Anna Szarek

Application of ONA in Change Management - Empirical Research in Energy Industry

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The article aims to examine the empirical change implementation process from the resource-based point of view and from the dynamic-based point of view, exploiting the organisational network analysis as the main method. The key question of the article is how competencies of change agents and relations among employees involved in change can affect the result of change implementation. The conducted empirical research is to depict correlations between effectiveness of change implementation and two aspects: (a) quality of change agents' groups responsible for change process and (b) relations of good atmosphere in departments in which change implementation took place. Firstly, the organisational network analysis (ONA) is briefly introduced together with the main definitions and indexes used further in the article. In second part, the presumptions of empirical research conducted in one of service and production companies are presented. Finally, in the frame of results and conclusions the research unveils how proper exploitation of social capital in change agent groups and proper structure of relations can help with successful change introduction.

Keywords: organisational network analysis, change management, organisational changes.

Zastosowanie analizy sieci organizacyjnych w zarządzaniu zmianą – badanie empiryczne w branży energetycznej

Artykuł ma na celu zbadanie empirycznego procesu wdrażania zmiany na podstawie teorii zasobowej i relacyjnej z wykorzystaniem analizy sieci organizacyjnej jako głównej metody. Kluczowym pytaniem artykułu jest, jak kompetencje agentów zmiany i relacje pomiędzy pracownikami zaangażowanymi w zmianę mogą wpływać na rezultaty wprowadzania zmiany. Przeprowadzone badanie empiryczne ukazuje korelację pomiędzy efektywnością wprowadzania zmiany i dwóch aspektów: (a) jakości grup agentów zmiany odpowiedzialnych za proces zmiany i (b) relacji dobrej atmosfery w działach, w których wprowadzanie zmiany miało miejsce. Po pierwsze, została krótko przedstawiona analiza sieci organizacyjnej (ONA) razem z definicjami i wskaźnikami wykorzystanymi później w artykule. W drugiej części zaprezentowano założenia badania empirycznego przeprowadzonego w jednej z firm usługowo-produkcyjnych. Finalnie w ramach rezultatów i konkluzji badanie odkryło, jak odpowiednia eksploatacja kapitału społecznego w grupach agentów zmiany i odpowiednia struktura relacji mogą pomóc w udanym wdrożeniu zmiany.

Słowa kluczowe: analiza sieci społecznej, zarządzanie zmianą, zmiany organizacyjne.

JEL: D22, D23

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1. Introduction

Existing models of change management provide knowledge of steps to be undertaken in order to introduce change. However, application of those steps is not that obvious, as the newest empirical research of top management level shows. One reason can be that employees are designated to project teams without consideration of the realistic flow of information or realistic features of personnel (Szarek, 2016). The fact is also that some teams are smarter than others. As the research of Thomas Malone and others (Malone, Woolley and Chabris, 2015) discovered, it is not the individual level of IQ that decides whether the group succeeds with a task or not, but the collective IQ of the whole team. The last one depends on three determinants: absence of a dominant person in the group, high ability to read emotions from the face (researched on basis of the method: *Reading the Mind from the Eyes*) and sex diversification in the group. So the choice of project employees itself can be displayed as the essential step in the change management process, especially that communication among project team members needs to be divested of any misunderstandings in order to manage change (Sghari, Chaabouni and Baile, 2015). The literary output on the correlation between quality of project groups and effectiveness of change introduction is, however, burgeoning.

Moreover, empirical data exhibit that in change management in real business there is a space for improvement. The last survey of Towers Watson Change and Communication ROI Survey conducted in June 2013 revealed that among a total of 276 large and midsize organisations from across North America, Europe and Asia, 55% of companies succeed with reaching initial change objectives but only 25 % manage to sustain them over the long term. Respondents claimed in the survey that the key role of change success is played by managers. However, only 9 out of 10 train the managers to manage change. And only 22% of managers admit that training is effective and helpful (https://www.towerswatson.com/en/Press/2013/08/Only-One-Quarter-of-Employers-Are-Sustaining-Gains-From-Change-Management).

Among the main streams of change management models, there are concepts of Lewin, Kotter or Greiner indicating certain steps of change management models. In the more modern theories of Senge, it is not certain concrete steps of change success that matter but the competencies of managers. So it is exactly like the Towers Watson survey showed. In the research, the author combines and compares three approaches to change management: certain Kotter steps identification, identifying Senge's important competencies indispensable for proper change implementation and finally relations among the employees linked to creation of good atmosphere at work. The empirical research via the method of Kotter steps defines the effectiveness of change implementation and via organisational analysis it identifies (a) quality of competencies of change agents

– competencies of managerial, leadership and entrepreneurial dimensions defined according to Bełz and Barabasz (Bełz and Barabasz, 2010) (b) relations of good atmosphere appearing among group members participating in change.

Analysis of key aspects of social power within teams can formulate morphology of social dependence of each member of organisational society which delivers the answer to the question of how the structure of network affects efficiency of change management. Moreover, the author conducts a supplemental analysis of process of change introduction by top management. An insubordinate application of change management models can result in the deranging of research conclusions and introduce such essential constraints of the research that undermine the outcome of the organisational network analysis (ONA).

The aim of this article is to present selective correlations between features of the structure of the social network of a team and effectiveness of change implementation. Firstly, the nature of organisational network analysis and its benefits are presented. Secondly, the company chosen for research and the changes made are described together with the methodological presumptions of the research. The next part of the article unveils the qualitative and quantitative results of the research. Finally, the author depicts the conclusions on how the structure of the social network in the aspect of creation of good atmosphere can affect change introduction. The author lastly presents limitations of the research and the premises for research continuation in the given matter.

2. Introduction to the Organisational Network Analysis (ONA)

The organisation network analysis (ONA) has lived to see many applications in management science (White, Boorman and Breiger, 1976; Freeman, 2006; Pinheiro 2011). Cross and Thomas peddled the organisational network analysis as a key to a company's success. Social capital and awareness of its characteristics is to guarantee that top management uses human resources optimally to reach the above average results (Cross and Thomas, 2009). In the context of organisational changes, until now, there have not been too many publications connected with the organisational network analysis. Bełz and Krzemiński find concrete correlations between social capital and introducing a strategy of company growth and strategic renewal (Bełz and Krzemiński, 2014). This matter was also analysed in the context of creation of innovative climate in companies (Klimas, 2015) and building the atmosphere of knowledge and innovation sharing (Suciu and Petrescu-Prahova, 2014, pp. 18–20). The world of business showed that a deeper analysis of social organisational network in the context of changes is indispensable (Bevan, 2011, pp. 4–6). As Heffernan proposed, in current business, one deals with the end of the era of 'super heroes' placed in the positions of

CEOs. One-headed management is pretty much over. It is the whole crew that decides about the success of the company – low, middle and high levels of management (Heffernan, 2012).

The social network analysis is essential and beneficial as it researches the internal relations from the inside not the outside of the organisation. As respondents not only judge (indicate) but also are judged (indicated), the research can shed light on hidden relations between employees. The social network analysis, when used with regard to management, concerns research not on whole societies but on the communities in specific organisations. Therefore, such research is called organisational network analysis (ONA), which is simply defined as a method for studying communication and socio-technical networks within a formal organisation and in consequence it describes quantitatively, via graphical models, relations existing between people, tasks, groups, etc. And only knowing the organisation well from the inside can prevent the management from failure to introduce organisational changes (Combes and Lethielleux, 2008). A network itself is defined as a group of nodes (actors, subjects) and relations occurring between them (Barabasi, 2012). The approach to analysing social networks is based on two dimensions:

1. Research on the level of *individual node* which reveals the *competencies* of individuals. In this aspect, the author seeks for unique human capital (resource-based view).
2. Research on the level of *network* which reveals the *relations* among individuals. In this aspect, the author seeks for unique social capital (dynamic capabilities view).

The main indexes that will be considered in the article are depicted in Tab. 1. The choice of those degrees is selective and does not exhaust all indexes available in social network science.

The results based on the first perspective – perspective of an individual subject (i.e. employee) – focus the attention on the indegree index in the article. Central indegree (Wasserman and Faust, 1994) indicates the number of votes which have been given by the rest of the team. Indegree is defined by the number of links between one node and the rest of the nodes in a graph. Density degree is the quotient figures of existing relations to all potential relations in a certain network. Betweenness centrality describes the number of the shortest paths which pass through the given vertex. Closeness measures the average shortest distance from each vertex to each other vertex. In turn, eigenvector indicates not only how many connections a vertex has but also the degree of vertices that it is linked to. Clustering defines how a vertex's neighbours are connected to one another. Generated aggregated data in the frame of graphs determine correlations and dependence among certain subjects (actors) of a network. Visualisation of graphs illustrates relations and network attributes (Freeman, 2010).

Dimension	Index	Area
from node perspective	Indegree	Managerial, Leadership, Entrepreneurial, Knowledge
from network perspective	Density Indegree PageRank Betweenness Centrality Closeness Centrality Eigenvector Centrality Clustering Centrality	Good atmosphere of work

Tab. 1. Main dimensions of the network and types of indexes used in the research. Source: own elaboration on the basis of K. Fuks, A. Kawa, and B. Pierański (2014). Zastosowanie mierników SNA w analizie sieci przedsiębiorstw. Marketing i Rynek, (5), 47–52.

To sum up, the organisation network analysis can exhibit morphology of social capital engaged to introduce organisation changes. A network lets one diagnose complicated interpersonal relations having influence on change success. In the article, the results of the indegree index describing competencies of the change agent group in the areas of knowledge as well as entrepreneurial, managerial and leadership features are depicted. Those indexes are designed to specify key personnel in a company and compare the compositions of both project teams. On the other hand, the whole network of employees participating in change is described using indexes for the ability to create good atmosphere of work. Only nowadays can the method based on network analysis deliver a multi-dimensional approach to leadership in project teams introducing changes in certain organisations.

3. Methodological Assumptions of Research

Network research has been conducted in December 2015 in one of the production and service companies that design and set up power installations and produce switchgears. The company cooperates with a fossil-fuel power station and employs 100 workers under a permanent contract of employment. With regard to personnel change in the CEO position, the company has started a series of changes in the direction of work organisation. Those changes are not that essential to consider them as strategic renewal changes in the light of their definition (Bełz and Skalik, 2015). The time under command of the new CEO was a period of change accumulation. Thus, it brought about (among others) two changes connected with reorganising work in service and production departments. The changes occurred last year and were made one by one, not simultaneously. Those changes were stated as the objective scope of the research. A short description of each change made is provided in Tab. 2.

#	Characteristic	Change 1	Change 2
1	Type of change	related to change of work procedures	
2	Description of new procedur	integrating new ISO procedure connected with retrieving parts from the warehouse during implementation of new projects	integrating new ISO procedure connected with controlling quality of parts on entry into production process
3	Degree of change success (from 1 to 5, where 5 is the most successful)	5 – very successful	1 – not successful
4	Degree of complexity (from 1 to 5, where 5 is the most complex)	2.5	3
5	Change introduction	project team of 4 employees designated to the task, leader is assigned according to organisational hierarchy	project team of 4 employees designated to the task, leader is assigned according to organisational hierarchy
6	Author of change	CEO – change is imposed	CEO – change is imposed
7	Place of change	Service Department	Production Department

Tab. 2. Characteristics of changes made. Source: own elaboration.

Changes are very much comparable with their characteristics. Both of them involved implementation of new ISO procedures in production and service departments in order to reorganise work for a better outcome. No change had been made in both departments for the previous seven years; therefore, employees from the departments were equally not used to changes. There was strong resistance to change; however, the first change was successful. The management wanted to discover how it had happened. The two changes were introduced according to the order given in the table. As the changes took place in different departments and involved two different groups of employees, there is no possibility that the organisation learned the change process over such a short period of time.

The change implementation proceeded likewise. It was processed via 8 Kotter steps according to the same procedure invented by top managers. The atmosphere of urgency was created via 4 meetings – two involving the whole organisation and 2 involving only heads of departments. Top management appointed four employees who, according to their knowledge and company hierarchy, had abilities, knowledge and experience for change implementation as members of each team. For both teams, the leader was

chosen: head of department. The managers were directly and on a daily basis involved with ownership of the procedure: in change 1 – the warehouse leader; in change 2 – the quality leader. And finally, for both leaders, 2 supporters were appointed from the group for each project team leader in order for them all to create a guiding coalition. Initiators of each change were top managers so the changes were imposed on the crew and they were responsible for generating a vision of the outcome they are reaching for after the change is ended. The outcome was communicated by the change agent team at operational meetings with whole departments every week for a period of 2 months. During those meetings, heads of departments presented short-term wins such as lowered indexes of claims by customers due to defected parts used for projects. In change two, only during the first two meetings the indexes were improved.

The research covered all employees directly involved in change, i.e. production and service employees. Respondents answered the questionnaires shown in Tab. 3. For each question, a relation or state was provided to be measured by the author of the research by means of central indegree.

Relation measured	#	Questio
1. Entrepreneurship level	A.9	Contact with these people provided me with a fresh outlook and inspiration to function in my area of expertise and in the company as such:
	B.3.	He/she achieved results by constantly rising up to new challenges and the willingness to fundamentally change the existing order:
	B.6.	He/she improved the results by encouraging and implementing innovative ideas concerning the range of services and products offered:
2. Leadership level	B.2.	He/she changed people's beliefs and attitudes and encouraged their engagement thanks to trust, communication skills and charisma:
	B.4.	He/she achieved effects as a leader who infused his/her team with a sense of shared goals, common identity and purposefulness of the performed work:
3. Managerial	B.1.	He/she achieved results as a good organiser who used a clear division of tasks, standards of work, and control and motivation systems:
	B.5.	He/she improved the results by constantly analysing and perfecting the organisation of work, increasing its efficiency and minimising risk:
4. Knowledge level	A.2	In my work, I mostly drew on the knowledge and experience
5. Good atmosphere level	A.3	My relationships with these colleagues positively influenced the atmosphere and good working environment:

Tab. 3. Questionnaire and relations measured. Source: own elaboration.

The first four levels such as managerial triumvirate (entrepreneurship, managerial, leadership dimension) proposed by Bełz and knowledge level served to describe competencies existing in change agent groups designated for change implementation. It needed to be checked whether the change agent groups presented comparable level of competencies. A dramatic change in groups' competencies could dismiss the results of research linked to relations. The entrepreneurship level was considered as the ability to be open-minded for generating new ideas, absorbing and introducing a revolutionary approach. The knowledge feature represents the level of knowledge on a certain branch in which the company operates. The leadership level is defined as the ability to inspire subordinates to engage in work and achieve goals. The management dimension gathers employees with the capability of good execution, administration and control of entrusted tasks. The first four levels were utilised as a tool for analysing the network of change agents from the perspective of nodes to identify competencies based on the resource-based view.

The fifth level of good atmosphere served to identify friendly relations among change members in each department (service and production) as good team atmosphere can strategically influence group effectiveness (Vygotsky, 1978). The last level was stated as a tool from the network perspective to identify relations from the dynamic-based point of view.

Firstly, the author examined the quality of each change agent group managing change implementation in each department to eliminate any discrepancies in this area. Secondly, the network perspective of each department with regard to creation of good atmosphere was compared to identify any differentiators in this matter.

4. Results of Empirical Research

The first analysis of competencies of change agent groups depicts high similarities in all dimensions of triumvirate and knowledge. The graphs presented in Tab. 4 describe the social network of each department based on relations of real information flow. The size of nodes reflects the number of indications that each employee gained from the rest of the employees with regard to a certain dimension of management, leadership, entrepreneurship and knowledge. The bigger the node, the higher the rate of indications gained, thus the size of the node represents the intensity of a given feature. When an employee is not seen in the network graph, it means that no indication was given for that person at a certain level. Nodes of change agents are marked with grey colour.

The images make it possible discover even organoleptically that three out of four change agents remain key employees in their department networks. One observes that top management exploited well the potential of the crew with regard to resources on each level of analysis. The fourth member of the change agent group in both departments is the person involved in

Service **Production**

MANAGEMENT
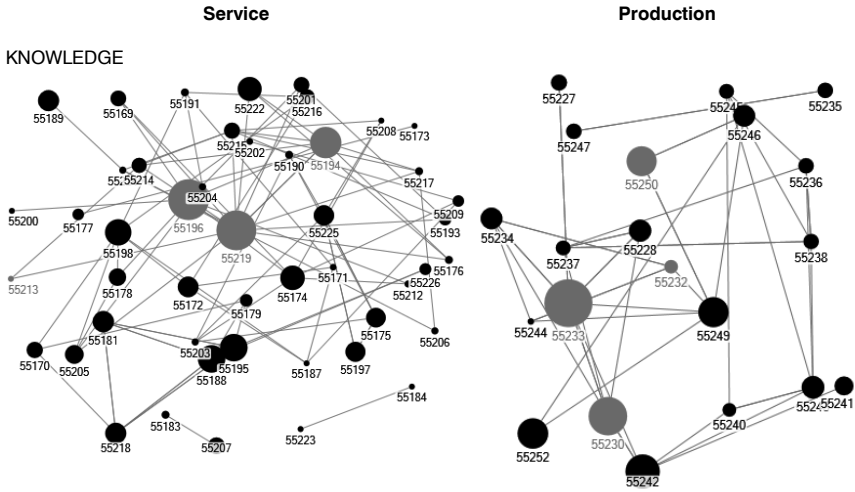

LEADERSHIP

ENTREPRENEURSHIP
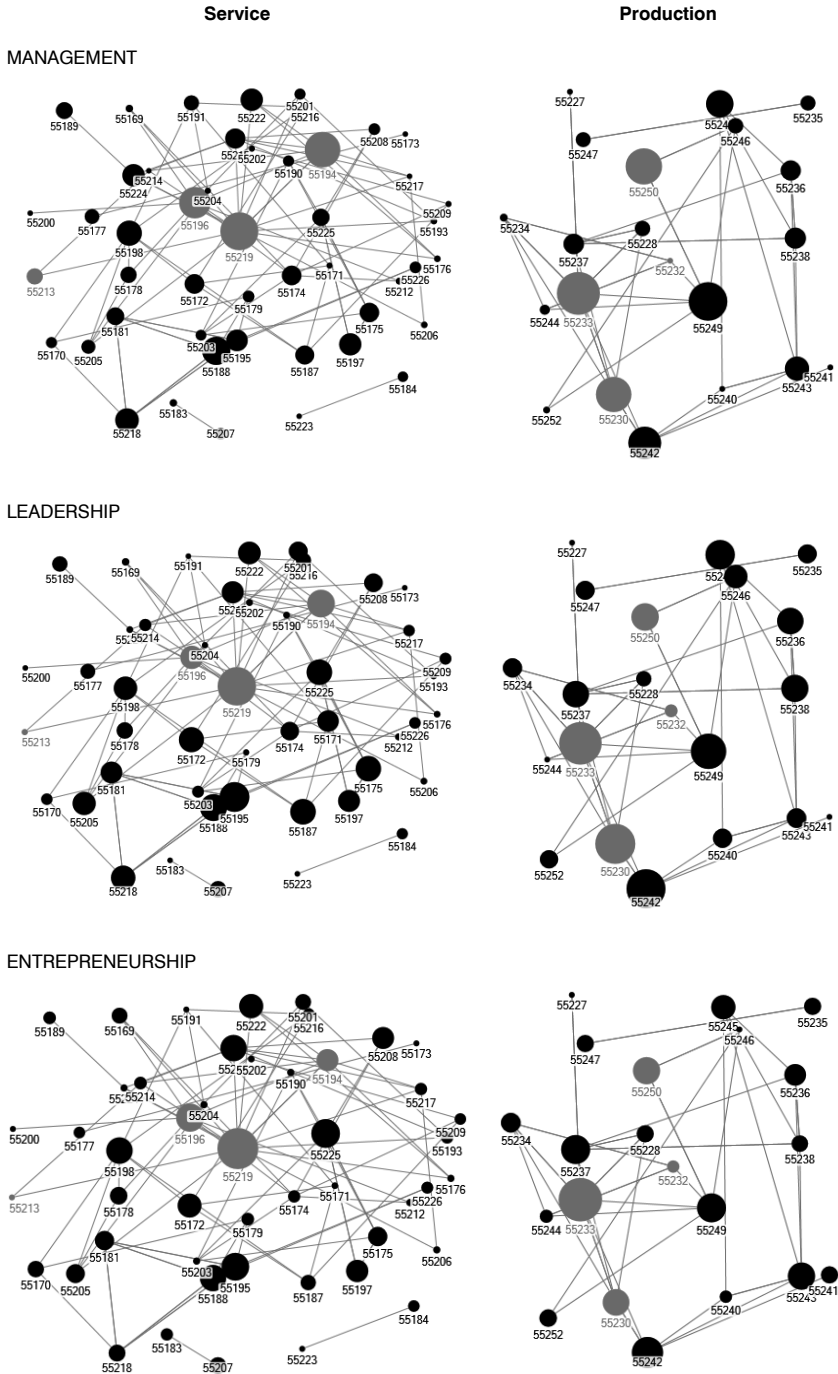
Fig. 1. SNA of certain levels. Source: own elaboration.

performing new daily duties linked to change. The above-mentioned findings, explored organoleptically, are presented by means of mathematical calculations of level of central indegree measured for each member of the project team in Tab. 4.

Department	Change agents	Managerial	Leadership	Entrepreneurial	Knowledgable
	55219	222	193	208	122
	55194	195	104	66	79
	55196	155	76	102	127
	55213	13	12		
Service total		**572**	**386**	**388**	**328**
	55233	143	132	172	126
	55250	105	55	67	
	55230	100	117	64	81
	55232	12	13		
Production total		**348**	**316**	**316**	**207**

Tab. 4. Level of indegree for each member of the project team (from the node perspective). Source: own elaboration.

The results of the area of the fifth level of creation of good atmosphere are presented in Tab. 5. At first sight, the service team is twice as big as the production team so generally the in service team there is higher probability of successful and easier change implementation due to a lower number of members. The number of unique edges and edges with duplicates is comparable in both teams. For unique edges, it varies between 75% and

79%. And for edges with duplicates, it is also comparable between 21% and 25%. The analysis of graph density of each team in which the changes have been implemented is surprising. As one can see, density in the production team was substantially more promising than in the service team, where the change has actually been successfully implemented. Such a group should have more potential of higher effectiveness than the service team and thus should be more likely to implement change successfully. Average degree centrality reflects similarities between both departments.

However, the last indexes marked in bold in Tab. 6 represent differences. Average betweenness centrality is much higher for the service team. So vertices in the service team have higher probability to occur on a randomly chosen shortest path between two randomly chosen vertices. Thus, the service team is more decentralised than the production team. In turn, closeness in the service team is substantially lower than in the production team. So the average shortest distance from each vertex to each other vertex is longer in the service team. It means that in the production team communication and diffusion of information is much faster than in the service team. This could have an effect on the speed of spreading information about the change being made in the organisation. Average eigenvector centrality of the production team also represents a higher figure. As it takes into consideration not only how many connections a vertex has but also the degree of the vertices that it is connected to, in the production team the vertices have better connections and more influential employees than in the service team. And finally, the clustering coefficient is also higher in the production team. So the share of cliques in the whole network is higher in the production team than in the service team.

Good Atmosphere	Servic	Index/Number of Service Vertice	Production	Index/Number of Production
Vertice	46		22	
Unique	61	75%	37	79%
Edges With Duplicates	20	25%	10	21%
Total Edges	81		47	
Graph Density	0.069	0.182		
Average Degree	3.087	6%	3.818	8%
Average PageRank	1.000	5.00	1.000	4.55%
Average Betweenness Centrality	39.978	87%	11.545	52%
Average Closeness Centrality		0.069	0.15	0.112
Average Eigenvector Centrality	0.022	0.04	0.045	0.21%
Average Clustering Coefficient	0.294	0.36	0.497	2.26%

Tab. 5. Level of network indexes of each department (from the network perspective). Source: own elaboration.

To sum up, change agents chosen for change implementation in both teams represented a similar level of competencies of managers, leaders, entrepreneurs and knowledgeable persons. Thus, the number of competencies in change agents' teams did not then differentiate or influence the results of the change implementation process. However, the relations of creation of good atmosphere at work appearing in both teams significantly differed from one another. The service department, where the change was successful, presented specific relations:

– service team represented higher homogeneity of relations (lower betweenness),
– service team characterised by a smaller number of central employees (lower closeness),
– service employees had worse individual connections (lower eigenvector),
– service team reflected a lower share of cliques in the network (lower clustering coefficient).

5. Conclusions and Limitations

Change management seems to be a more complicated matter than the models of change management show. Comparably fulfilled Kotter steps still differentiated the results of change implementation. Additional research on morphology of social organisational capital via the organisation network analysis can examine competencies of change agents participating in the change process using the approach of resource-based view. And also the research can examine the relations among the employees based on the approach of dynamic-based view. Both approaches resulted in many benefits:

1. Although all steps of the change management process were earnestly fulfilled, the result of change was not as expected by top management.
2. Change agents were properly chosen according to a sufficient level of managerial, leadership, entrepreneurial and knowledge abilities.
3. The department in which the change was successfully implemented was characterised by lower network completeness, higher decentralisation, slower communication, lower level of connection quality and finally lower importance of cliques in the whole network. In general, one can state that the network where change was successfully introduced had looser connections and its employees were much more homogenous. Such employees were, in consequence, more manageable and thus represented a lower level of resistance to change.

In consequence, there is a business need for getting to know better social capital which is in an organisation's hands in order to manage the change. Models of change, although crucial in showing the directions of the process of change, need to be extended with a social analysis in order to get to know with whom to take a certain direction designed by top management.

The author perceives some limitations of the research which might constraint the process of deduction. The first one is the limited number of changes in the organisation. More changes are planned for the organisation which encourage the author to further research this topic. Another limitation that can be seen is examining only relations of creation of good atmosphere. Perhaps, there exist relations of a different character that influenced the failure of change implementation. Such possible relations could be as follows: real information flow, openness of employees, decision flow, etc. Such relations are the aspect of further research of the author.

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