

The informal organizational chart in organizations: An approach from the social network analysis

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In the early 20th century the Hawthorne experiments began a line of research centred on the analysis of informal relationships as a source of influence in organizational environments. The social network analysis at the present allows us to get closer to the structure of relationships in an organization in a variety of ways. Broadly speaking, this structure can resemble the informal chart. In this way it is possible to carry out a non-metaphorical analysis of the informal structures of relationships.

Introduction

The *Hawthorne* experiments carried out in the *Western Electric* company between 1927 and 32 demonstrated the importance of social factors in the understanding of organizational behaviour (Bonazzi, Giuseppe, 1994). The scientific organization of the Taylorist study based the increase in production on the rational design of production and on the establishment of an appropriate system of incentives. However, Elton Mayo and his collaborators demonstrated that the increase in productivity only depended in part on retributive, environmental and technical factors. Their research on psycho-social factors of motivation and productivity lead to the so called Human Relations School.

In the first study, the *Harvard* researchers concentrated on testing the productivity of a group of workers, directly manipulating their working conditions. Their main conclusion was that the existence of an amiable supervision, rather than the periods of rest or the retribution, was a key element in the explanation of the increase in productivity. This is the well known "*Hawthorne effect*": the simple fact of paying attention (by the researchers in this case) to a worker increased his or her productivity even though the environmental working conditions got worse.

The second investigation consisted in carrying out 21,000 interviews (in a population of employees of 40,000) on the workers' reasons for complaint, in a colossal effort to introduce the interview as an intervention technique in the climate of the organization.

In the third, with the collaboration of the anthropologist Lloyd Warner, the informal relationships in a room dedicated to the fabrication of telephone panels, the *Bank Wiring Room*, were investigated. This research sought to apply participant observation, which was giving such good results in small exotic populations, to the study of organizations. This research demonstrated the existence of informal dynamics of opposition and solidarity among the workers. These dynamics explained the constant maintenance of productivity despite the manipulation of the incentives system. The innovation of this study lay in the introduction of sociograms and the explanation of phenomena of political influence through the structure of relationships at the core of the organization.

The issue of the informal organizational chart leads us directly to this research, to the idea of a network of influences that are not foreseen in the rational design.

The influence of the *Hawthorne* experiments has been enormous in social sciences and in the social network analysis, which constitutes one of its sources. It is precisely the developments that have come about in the social network analysis that allow us to approach the establishment of this network of influences in a non-metaphorical way at the present.

In this article, we propose to present a panorama of the different methods that exist today for the establishment of a network of relationships in the core of an organization. This network of relationships resembles the “informal organizational chart”, on assuming that the phenomena of influence are directly related to the structures of existing relationships (BRASS, Daniel J., 1984; Brass, Daniel J. and Marlene E. Burkhardt, 1992).

Organizational chart and informal organizational chart

The organizational chart can be defined as the rational, conscious and institutionalised arrangement of the division of labour (Mintzberg, 1988). In fact, the image that we have of an organizational chart corresponds to the Weberian concept of bureaucratic organization (Weber, 1969), according to which the division of labour must be carried out through non overlapping functional divisions, with a hierarchy of coordination and control and with procedures and rules of action that guarantee formalised and impersonal relationships among its members.

We can find a good example of this kind of organization in the description that Crozier makes of the Parisian Accounting Agency (Crozier, 1965), offices depending on the Ministry of Finance, in which 4,500 persons were working at the time the research was carried out.

The basic group of the Accounting Agency was made up of 4 persons operating heavy accounting machines or verifying the calculations. These groups worked in rooms in morning and afternoon shifts under the control of inspectors. A section was constituted by around a hundred employees, with a supervisor in control. This chief also had a special section with 24 persons who took care of particular cases and general inspection and control. Each group of 10 sections was directed by a head of division, who was in charge of approximately a thousand employees. The head of division had a typist and two assistants with the rank of head of section. The agency was made up of three divisions of this kind and a fourth that included all the auxiliary services: reception and dispatch of mail, new accounts, filing, equipment and supplies, maintenance, printing, etc. A fifth head of division was theoretically in control of everything, with a staff of only 12 persons, and took care of personnel and general coordination matters.

Graphically, we can represent this organization in the following way:

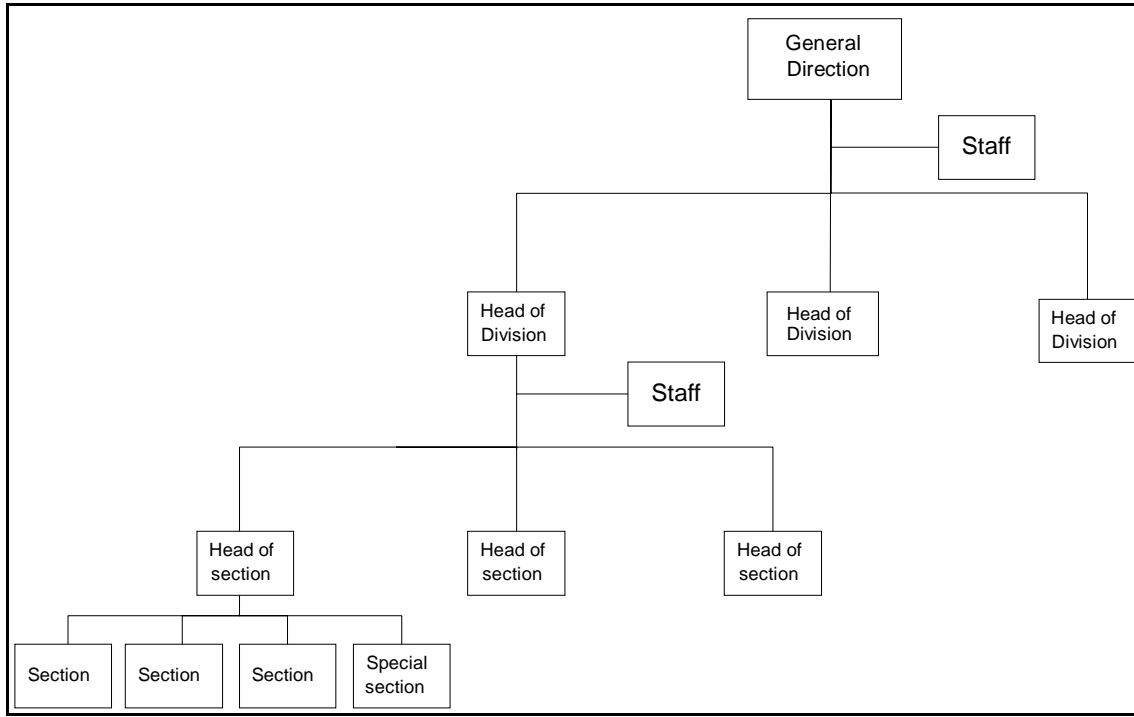


Figure 1. Simplified organizational chart of the Parisian Accounting Agency.

In fact, this conception of the organizational chart, as well as bureaucratic organizations themselves, corresponds to a certain level of development of information technologies. Indeed, the different levels of bureaucratic organization are not only justified by their control functions (incorporated in the organizational chart through special units for supervision), but also by their function in the coordination of activities, necessary for specialisation in units to increase their productivity and effectiveness. The rooms, sections and divisions are, in this case, the mechanisms that coordinate the work of thousands of employees.

To this multiplication of hierarchical levels, typical of bureaucratic organization, is added the existence of auxiliary bodies, to transport, reproduce and process information—paper in the core of the organizations: concierges, administrative clerks, secretaries... Nevertheless, the registration and distribution of documents, typing letters, creating listings, organising, filing, photocopying and even answering the telephone and mechanising data, are functions that are increasingly taken on by electronic mechanisms. Electronic mail, voice mailboxes, EDI systems (Electronic Data Interchange), electronic commerce... directly communicate suppliers and consumers of products and services and make both the intermediate levels in organizations and their auxiliary bodies unnecessary.

Although their role is fundamental, information technologies cannot totally explain the transformation that is occurring in organizations today. According to Castells (1997), this transformation is also due to the generalisation of a new organizational model that has its origins in the restructuring that occurred in capitalist businesses from the mid 70's onwards as a consequence of the erosion of profit margins. This restructuring obliged the incorporation of new production and distri-

bution strategies, which were originally born in the automotive sector (Toyota, Japan, and Volvo, Sweden). The principles of this new model, known as Toyotism, are the following:

- Zero products in storage: *just-in-time* production. This strategy requires continually adapting production to the demands of the market, avoiding warehouse costs and leading a sector of suppliers trained in the methods of the mother business.
- Zero defects: total quality. The assurance and continuous improvement of quality is added to quality control, thanks to the participation of the workers in the process.
- Horizontal organizational charts, with wide autonomy for the units and workers (*empowerment*).

These organizations are arranged, moreover, in a flexible way in networks of organizations (of suppliers, clients, normalisation) so that for the first time, the unit is not the firm or the mother organization, but the *network itself*. This network-company — continues Castells — is made up of segments of other networks with which they share objectives and means, although by definition, only partially.

This organizational paradigm centred on quality, horizontal organizational charts, the *empowerment* of the workers (participation, autonomy) is also applicable to the world of services, and recently, to public administrations themselves, which are incorporating management methods from the business world to respond to the growing social pressure for an increase in their effectiveness and efficiency (López Camps and Gadea, 1995; Osborne and Gaebler, 1994).

Once the tendency towards the reduction of the hierarchical levels in organizations has been established, along with the establishment of flexible forms of organization (management by projects, for example, typical of R+D consulting firms), we can tackle the study of the formal organizational chart and its correspondence with the informal organizational chart.

From the point of view of network analysis, the formal organizational chart defines the relationships that should exist in the core of the organization: who should speak to or communicate with whom. In the example studied above, the persons in one section do not have to interact with the persons in another section or division: this relationship is not foreseen in the design, and for a start, does not add value to the work of the organization. In fact, the hierarchical level determines to a large extent the quantity and quality (in terms of power) of the relationships. Herminia Ibarra (1992), has shown that the degree of correspondence between formal and informal organizational chart is very high. In fact, one structure cannot be understood without the other and the power strategies of the participants depend on the degree of alignment between the two structures.

Although the formal organizational chart is rarely updated, as it constitutes one of the principal means of intervention by management, it allows us to establish an initial approximation to the power map of the organization. How then, can we draw up an *informal* organizational chart?

The establishment of the informal organizational chart

Analysis studies on networks in organizations have basically gathered three types of information: work relationships (*work-flow, report to*), friendship relationships (*friendship or expressive rela-*

tions) and advice relationships (*advice networks*). In the studies carried out by the author in different public and private organizations, information has been gathered on work, friendship and leisure networks (leisure networks being relationships outside the organization). All of this information configures the way in which a different network of relationships will be seen in the next section. Theoretically, the sum of the three networks should constitute the network of relationships of the organization—the informal organizational chart (Molina, 1995) .

The options for the establishment of the structure of relationships in an organization are the following:

1. Direct observation.
2. Sampling.
3. Informants.
4. Questionnaires on relationships.

The following is a presentation of each of the options.

Direct observation

Direct observation is difficult to apply as a data gathering tool for relationships in an organization. One example will be enough to illustrate this statement:

In the analysis of the interactions of a single person for two days, the results were the following:

165 interactions — 63 on the first day and 102 on the second!

80 initiated by the person in question, 59 received, 19 "encounters in the corridor," and 7 meetings.

42 telephone conversations, 8 faxes, 105 face-to-face, and 10 letters.

77 of the interactions lasted less than a minute, 24 less than 2 minutes, 15 less than 3 ...

This example illustrates the avalanche of information that a researcher who wishes to extract relationships from direct observation would find him or herself smothered in. This observer would have to add the interactions of the 45 persons with whom they established relationships in these two days to these interactions (7,425 or more!), in order to get an overall view of the network.

Therefore, "relationships" are not observed in the sense of work relationships, friendship relationships or leisure relationships. Interactions that need to be interpreted are observed, without a doubt with the help of the same persons involved or with the help of informants, and it is necessary to abstract the data from immediate experience in categories imposed by the researcher in order to carry out the analysis.

A fast alternative to establishing an approximation to the organization network is constituted by sampling systems tested recently.

Sampling

The sampling of networks is still an unresolved problem, as the methods of traditional statistics cannot be applied directly. The snowball technique is the procedure most commonly used to approach the size of a network quantitatively from sampling (Pompidou Group, 1995; Erikson and Nosanchuck, 1983; Erickson, 1981).

Patrick Doreian (Doreian and Woodard, 1994) and Ronald Burt (Burt and Ronchi, 1994) have tested methods for the establishment of the limits of a network and its internal structure.

In Ronald Burt's case, interviews were carried out for 3 days with the members of an organization of 200 persons. In the first place, informants were interviewed so that their reports overlapped due to their position in the network. 2,121 relationships were obtained from these informants. Once these reports had been analysed, the reliability of the different relationships collected was estimated through comparison among themselves. Finally, the unknown relationships were extrapolated so that it was possible to obtain a network of 24,531 relationships, with a density of 0.14%.

Without going into the details of the methodology used by Doreian and Burt, the perfection of sampling systems is one of the conditions for progress in the analysis of social networks. The obtention of reliable data is the main problem encountered by the researcher on seeking to obtain data sensitive to power relationships.

These examples are interesting because they use informants to illustrate segments or parts of the whole network. In the following section we shall study the use of informants in depth, persons who in principle can inform us about the whole of the network which is the object of the study.

Informants

In 1976 Killworth and Bernard began a series of articles that investigated the accuracy of informants on the data of their social network (Killworth and Bernard, 1976). The objective of these studies was to elucidate the mental maps built up by the informants and used to guide themselves through their social network. Important principles were established in the literature generated from this line of research (Romney and Faust, 1983; Freeman, Romney and Freeman, 1987), such as, for example, that (i) the precision of the knowledge of an informant on the existing relations in a social network are directly related to his or her degree of interaction, and that, (ii) despite the fact that we tend to be mistaken in the short term on explaining who relates with whom, we are quite good at immediately reflecting relationship patterns in the long term.

One of the most important discoveries in the analysis of social networks is that the perception people have of their social network is related to their position occupied in this network. In other words, two people working in the same department of an organization for years can describe different networks. In a study carried out in 1996 in the HP factory in Sant Cugat (Barcelona), the view of the network of the two informants who we worked with was completely different. We asked each of them to organise labels that contained the names and surnames of the 144 persons who made up the R+D department at that time on a board. Once they had classified the labels by groups, in each case we asked them to draw lines that would link the labels according to three different kinds of relationships: work, friendship and leisure. The networks built up from information provided by María, a computer programmer who had arrived recently in the department but with

a very broad social activity within the organization, and 8 years seniority, are very different from those provided by Bill, an American mechanical engineer, transferred two years previously to the department to work on a project on large format *plotters*.

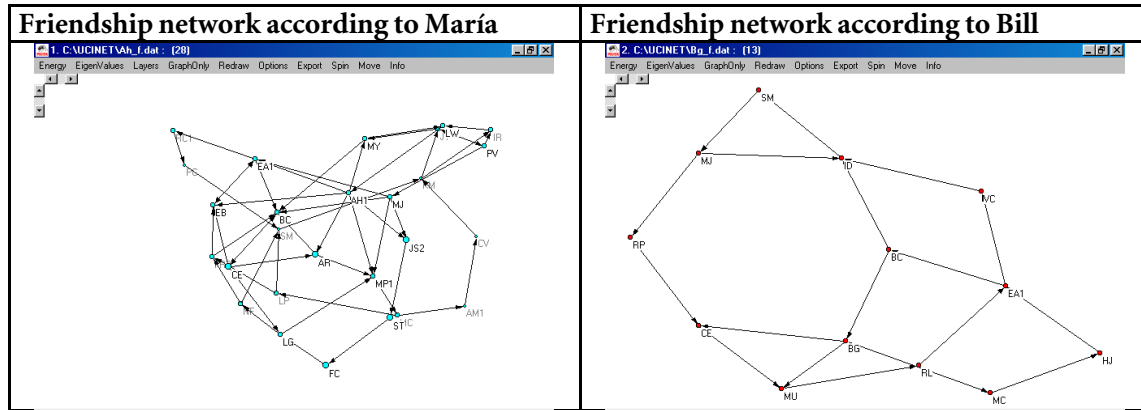


Figure 2. Reports on the friendship network in the R+D department

As we can see, the degree of information on the relationships existing in the department is much higher in María's case (AH1) than in Bill's (BG).

This discrepancy is much higher in the case of the leisure relationships. At this point we should point out that the HP factory in Sant Cugat has complete sporting installations and that these activities are promoted by the organization and permit a wide range of social contacts. María herself took care of organising many of these activities.

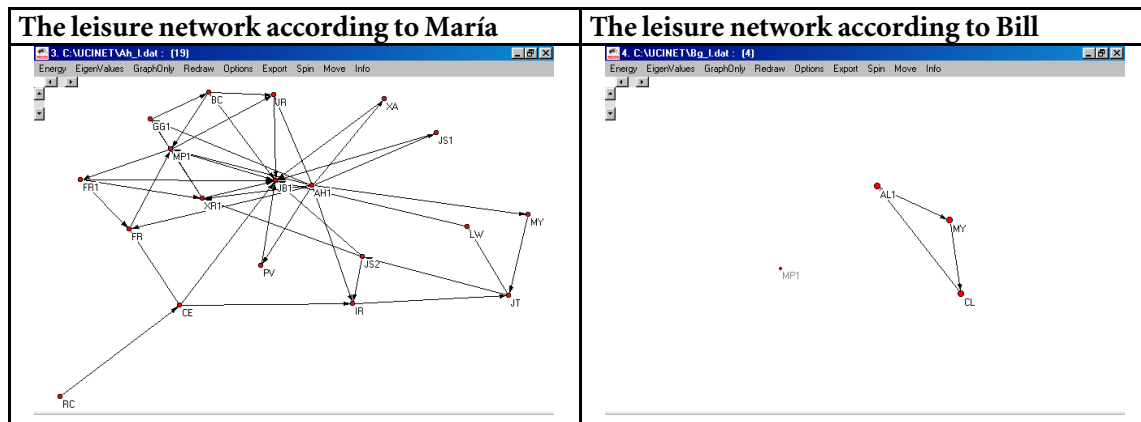


Figure 3. Reports on the leisure network.

Nevertheless, despite the large differences between the two previous networks, the work relationships indicated by the two informants were quiet similar as far as their volume was concerned.

What is the reason for this situation? We should not forget that the data gathered corresponds to an organizational environment, whereby the existing relationships are to a large extent determined by the formal organizational chart. Consequently, both María and Bill reported on the existence of a network made from their own information and by the organizational *assumptions*. In other words, unknown relationships were substituted by the relationships that the persons *should have*

had according to their place in the classificatory system of the organization. If two persons form a part of the same working team, it is assumed that they should have relationships, just as we suppose it should occur in the case of two lecturers who belong to the same university department or two students in the same class. This tendency to *fill-in-the-blanks* was indicated by Linton Freeman (1992) and can generally be applied to the view that the informants have of their personal networks. Naturally, reality is much more complicated and only the informants who have a deep understanding of the nature of the existing relationships succeed in reproducing a network which is close to reality.

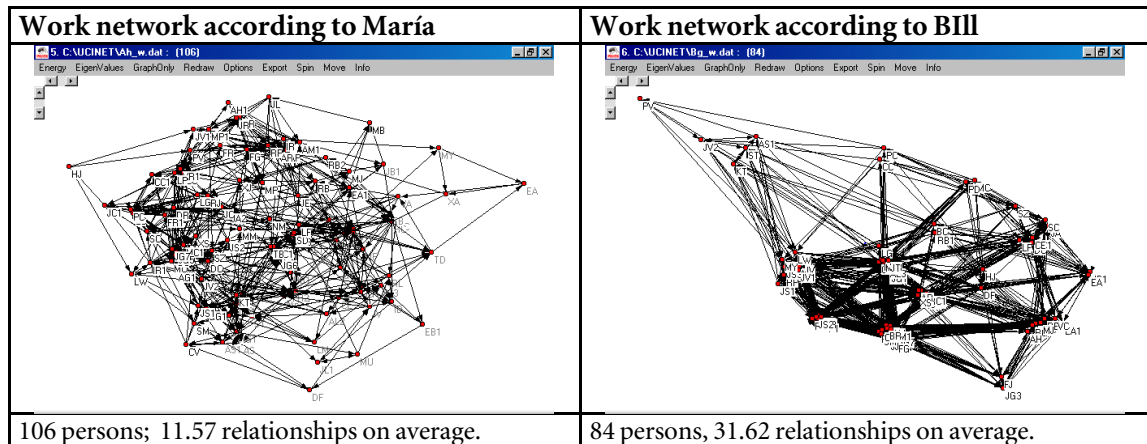


Figure 4. Reports on the work network.

This can best be observed in Bill’s case, where the perceptible groups in the sociogram correspond to the different project teams in action at that time.

Another effect has to be added to this one: the tendency to see ourselves as more central than we really are to the relationships that we have with others. Ronald Burt (1992) has indicated that when we report on relationships with various persons, among whom we are included, we tend to overestimate our capacity to connect them, in other words, our “bridging” capacity between them. Once again, reality is much more complicated and these persons usually have either direct relationships among themselves or alternatives for connection that are different from ours. This effect can be appreciated in the illustration in the following:

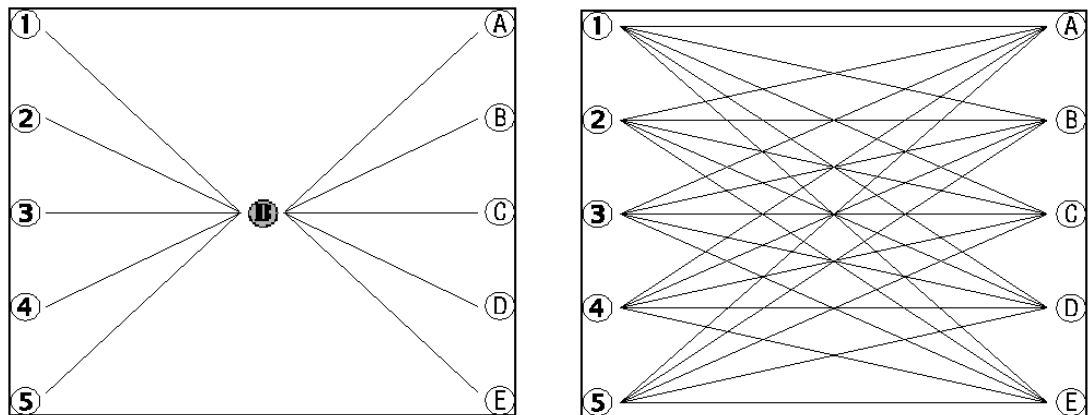


Figure 5. Reality is usually closer to the image on the right...

Questionnaires on relationships

An alternative to the use of informants is the distribution of a questionnaire on relationships to the members of an organization. One of the problems of this method is that we usually obtain rectangular matrices. In order to analyse the matrices we have to extract those nodes that do not have relationships and build up a squared matrix. In the following example, taken from the NGO for the Development of Barcelona, we can see how 15 persons enumerate relationships with 21.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
		Car	Isa	M	J	Mar	Rog	Lun	Xav	Dol	Eul	Jul	Jua	Mar	ung	Mar	Con	Alf	Mon	Car	Azn	Man	Tit
1	Carles	0	9	7	0	8	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Isabel	0	0	10	0	0	7	8	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0
3	MaJosé	0	7	0	0	0	0	10	9	6	0	0	0	0	0	8	0	0	0	0	0	0	0
4	Martí	9	8	7	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Roger	8	9	10	6	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0
6	Luna	0	10	4	0	0	0	5	2	1	0	8	9	0	6	3	0	0	0	0	7	0	0
7	Xavier	2	6	10	0	0	8	0	7	5	0	0	0	0	0	9	4	3	1	0	0	0	0
8	Dolors	0	7	8	0	0	5	9	0	6	0	0	0	0	10	0	0	0	0	0	0	0	0
9	Eul...lia	0	7	10	0	0	5	8	6	0	0	0	0	0	0	9	0	0	0	0	0	0	0
10	Julio	0	10	9	0	0	8	4	5	7	0	0	0	0	0	0	0	0	0	0	0	0	6
11	JuanM	0	8	0	0	0	10	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0
12	Mariano	0	8	0	0	0	10	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0
13	Àngel	4	10	9	2	5	7	8	6	1	0	0	0	0	3	0	0	0	0	0	0	0	0
14	Marc	8	10	6	0	7	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Manel	8	10	0	6	7	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0

Figure 6. Rectangular matrix of relationships in an NGDO.

If we represent this matrix in a sociogram, we can see how we find nodes around the main network that receive but do not transmit relationships.

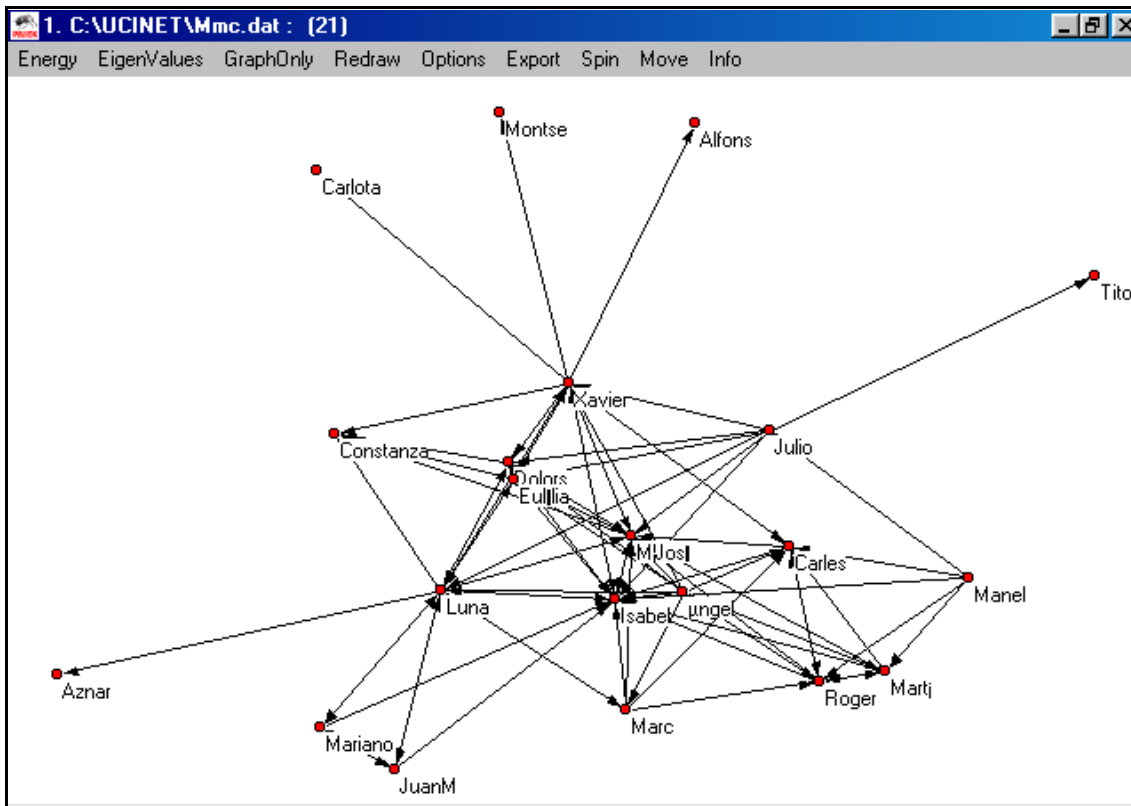


Figure 7. Network of Relationships in an NGDO.

Once the nodes in question were extracted, the following squared matrix was obtained:

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Car	Isa	MJ	Mar	Rog	Lun	Xav	Dol	Eul	Jul	Jua	Mar	ung	Mar	Man
1	Carles	0	9	7	0	8	0	10	0	0	0	0	0	0	0	0
2	Isabel	0	0	10	0	0	7	8	0	9	0	0	0	0	0	0
3	MaJosé	0	7	0	0	0	0	10	9	6	0	0	0	0	0	0
4	Martí	9	8	7	0	10	0	0	0	0	0	0	0	0	0	0
5	Roger	8	9	10	6	0	0	0	0	0	0	0	0	7	0	0
6	Luna	0	10	4	0	0	0	5	2	1	0	8	9	0	6	0
7	Xavier	2	6	10	0	0	8	0	7	5	0	0	0	0	0	0
8	Dolors	0	7	8	0	0	5	9	0	6	0	0	0	0	0	0
9	Eulàlia	0	7	10	0	0	5	8	6	0	0	0	0	0	0	0
10	Julio	0	10	9	0	0	8	4	5	7	0	0	0	0	0	0
11	JuanM	0	8	0	0	0	10	0	0	0	0	0	9	0	0	0
12	Mariano	0	8	0	0	0	10	0	0	0	0	0	9	0	0	0
13	Àngel	4	10	9	2	5	7	8	6	1	0	0	0	0	3	0
14	Marc	8	10	6	0	7	9	0	0	0	0	0	0	0	0	0
15	Manel	8	10	0	6	7	0	0	0	0	9	0	0	0	0	0

Figure 8. Asymmetric squared matrix of work relationships in an NGDO

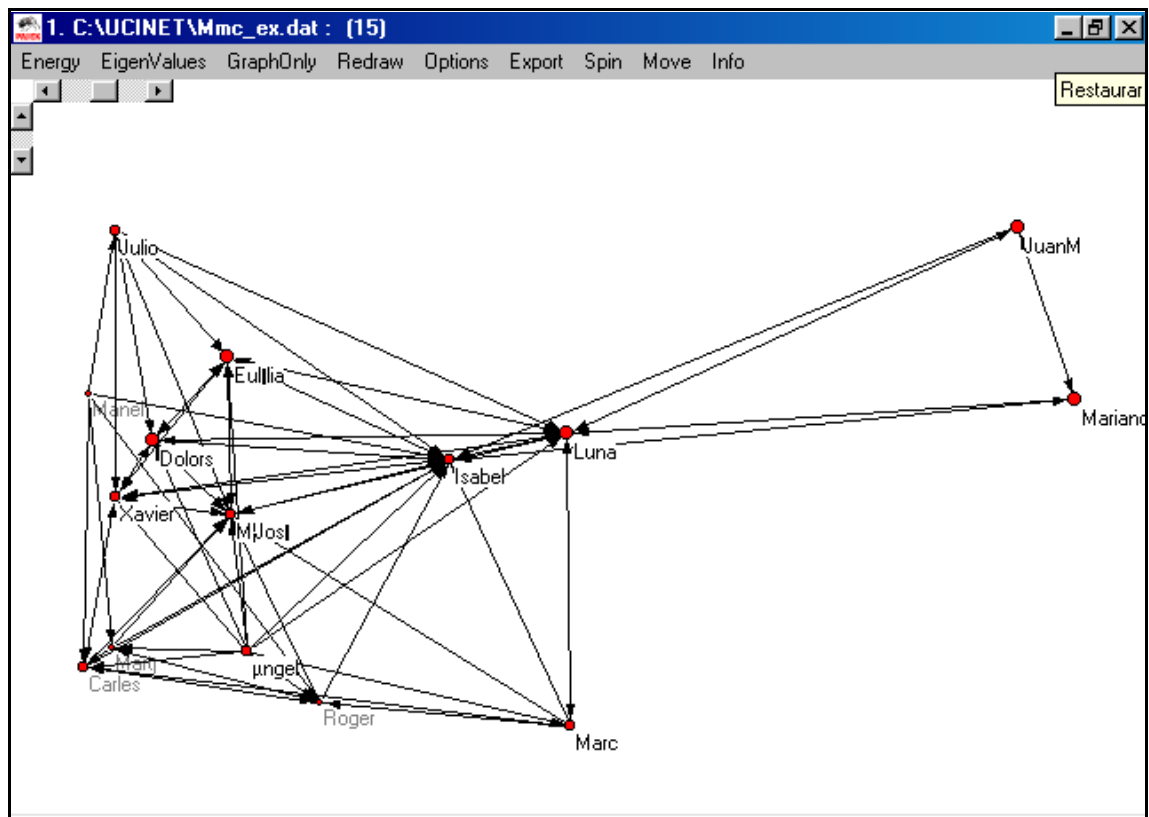


Figure 9. Network of relationships in an NGDO

In the sociogram of illustration 9 we can appreciate how Mariano and Juan M. are related to the organization through Luna and Isabel. It is also possible to see how Xavier, Dolors, María José and Eulàlia form a dense nucleus of relationships.

The organization we are analysing was made up of professional personnel (Luna, Isabel, Xavier, Dolores, María José, Eulàlia and Constanza –not reflected in the previous sociogram), conscientious objectors and volunteers. When the research was carried out (January 1997), NGDO’s still accepted conscientious objectors for substitutory social service for military service. These objectors, who worked around four hours a day from Monday to Friday, were formally assigned to one of the four departments of the organization (Administration, Communication, Projects, Pharmacy). The organizational chart of the organization was the following:

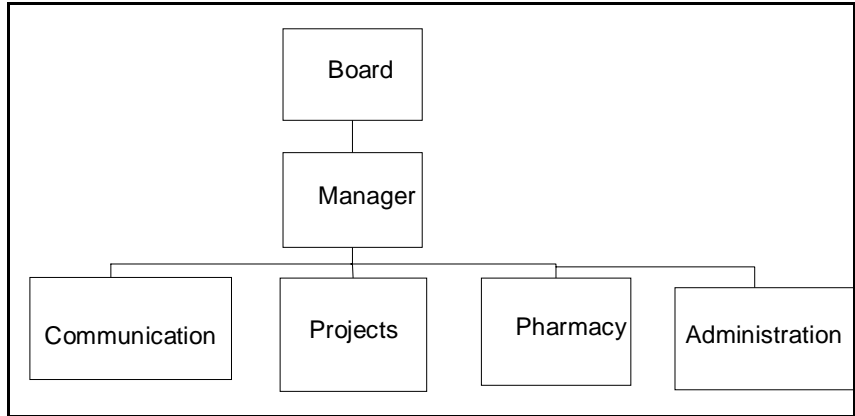


Figure 10. Organizational chart of an NGDO

The board was made up of volunteers and was the maximum body of direction of the organization. The board chose the manager, (Xavier), on whom the rest of the units depended. Luna took care of the Communication Department and the volunteers (Juan M. and Mariano in this case). Marc, an objector, was assigned to this department. The Projects Department consisted of two people, Dolores and Constanza. The latter also coordinated the work of the pharmacy. The Department of Administration was taken care of by María José, with the help of Eulàlia and to a lesser extent Isabel, the secretary of the NGDO.

		1	5	10	4	15	13	14	11	12	3	2	9	6	7	8
		Ca	Ro	Ju	Ma	Ma	Àn	Ma	Ju	Ma	M*	Is	Eu	Lu	Xa	Do
1	Carles		8								7	9		10		
5	Roger	8			6		7				10	9				
10	Julio										9	10	7	8	4	5
4	Martí	9	10								7	8				
15	Manel	8	7	9	6							10				
13	Àngel	4	5		2			3			9	10	1	7	8	6
14	Marc	8	7								6	10		9		
11	JuanM									9		8		10		
12	Mariano								9			8		10		
3	M*José											7	6		10	9
2	Isabel										10		9	7	8	
9	Eulàlia										10	7		5	8	6
6	Luna							6	8	9	4	10	1		5	2
7	Xavier	2									10	6	5	8		7
8	Dolores										8	7	6	5	9	

Figure 11. CONCOR with two partitions

Through a series of CONCOR (Borgatti, Everett and Freeman, 1994) analyses of the squared matrix¹ it has been possible to establish the different groups of the organization. These analyses allow us to get closer to what is the informal organizational chart of the organization.

In the first analysis we shall only deal with the identification of the two groups according to the density of their relationships. As it can be seen from the following illustration, these two groups establish a clear difference between the professional structure (the second group) and the structure of objectors and volunteers.

In the following analysis, we have gone on to divide each group into two sub-groups. The result is shown in Figure 12.

		1	5	10	4	15	13	14	11	12	6	2	9	3	7	8
		Ca	Ro	Ju	Ma	Ma	Àn	Ma	Ju	Ma	Lu	Is	Eu	M ^a	Xa	Do
1	Carles		8									9		7	10	
5	Roger	8			6		7					9		10		
10	Julio										8	10	7	9	4	5
4	Martí	9	10									8		7		
15	Manel	8	7	9	6							10				
13	Àngel	4	5		2			3			7	10	1	9	8	6
14	Marc	8	7								9	10		6		
11	JuanM								9		10	8				
12	Mariano								9		10	8				
6	Luna							6	8	9		10	1	4	5	2
2	Isabel										7		9	10	8	
9	Eulàlia										5	7		10	8	6
3	M ^a José											7	6	7	10	9
7	Xavier	2									8	6	5	10		7
8	Dolors										5	7	6	8	9	

Figure 12. CONCOR with four partitions

As we can see, for the professional and non professional structures respectively, Luna and Isabel and Mariano and Juan M form separate groups that can be appreciated in the sociogram. These persons carry out or give support to the sensitisation and communication tasks of the activities of the NGDO. On the other hand, the density of relationships between the Management, Projects and Administration indicates the priorities of the formal structure of the organization in the management of cooperation structures: the creation of cooperation projects with possibilities for financing, the purchase of equipment, support for collaborators, dispatch of supplies... The Pharmacy department only exists as a separate entity on paper. The rest of the people (objectors) carry out support functions for the rest of the organization.

The analyses could be multiplied. However, we believe that we have demonstrated that it is possible to approach the informal organizational chart of an organization using the methods and techniques of the analysis of social networks. Thus we have an additional tool for the social analysis of organizations.

¹CONCOR: An analysis carried out with Ucinet IV by Borgatti, Everett and Freeman (1994). <http://www.analytech.com>. The sociograms are represented with Pajek: <http://vlado.fmf.uni-lj.si/pub/networks/pajek>.

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