, a senior manager of a representation and supervision company, refer to other dark green connections. Similar to dark green connections (4.0), light green (3.0), light blue (2.0), and purple (1.0) are the other levels that express the strength of the connections. We can understand from the position-contacted network that managers can get in contact with managers at the same level to solve disruptions. On the other hand, they are also able to get in contact with managers at different levels by the urgency and magnitude of the problem. Connections of K22, the middle-level manager of a

catering company, with senior, middle-level, and operation-level managers can be given as an example. Among other participants, connections with managers at one level, two different levels, or three different levels can be found in terms of informal connections that they have established in solving disruptions. Accordingly, it is seen that the vast majority of participants from airlines, shown in the red diamond, and from representation and supervision companies, shown in the red triangle, use their connections with senior managers to solve disruptions.

Figure 3

Network between Contacted Person and Position

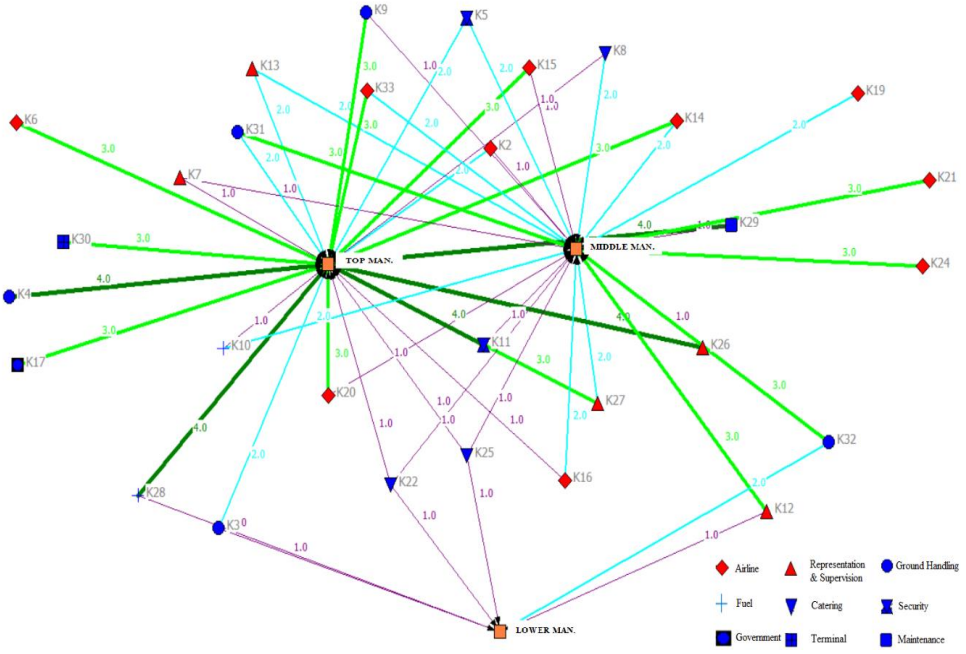


Table 10, which expresses the frequency of contact among position levels, and Table 11, which reveals the reasons for contact according to position levels provide significant evidence. Accordingly, Table 10 shows that very few of the connections established in solving disruptions are established with operation managers. We can also see that there is a proportional hierarchical situation between position levels. The most established connection is 63 connections with senior managers, followed by 43 connections with mid-level managers. On the other hand, examining the number of connections among managers at the same level, we can see that the number of connections between separately senior managers, mid-level managers, and operation managers each other is 39, 15, and 1, respectively.

Table 10

Frequency of Contact in Managing Disruptions in terms of the Positions of the Managers Involved in the Informal Relationship Network

	Senior level manager	Mid-level manager	Operational level manager
Senior level manager	39	24	3
Mid-level manager	23	15	3
Operational level manager	1	4	1

When we examine the contact reasons in terms of the position in Table 11, we can state that informal contacts containing delays in services, special requests, and information/idea/experience sharing are mostly established with senior managers for managing disruptions. Special requests are the main reason for an informal connection with mid-level managers and this is followed by exchanging information/ideas/experiences. It seems that the frequency of connections established with operation managers is almost equal to other contact reasons.

Table 11

Contact Reasons by Position

	Senior	Mid-level	Operation manager level
Delays in service provision	14	6	1
Special requests	21	14	3
Information/ideas/experience exchange	10	8	1
Personnel/equipment/vehicle exchange	1	3	0
Procedural disruptions	6	4	2
Technical disruptions	1	5	0
Capacity constraints	4	5	0
Other operational disruptions	6	4	0

Conclusions, Limitations, and Suggestions

If the disruptions encountered in the airline ground operation process are not managed well, they can lead to some negative effects for all actors involved in the process, especially the airlines. These negative effects are expressed as economic, environmental, and social effects. The simultaneous service of different types of actors in a limited time makes the airline ground operation process complicated. The process becomes more complicated during peak times in summer. In this sense, the management of the disruptions encountered in the airline ground operation process becomes more important, especially in these periods. Managing disruptions as soon as possible reduces or completely avoids the additional operational costs that airlines may face. The aim of the study, in

this context, is to investigate the formal and informal connections, and informal exchanges among the actors (airlines and the suppliers) in managing disruptions in the airline ground operation process during peak periods in summers that we called crisis times in this study. The conclusions drawn from the network research findings are given below.

The first significant conclusion of the study is that an informal relationship network consists of strong ties (the contact frequency: 60% often, 44% sometimes, and %1 rarely). In addition, we observed that there are almost no weak ties in the informal relationship network. Strong ties allow us to overcome disruptions more easily, while weak ties provide us with different ideas and opportunities. Another finding indicates that strong ties are effective in managing delays in service provision, procedural disruptions, technical disruptions, and other operational disruptions. The insufficient number of weak ties in the informal relationship network by contrast with Granovetter's (1973) argument on strength of weak ties also makes it difficult to reach conclusions about several exchanges in the sense of new knowledge/ideas or opportunities between actors with weak ties within the scope of the study.

In another conclusion, we can draw those vertical informal relationships between airlines and suppliers in the informal relationship network match up with the formal network. Apart from the vertical connections between the airline and the supplier, the study remarkably uncovers horizontal connections between the airline-airline and the supplier-supplier in the informal relationship network as an unexpected situation. While the vertical informal connections are mostly established as a result of delays in the service provided, and special requests, the horizontal connections include some abstract and concrete exchanges such as information/idea/advice and personnel/equipment/tools. At this point, we should note that there is no competition between airlines at lower levels that supports horizontal informal relationships. As a reflection of this condition, some horizontal connections show us that some services are not billed among actors having a horizontal relationship even though these services have a significant cost. This reveals that the actors operating in the same service area need each other's informal help to survive and to protect the market they operate, especially during crisis times. In addition, to consider airports as closed areas and networks that actors know each other closely and have neighborhood relationship which paves the way for mutually exchanges, we can also say that it is normal situation. In another perspective, using informal relationships is a way of managing interdependence during the times of uncertainty and scarcity for actors who do not want to lose their position in the sector (Doğan, 2018; Pfeffer & Salancik, 2003; Üsdiken, 2010).

The speed is critical to the success of airline ground operations and for airlines to achieve their on-time performance targets. Thus, delay in the service provision is in the first rank among the contact reasons between the actors. Formal relationships are seen as an obstacle to get over disruptions urgently. Managers use their informal relations to get results earlier. In addition, the magnitude of the problem and the urgency of the solution affect the position

contacted. In this sense, we revealed that there are more contacts with senior (39) and mid-level (24) managers, and there are almost no contacts with operation-level managers to eliminate disruptions. This is due to the crises in the airline ground operation during peak times in summers. We can say that the role of senior managers is of great importance in the management of a crisis. Rubinstein et al. (2016) also approves the change the level of management in crisis times in their study carried out on the patterns of communication networks during uncertainty by underlining that the change among level of managers communicated as uncertainty gets increase.

In another significant conclusion, the study reveals that two ground handling companies GH1 and GH2 are at the center of the informal relationship network as critical actors for solving disruptions. Moreover, another remarkable result for informal relationships established with state actors in the airline ground operation process reveals that state actors (D1, D2, D3) play an important role in the informal relationship network used in the management of disruptions encountered. The fact that D1 is among the actors at the center of formal and informal networks is also important evidence to support this perception. Another piece of evidence supporting this situation is that the state nodes are involved in most of the cliques (6/34). Informal contacts established with state actors often occur with special requests and procedural disruptions. Holistically, we can state that the high workload or wide service area of the suppliers in the airline ground operation process enables them to be at the center of the network.

Based on all conclusions, the study confirms the importance of informal relationships among the actors in the airline ground operation process during crisis times. Ensuring coordination in emergency situations with uncertainty and complexity, making rational decisions and increasing performance by overcoming the setbacks are provided through exchanges based on informal relations rather than formal relations between network members (Gittell, 2001; Gittell, 2002). Accordingly, as managerial implications, the study first suggests that airline managers should be aware of their network connections and strengthen informal relationships with other actors' managers in their business environment. Second, station managers should have some weak ties for achieving valuable information and opportunities. Third, station managers should be preferred from managers having multiple connections with a mix of strong and weak ties with critical actors by human resources managers.

The study has also some limitations. In the process of collecting network data, the participants were asked to name 5 people. This is a significant limitation of the study and other limitations are tied with this limitation. In line with the first limitations, other limitations of the study are that participants cannot remember important examples when answering the question, give fewer examples by hesitation, cannot give important examples, or cannot share their network data. In fact, these constraints are specific to all research conducted through social network data. It is possible to get different results if the same

participants take part in the study at a different time. In addition, similar studies can be conducted at different airports to verify the results of the study.

Further studies can address the relationship between airline organizational networks and on-time performance. A quantitative study can be conducted to measure the impact of the network position of airlines on the efficiency of airlines in different aspects and their competitiveness. A comparative quantitative study measuring the relationship between the use of informal relationships and airport performance can be appropriate for revealing the effect of informal relationships on the efficient use of airport capacity. This network research is unique in that no other study has been encountered in the literature that deals with the airline ground operation process in terms of organizational networks. The study is expected to contribute to all stakeholders relating to the airline ground operation process, the theory of organizational networks, and the field of aviation management.

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Appendix A: Number of International Arrival and Departure Flight Numbers Between 2015-2018

Months	2015		2016		2017		2018		**Combined Arrival-Departure Flight Numbers**		2017-2018 (%)
	Arrival	**Departure**	**Arrival**	**Departure**	**Arrival**	**Departure**	**Arrival**	**Departure**	2017	2018	
January	1.207	1.225	842	841	864	830	823	835	1.694	1.658	-2%
February	1.014	1.055	794	814	705	705	784	776	1.410	1.560	11%
March	1.776	1.879	1.481	1.516	1.093	1.138	1.511	1.570	2.231	3.081	38%
April	3.776	3.752	2.353	2.359	3.047	2.999	3.895	3.856	6.046	7.751	28%
May	6.851	6.860	3.789	3.826	5.437	5.431	7.883	7.889	10.868	15.772	45%
June	8.284	8.291	4.133	4.148	7.290	7.294	9.773	9.808	14.584	19.581	34%
July	9.848	9.869	5.831	5.825	9.010	9.020	11.215	11.199	18.030	22.414	24%
August	10.322	10.312	5.994	5.991	9.326	9.281	10.996	10.987	18.607	21.983	18%
September	8.527	8.456	5.386	5.414	7.963	7.993	9.800	9.797	15.956	19.597	23%
October	6.855	6.887	5.131	5.144	6.406	6.366	8.435	8.401	12.772	16.836	32%
November	2.409	2.451	1.462	1.439	1.654	1.648	2.465	2.456	3.302	4.921	49%
December	905	926	866	854	960	956	1.464	1.461	1.916	2.925	53%
Total	61.774	61.963	38.062	38.171	53.755	53.661	69.044	69.035	107.416	138.079	

Appendix B: Question to airlines, and representation and supervision companies

Who do you contact to provide informal assistance in overcoming disruptions in the airline ground operation process?

No	Name	Company/Position	Contact Reason	Friendship Type (Co-worker, close friendship)	Source of Acquaintance (work, school, club membership)	Contact Frequency (Weekly)	Acquaintance Duration (Year)
1.							
2.							
3.							
4.							
5.							

Appendix C: Question to suppliers

Who contacts you to provide informal assistance in overcoming disruptions in the airline ground operation process?

	Name	Company/Position	Contact Reason	Friendship Type (Co-worker, close friendship)	Source of Acquaintance (Work, school, club membership)	Contact Frequency (Weekly)	Acquaintance Duration (Year)
1.							

2.							
3.							
4.							
5.							