

Occupational safety layer network (OSLN)

Peter Leisztner

Óbuda University, Doctoral School for Safety and Security Sciences,
leisztner.peter@uni-obuda.hu

Abstract: Can safety organization of a company be visualized using network science? What kind of relations of occupational safety are between managers, employees, Occupational Safety Specialist (OSS) and Occupational Safety Representatives (OSR)? As a result of the knowledge of network science, We try to visualize the occupational safety layer network of the examined companies, with its tools. First of all, We examine whether this can be defined and visually represented in any randomly selected company. To explore the problem, We used directed network, weighting the connections with numbers of occurrences between participants. We included six companies with an Occupational Safety Service Provider (OSP) or an OSS into the research. To map the relationships, We created a questionnaire that We made available both on paper and online as well. To process the responses We used Excel, and the Gephi application which can handle the directionality, the weighting and the graphical displaying. The results have been shown that network science can be used to present and analyze the safety layer of an enterprise. Based on the research, We came to the conclusion that the obtained results can be used to determine the areas of organization to be developed in terms of occupational safety at the examined companies.

Keywords: occupational safety layer network, human relations network, occupational safety, occupational safety representative

1 Introduction

We live among networks. More and more research is looking at organizations from a network science perspective[1]. We examine the occupational safety relations at some companies. It would be good if OSR had a significant number of relations, because, according to an EPSARE project[2], they can play a significant role in prevention. In our study, networks are organized around nodes, as Barabási put it, in his view, most of the networks are not random is created but organized around nodes[3]. Many studies deal with multilevel networks within organizations[4][5], and although there should be isomorphism between levels for multilevel analysis[6], however, We examine the OSLN on its own. Getting to know the network of human relationships in a chain[7] has helped a lot in defining the task. Network research fits well with workplace risk management and it is, one of its areas.[8]

2 Research method

We first compiled a questionnaire and then sent it to five OSS and OSP to look for businesses in their area of operation who would be happy to participate in the

research. This area covered about two hundred businesses. When We started our research, We hoped to look into at least eight companies, but We hit a wall everywhere. Finally two Professionals helped us, and We got results from six companies in two ways, because the labour safety, and the occupation health networks are separated in many companies. The first two were examined by Imre Komlódi, He had taken questionnaires to the Owners, and asked them to help us. This organisations filled them out by theirself. The next three companies I examined myself, and I asked them personally employee by employee. The last research was made by Ferenc Faragó, who asked employees with similar method as I. The questionnaire was assembled by online as well, but finally nobody used it. We used directed network for my research, because We wanted to know that, if the relations were bidirectional, or not. To displayed results, We used Gephi application.

2.1 The questionnaire

The final version of questionnaire had five questions. The online questionnaire was similar with this. The first two questions were about titles at the company, third question was about labour safety, fourth question was about occupational health, and the fifth question was control question of third question.

Q1: Status at the company?

Q2: What is Your occupational safety task of the company?

Q3: From whom do you get instructions, education and help related to occupational safety?

Q4: From whom do you get the referral? Who sends you for a medical examination?

Q5: Who can you turn to with your remarks, problems and questions related to occupational safety?

3 Results

When We sent out questionnaires We could not be sure that everybody would send them back. Then We thought it over. Nothing would happen, because if She, or He was a hub, then She or He would appear as an unidentified person with a lot of relations, otherwise She or He would be a standalone individual with few relations. We marked them with question mark and painted them red. We displayed individuals' strength with their sizes. If the average degree was ≥ 2 then the relationships were mostly two-way, if it was < 2 but it was ≥ 1 then the relationships were mostly one-way. (Except for special cases where everyone was connected to everyone with only one one-way edge)

		No answers	Nodes	Unidentified employees	Edges	Average degree
1st Company	Labour safety	11	13	2	37	2,846
	Occupation health				18	1,385
2nd Company	Labour safety	21	26	5	46	1,769
	Occupation health				20	0,769
3rd Company	Labour safety	5	5	0	4	0,800
	Occupation health				2	0,400
4th Company	Labour safety	19	19	0	18	0,947
	Occupation health				0	0,000
5th Company	Labour safety	27	27	0	1	0,037
	Occupation health				26	0,963
6th Company	Labour safety	154	159	5	504	3,170
	Occupation health				185	1,164

Figure 1
Results (Results from Gephi)

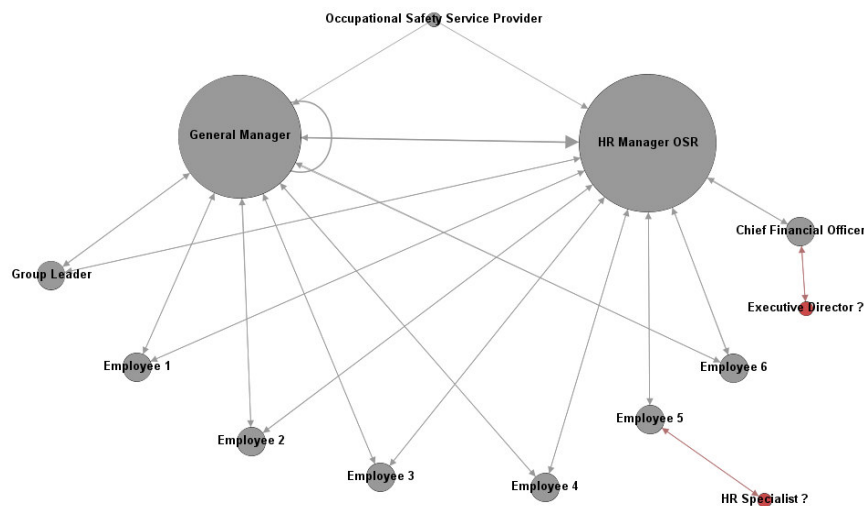


Figure 2
First company labour safety layer network

The occupation health layer network (Figure 3) presented Us the Occupation Health Care without health care provider. We could see that the relations were only one directional. It was right, because the stuff in duty sent employees to medical check. Our main problem with this illustration was that, there were two employees, who could get medical referral from unidentified personal.

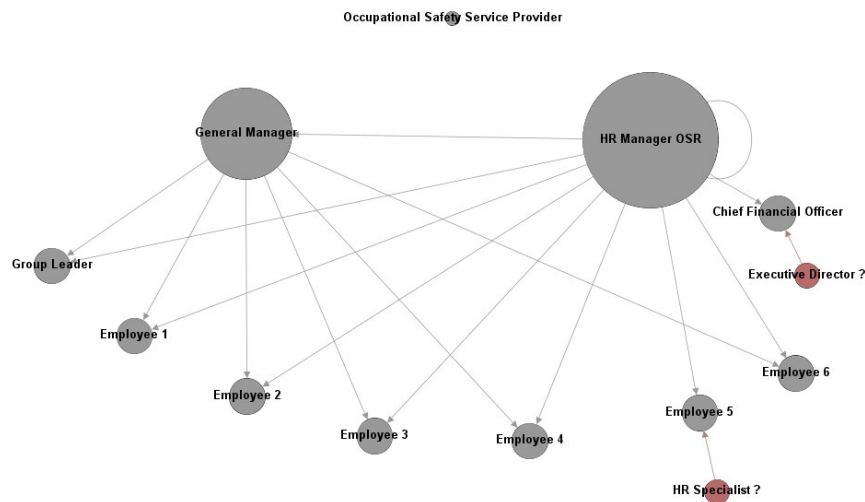


Figure 3
First company occupation health layer network

At the following results We focused on only to present the main problems.

Second examined company was a small company as well, with twenty employees. They all sent questionnaires back. Problems were the same as before. There were unidentified titles, and there were employees, who got medical referral from unidentified personal.

Third examined company was the smallest company of all examined, and the occupational safety problems of a typical Hungarian company became clear. The Administrator is the Executive Director's wife, who did not do real job for the company. This company had an outsider Occupational Safety Provider. As We could see, the employees were not interested in Occupational Safety, because relations had only one direction. (Figure 4)

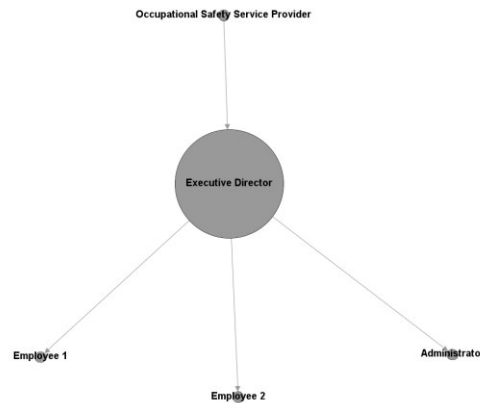


Figure 4
Third company labour safety layer network

At the next company, which was the fourth, problems were the same as before. It was a small company too. The employees were not interested in Occupational Safety because relations had only one direction. The main problem at this company was that, the employees known nothing about annual medical check. Two of them were the Executive Director's relatives. (Figure 5)



Figure 5
Fourth company occupation health layer network

Fifth examined company was a small company as well, but they were the first, which required to elect an OSR. We did not find an OSR in OSLN. They were

not interested in Occupational Safety, but They at least went for an annual medical examination. At this result (Figure 6) We thought, everything was over. Mainly because We have made the documentation of occupational safety, but We did not have contract with occupational safety services. Then We considered, and We recognised, We did not get faulty result, because it showed Us, which areas had to develop at the company.

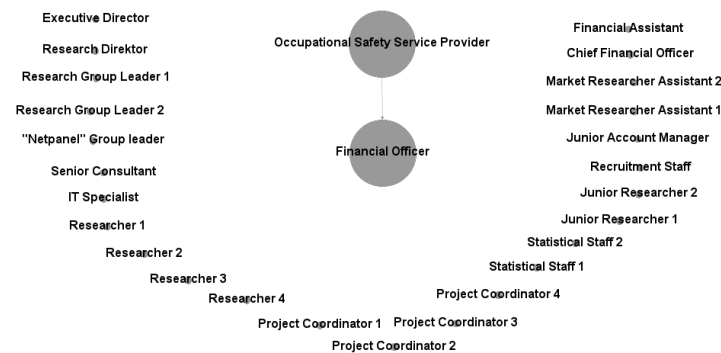


Figure 6
Fifth company labour safety layer network

The next company which was the sixth in the row, but it was the biggest. Ferenc Faragó was a huge help in my data collection at this company. He asked employees personally too. They sent one hundred and fifty-four answers back. Processing was slower, but the results spoke for themselves. They were the nicest layer networks of them all. Nodes were well recognized, but the layer networks had the known problems.

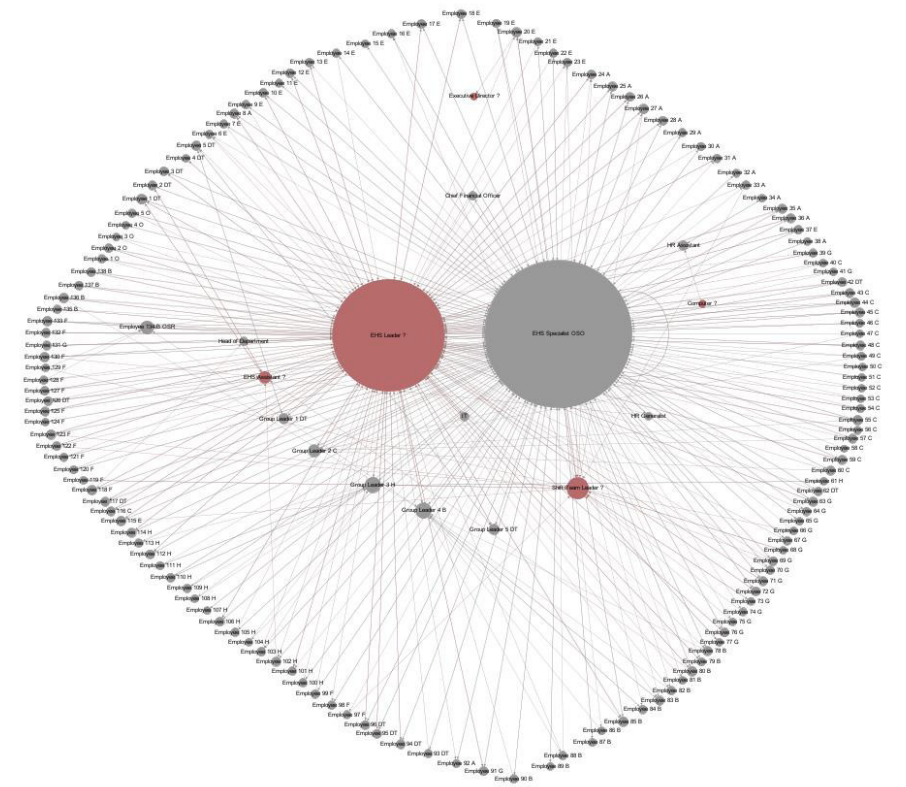


Figure 7
Sixth company labour safety layer network

There were not identified titles (Figure 7), and there were employees, who got medical referral from unidentified parciptiant (Figure 8).

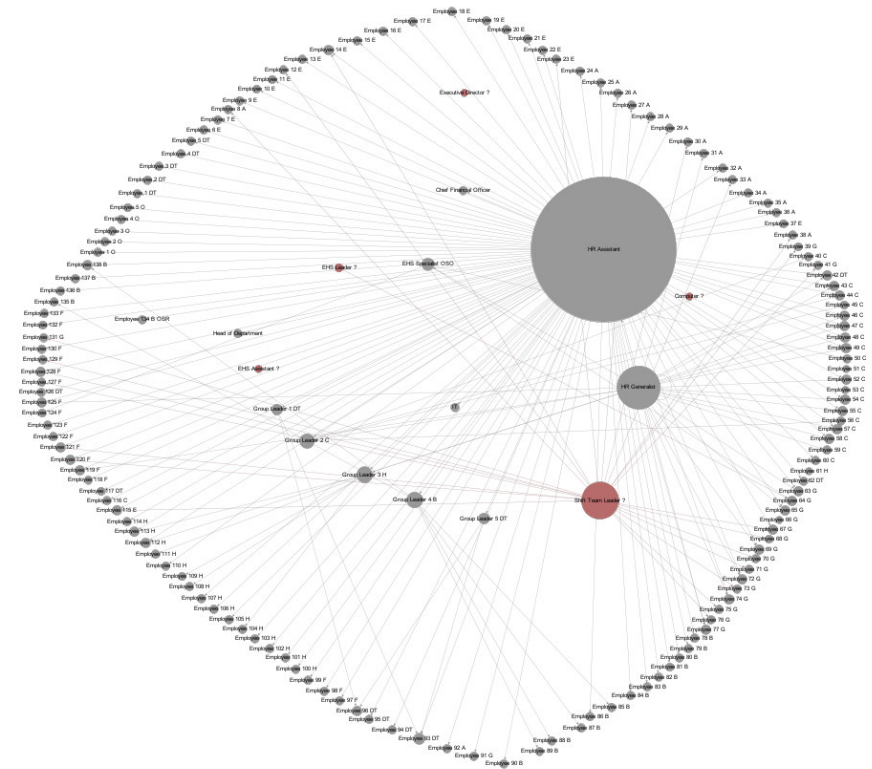


Figure 8

Sixth company occupation health layer network

Conclusions

We confirmed, We are able to display the OSLN of an arbitrary company. It helps us to recognise occupational safety deficiencies at the company. The research highlighted that we have to focus on the roles of OSP, OSR or OSS. We could recognise that, OSR do not have many relations at the examined companies, and sometimes the employees try to avoid election of OSR.

Acknowledgement

Many thanks to Dr. Habil. Jolán Velencei for her help and support, and to Dr. Győző Szilágyi for basements of network science, and to Dr. Gyula Szabó for help in write an article. Special thanks to Ferenc Faragó and Imre Komlódi for their great help in collecting the data.

References

- [1] M. Baksa and G. Drótos, “A szervezetek hálózattelmélete: gondolati lépések egy új paradigma felé • The Network Theory of Organizations: Conceptual Steps towards a New Paradigm,” *Magy. Tudomány*, vol. 182, pp. 69–80, 2021, doi: 10.1556/2065.182.2021.1.11.
- [2] L. Ollé-espluga, M. Vergara-duarte, M. Menéndez-fuster, M. Vázquez, L. Ollé-espluga, and M. Vergara-duarte, “Relations industrielles / Industrial Relations Workers ’ Knowledge and Views on Interaction with Health and Safety Representatives : An Exploratory Qualitative Study Connaissances et opinions des travailleurs sur les interactions avec leurs représentants en santé et sécurité : une étude qualitative exploratoire Conocimiento y Opiniones de los Trabajadores sobre la Interacción con Representantes de Salud y Seguridad : Un Workers ’ Knowledge and Views on Interaction with Health and Safety Representatives : An Exploratory Qualitative Study,” 2022.
- [3] R. Albert, H. Jeong, and A.-L. Barabási, “Error and attack tolerance of complex networks,” *Nature*, vol. 406, no. 6794, pp. 378–382, 2000, doi: 10.1038/35019019.
- [4] G. T. Payne, C. B. Moore, S. E. Griffis, and C. W. Autry, “Multilevel challenges and opportunities in social capital research,” *J. Manage.*, vol. 37, no. 2, pp. 491–520, 2011, doi: 10.1177/0149206310372413.
- [5] P. Zappa and A. Lomi, “The Analysis of Multilevel Networks in Organizations: Models and Empirical Tests,” *Organ. Res. Methods*, vol. 18, no. 3, pp. 542–569, Apr. 2015, doi: 10.1177/1094428115579225.
- [6] T. P. Moliterno and D. M. Mahony, “Network Theory of Organization: A Multilevel Approach,” *J. Manage.*, vol. 37, no. 2, pp. 443–467, Jul. 2010, doi: 10.1177/0149206310371692.
- [7] A.-L. Barabási, *Behálózva. A hálózatok új tudománya*, 2. kiadás. Budapest: Libri Kiadó, 2020.
- [8] Szabó Gyula, “A munkavédelmi kockázatkezelés sajátosságai,” *Bánki Közlemények*, vol. 3, no. 1, pp. 5–12, 2020.