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Social Network Mixing Patterns In Mergers & Acquisitions - A Simulation Experiment

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Abstract
In the contemporary world of global business and continuously growing competition, organizations tend to use mergers and acquisitions to enforce their position on the market. The future organization's design is a critical success factor in such undertakings. The field of social network analysis can enhance our uderstanding of these processes as it lets us reason about the development of networks, regardless of their origin. The analysis of mixing patterns is particularly useful as it provides an insight into how nodes in a network connect with each other. We hypothesize that organizational networks with compatible mixing patterns will be integrated more successfully. After conducting a simulation experiment, we suggest an integration model based on the analysis of network assortativity. The model can be a guideline for organizational integration, such as occurs in mergers and acquisitions.

Keywords: mergers & acquisition, social network analysis, mixing patterns, assortativity, organizational design

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1. Introduction

Mergers and acquisitions (M&As) as a popular means of growth for firms leads toward the creation of new organizational forms. Through M&As activities companies try to protect or enforce their competitive position. Merger comprise the integration of two or more organizations into a new entity or holding company, it refers to the complete transfer of assets and liabilities from one company to another or the unification of two companies into one economic unit (Weston andWeaver, 2001). An acquisition is the acquirement of shares or property of some company in order to gain control over it (European Central Bank, 2000; Hagedoorn and Duysters, 2002).

According to some authors merger waves occur in response to specific industry shocks that require large scale reallocation of assets (Harford, 2005). Most important reasons for mergers and acquisitions are overcapacity, regional or expansion to new markets, enrichment of products or services, facilitation of new research and development (Bower, 2001). Through mergers companies hope to gain advantages by: (1) downsizing, (2) economy of scale (for example, a bigger company can save a lot of funds by ordering greater amounts of some goods and then have a better position for negotiation), (3) absorbing new technology (for example by acquiring a smaller company with advanced technology), or by (4) market share growth (companies acquire other companies to appear on new markets) (De la Mano, 2002, pp. 63 – 64).

Predisposition of success of mergers and acquisitions is very important question and some recearch (Hogarty, 1970) found that performance of heavily merging firms could be very poor. The literature puts a great accent on the process of due diligence which is the process through which a potential acquirer evaluates a target company or its assets for acquisition (Hoskisson, Hitt, Ireland & Harrison, 2008, p. 252). This process mostly concentrates on measurable figures like estimation of inventory and contracts, financial options, implications on the balance sheet, existing work contracts, supplier contracts as well as figures concerning products and their distribution. Evaluation should actually be aimed at determining the possible synergies. Analyses often do not include an assessment of the human resources (organizational knowledge, technical capabilities, creativity, experience etc.) and only more advanced approaching to due diligence activities include an evaluation of corporate culture and organizational compatibility.

Assessment of intangible resources and possibilities of knowledge transfer in M&As recently given its place in the strategic management literatures (Yildiz and Fey, 2010). In practice, an assessment of the human capital is often conducted just after the contract has already been signed or when the first integration problems appear. Integration is not finished signing the contract. It includes the activities of harmonizing the organizational structure, business processes as well as objectives of the merging firms. Failure to integrate due to incompatible organizational cultures is the most common reason for failed mergers and acquisitions (Schuler and Jackson, 2001).

While performing M&As processes, a previous investigation on organizational characteristics as well as an evaluation of the new organization is an important step. Herein a formal approach for this step will be presented based on organizational network mixing patterns. We hypothesize that organizational social networks that have compatible mixing patterns will be integrated more easily then ones that don't. In order to prove this statement we will use a simulation experiment on two organizations with controlled characteristics which determine the outcome of a possible integration. These characteristics have their roots mainly in the spheres of so called soft variables- organizational culture and human resources.

Designing organizational culture and human resource policies are among the main issues when creating a new organization. The objective of this research is thus to identify common laws in processes of mergers and acquisitions, as well as prerequisites for organizational success by using insights from social network analysis. We used the Watts-Strogatz algorithm (Watts and Strogatz, 1998) for generating social networks of two organizations. The algorithm was modified in order to reflect assortative mixing which we shall define further. The two networks were then integrated by using a new modification of the algorithm, in order to analyze the characteristics of the new (integrated) network.

The rest of this article is organized as follows: firstly we give a literature review of organizational aspects of M&As in section Pogreška! Izvor reference nije pronađen.. In section 3 we analyze the reasons for success and failure of integration in M&As. Section 4 introduces social network analysis as an analytic approach to M&As. In section 5 the concept of mixing patterns and assortativity in social networks is introduced. Section 6 describes the simulation experiment that was conducted, and the results are presented in section 7. Based on these results, we propose a model for the organizational design in M&As in section 8. In the concluding section 9 we discuss the implications of the proposed model and give guidelines for future research in this area.

2. Organizational M&A

During a process of merger or acquisition, a new organization is designed. This is the main reason why a common vision as well as a strategic orientation towards achieving objectives of the new organization have to be established. In order to achieve this vision, one needs to create a frame of favorable social, cultural, technical, and economic conditions for organizational design (Mitleton-Kelly, 2004). Under organizational design we understand the process of arranging and adjusting the organizational architecture of a new organization (structure, processes, culture, human resources and strategy) (Žugaj and Schatten, 2005, pp. 1 - 6) which is in accordance to Galbraith's star model (Galbraith et al., 2001).

The integration, as a new organizational form, is almost always a matter of degree and can be complete, partial or minimal (Nalbantian et al., 2003). **Complete integration** is the case when the acquired organization adopts all characteristics of the acquiring company including business style, infrastructure, identity, as well as brands, and the organizational units and operations of both organizations are merged. **Partial integration** happens when the acquired company adopts some, but not all systems, practices, rules and procedures of the acquiring firm. The acquiring company can, for instance, provide accounting and finance operations while the acquired organization independently performs its product development and marketing processes. If the acquired company still operates as an independent portfolio firm, then **minimal integration** is in question, and the acquiring organization influences the acquired only in few minor details.

During the due diligence of another company, the acquiring firm's leadership has to estimate if the acquisition will positively influence the new organization. A priority is the estimation of the actual value of the company to be acquired. Both sides in M&As often have a different perception of this value, which later can become a source of integration problems.
There are various methods for assessing the value of the organization to be acquired (Weston et al., 2001, pp. 225–233), including:

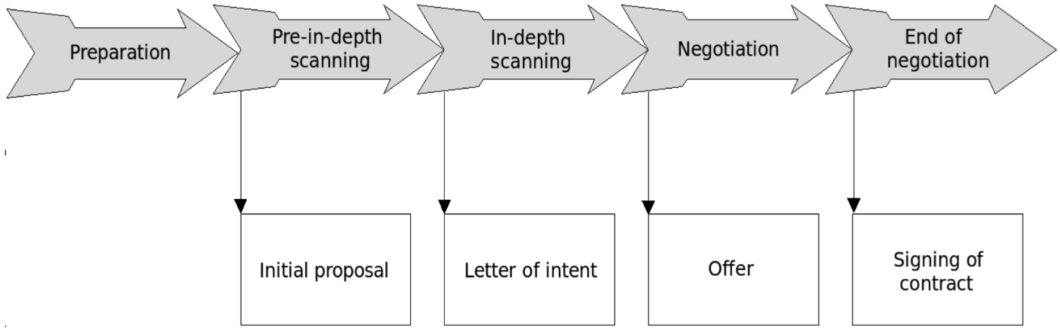
- Comparable ratios;
- Replacement costs;
- Discounted money flow method;
- Balance sheet analysis;
- Liquidator assessment method.

We need to stress here that none of these methods take the human capital nor the characteristics of other intangible assets like corporate culture, into consideration. Since all these methods provide a foundation for decision making in M&As, it is important to work on additional methods that will take these assets into consideration.

The proper organization of human resources is an important step in the integration process. Organizations which embrace mergers or acquire another organization have to attend to the others human resources, their value and aptitude to integrate, with very special care. This care has to be taken before the final settlement, and especially after it when integration begins.

Figure 1 shows the process M&A negotiation. Only if all of these steps are carefully performed, prerequisites for a successful integration will be established (Kummer and Sliskovic, 2007, pp. 8 – 10).

Figure 1: Steps in M&A negotiation



The steps of integration after the very merger or acquisition are usually performed on multiple levels (including operational, business and cultural level) often over a period of several months. While the operational integration ensures the normal flow of every-day business, the business integration includes the definition of a strategic concept, functional integration and the targeting of synergistic objectives. The integration of corporate cultures comprises conflict management, employee inclusion as well as the establishment of a positive climate regarding the integration. As in most greater organizational changes, the integration has to include the creation of employees trust which often tends to resist changes (Gareth, 2004, p. 308).

A model of M&As which can be formulated from an analysis of integration experiences has three phases: (1) pre-combination; (2) combination – integration of the partners; and (3) solidification and advancement of the new entity (Schuler and Jackson, 2001; Habeck et al., 1999). These phases comprise a wide set of organizational operations and activities. In phase 1, pre-combination, methods from the domain of human resources as well as cultural assessments, as an element of soft due diligence, are also becoming common (Numerof and Abrams, 1998). Cultural assessments involve describing and evaluating the two organizations' values with respect to: leadership styles, relative value of stakeholders, risk tolerance, and the value of teamwork versus individual recognition.

From this reasoning one can see that there is need for methods of soft due diligence, where our analytical approach and our contribution are positioned.

3. Organizational Culture as a Reason of Integration Success and Failure

According to Schein (1985) organizational culture is a pattern of mutual fundamental presumptions which groups learn during adjustment and internal integration related problem solving, and which have to be valid and understood by new members of the organization as the approved way of perception and understanding organizational problems. Levels of organizational culture according to Daft fundamental presumptions, values, behavioral norms, patterns of behavior, artifacts and symbols. Artifacts include apparent phenomena like language, technology, personal style, dressing, rituals, ceremonies, visible organizational structure and processes Daft (1992).

The fact that many companies have experienced in practice a plenty of studies have shown- that so called soft factors like organizational culture, play a major role in integration and seem to be one of the primary reasons for the high failure rates of mergers. Compatibility of social systems is often more demanding then compatibility of technical systems. After a literature review Nambudiri (2006) concluded that there are two key factors with direct influence on mergers success: (1) compatibility of corporate cultures, and (2) cultural change management. Compatibility could be defined (Rogers, 2003) as the degree to which is something (an innovation) perceived as consistent with the existing values, paste experience and adopters needs.

How much is actually a level of success of an organization created by M&As have explored by the Deloitte & Touche, among others. In their study (Deloitte & Touche, 2002) proved that only 35% of over 500 considered M&As could be considered successful. Most important reasons for failure were: (1) ignoring people and culture, (2) slow integration, (3) lack of communication, as well as (4) failure to define roles, responsibility and structure precisely. Quite similar to the previous, DiGeorgio (2002) contemplates that reasons for M&A failure are (1) non-adequate due-diligence, (2) value overestimation of the company to be acquired, (3) lack of rational strategy, (4) conflicting organizational cultures, and (5) slow integration.

Synergy can be defined as a emergence of positive outcomes deriving from the interrelations among a system's components. The new M&A organization usually has many components as a subsystems of the previous organizations. A survey by Bain & Company (Grob and Meacham, 2002) of 250 global executives involved in M&A, 61% identified "Problems integrating management teams" as a reason why deals break down. The only two factors which had a greater percentage were "Overestimated synergies' (66%) and "Ignored potential integration challenges" (67%). Furthermore, the study shows that 83% identified on-time cultural integration as a critical success factor (Harding and Rovit, 2004, pp. 197–201). Another study by Bain & Company (Vestring et al., 2003) conducted over 125 mergers suggests that M&As where management proactively addressed culture had a higher average acquirer share price performance versus sector index, then deals in which companies failed to address cultural issues.

Any major organizational change requires preparation and planning. M&A represents a radical change in organizational structure and contains the imperative of adjustment to new circumstances, for at least one of the organizations. Harding & Rovit also identify culture in addition to other elements in their M&A decision making principles grouped into the following categories: (1) ownership takeover plan, (2) fast integration where important, (3) setting culture at the peak of the management plan, and (4) maintaining the power of every-day business (Harding and Rovit, 2004, pp. 108–111).

All the above mentioned research and studies proved that organizational culture plays an important role in M&As as one of the keys to success, which is why we will concentrate our efforts to establish a formal procedure for analyzing it and providing a model for decision making in M&As based on it.

4. Social Network Analysis as an Analytic Approach to M&As

In the following we will presume that organizational culture is (at least in some aspects) measurable. In order to analyze similarities between individual and group organizational culture, one need to use most distinguishable artifacts, but elements from other cultural levels can be used as well. As on a global scale artifacts describe the components of organizational culture, likewise they describe every individual in some organization. Every member of an organization, can be observed as the total of its characteristics in terms of artifacts. Consequently, if we observe an organization as a social network of individuals we note mixing patterns among individuals which describe how similar or dissimilar individuals connect with each other.

Network theory, or as A.-L. Barabasi calls it, the new science of networks (Newman et al., 2006), studies social, biological, transport, technological, physical, semantic and other types of networks. The field of social network analysis has a long tradition, but with the development of the Internet and contemporary information and communication technologies it gained a major take-off.

A network can be defined as a mathematical abstraction consisting of two parts: (1) nodes (which can be interpreted as people, organizations, countries but also computers, animals, molecules or concepts), and (2) edges (which can represent any distinguishable connection between the nodes like friendship between people, joint ventures between companies, geographical neighborhood between countries, a wireless network connection between computers, food chains in some ecosystem, bounds between molecules or an essential similarity between concepts in some language). If these connections are directed (like message communication, spreading of a contagious virus or power influence etc.) than a directed network is in question.

For every network one can define a number of different statistical metrics which allow us to study the networks structure and behavior. One of these metrics is the nodes' mixing patterns which tell us how nodes inside a network connect to each other: do nodes connect more often to similar ones or rather bound to dissimilar nodes? In principle, there are three types of such mixing patterns: (1) assortative, (2) neutral and (3) disassortative. As outlined already, the hypothesis of this study is that networks with more similar mixing patterns will integrate fasted and in a more cohesive manner than networks with different ones. Thus we will use mixing patterns to establish a model of organizational integration.

By organizational unit one can understand a group, department, division, but also whole organizations or even suprastructures of organizations according to the fractal principle as interpreted in (Žugaj and Schatten, 2005, pp. 149–151). If we conceptualize each organizational unit as a social network, we can reduce the problem of organizational integration to social network integration. Since every network participating in the integration has its own mixing pattern, the goal is to maximize cohesion of the new network (under the assumption that cohesion is desirable).

5. Mixing Patterns

As stated already, every (social) network consists in principle of two parts: nodes and edges. Formally, networks are represented as mathematical graph structures which are the pair $G = (N, E)$, whereby $N = \{n_1, n_2, ..., n_m\}$ is the set of nodes, and $E = \{(n_i, n_j) | n_i, n_j \in N\}$ is the set of edges or arcs. If the pairs in E are arranged then G is a directed graph or digraph (Wasserman and

Faust, 1994). Networks are often represented in form of the adjacency matrix $A = [a_{ij}]$, $a_{ij} \in \{0, 1\}$, which is of size $m \times m$ where m is the number of nodes in the network. Elements of the matrix equal to 1 if an edge exists between the corresponding nodes, or equal 0 otherwise. If the network is undirected, the matrix is symmetric.

The degree of a node is defined as the number of edges in which the nodes participates. Formally, the degree of a node i equals to the sum of a corresponding row or column in the adjacency matrix:

$$\mathcal{D}(i) = \sum_{j=1}^{m} a_{ij}$$

If the network is directed in-degree (row sum) and out-degree (column sum) are defined in particular, representing incoming and outgoing edges respectively.

The node's type is some arbitrary node characteristic. In a social network of people for instance, the node type can be for example a person's sex, age, race, but also a network depended category like the node's degree. In our case we will assume that node types are artifacts in the sense of organizational culture's elements. Mixing patterns describe how particular nodes interconnect. There are possibly other types of mixing, but in our case we will focus on assortative mixing (Newman, 2003). Assortative mixing with respect to given characteristic exists in a network if, on average, mutually similar nodes connect. Likewise, disassortative mixing exists in a network if, on average, mutually different nodes connect. If there is neither assortative nor disassortative mixing in some network, we say that the network is neutral. This means that nodes do not choose other nodes with respect to the considered node type.

For example, the network of co-workers in a functional organizational structure with respect to education and professional training is a typical example of a network with assortative mixing. In an accounting department will most likely work accountants, while in the IT department computer engineers. On the other hand, a good example for a network with disassortative mixing could be a divisional organizational structure with respect to the same characteristic as above. In this case every division will most likely have at least one accountant, at least one marketing professional etc. Hence, the criteria for co-workmanship is the diversity of professionals not their similarity. As an example of a network that is neutral to asortative mixing, any criteria can be used that does not influence (or minimally influences) the linkage of nodes in a social network. Such a criterion is for example the eye color of participants in a textual chatroom communication network. A participant's eye color has no influence on the selection of communication partners.

Assortative mixing is usually characterized with the quantity e_{ij} which measures the ratio of edges in a network which connect nodes of type i to nodes of type j. In undirected networks the quantity is symmetric in its indices, e.g. $e_{ij} = e_{ji}$. In directed networks this does not have to be the case. Also, the following equations hold:

$$\sum_{ij} e_{ij} = 1 \qquad \sum_{j} e_{ij} = in_i \qquad \sum_{i} e_{ij} = out_j \tag{1}$$

Whereby in_i and out_i are the fractions of each type of end on an edge that is attached to node of type i. In undirected networks, where the ends of edges are all of the same type $in_i = out_i$. To measure the level of network assortativity one usually uses the assortativity coefficient (Newman, 2003):

$$r = \frac{\sum_i e_{ii} - \sum_i in_i out_i}{1 - \sum_i in_i out_i} \tag{2}$$

or in matrix notation:

$$r = \frac{tr(\mathbb{E}) - ||\mathbb{E}^2||}{1 - ||\mathbb{E}^2||} \tag{3}$$

where E is a matrix which elements are e_{ij}, $tr(\mathbb{X})$ is the trace of matrix X (the sum of the main diagonal in a quadratic matrix), and $||\mathbb{X}||$ the sum of all element of matrix X. The formula yields $r = 0$ when there is no assortative mixing (neutral network), since $e_{ij} = in_i out_i$. If the network is perfectly assortative the formula yields $r = 1$, since $\sum_i e_{ii} = 1$. If the network i perfectly disassortative, e.g. every edge connects two nodes of different type, then r is negative and has the value:

$$r_{min} = -\frac{||\mathbb{E}^2||}{1 - ||\mathbb{E}^2||} \tag{4}$$

where r_{min} is in the interval $-1 \leqslant r \leqslant 0$. The value is not (as could be expected) equal to -1 since a perfectly disassortative network is closer to a randomly mixed network than is a perfectly assortative network. Especially in the case when there are more than 3 possible types of nodes, in a randomly mixed network, different nodes will connect more often.

The dynamics of networks with respect to mixing patterns is of special interest here. In order to simulate a network one can use various random network model. One of such models, which we want to point out here, was developed by Watts and Strogatz (Watts and Strogatz, 1998) which was specially designed to generate aproximations of social networks (as opposed to other types of networks). Since we deal with organizational networks herein, this model will be the foundation of our simulations. The Watts-Strogatz algorithm (WS) starts with a mutuaslly connected ring of N nodes, in which every node is symmetrically connected to its $2m$ nearest neighbors (e.g. m nodes in both directions). The algorithm runs through all nodes and selects edges connecting in a clockwise manner. Edges are redirected with a probability of p, or left intact with probability $1 - p$. If an edge has to be redirected, a random node is chosen from the network except the one under consideration (reflexive edges – nodes linking to themselves – are avoided). In this way the algorithm typically establishes shortcuts to remote nodes in the network.

In the following, to reflect the needs of our simulation, we introduce two modifications to the WS algorithm. Since WS doesn't allow us to generate networks with a given assortativity coefficient, for every node n we introduce an arbitrary characteristic (denoted with $C(n)$) in order to generate a desirable mixing pattern. In addition to the probability p (represented with the random variable X_p), we introduce the probability q (represented with the random variable X_q) that determines the likeliness that two nodes with the same characteristic (e.g. similar nodes) will connect. For an edge (n_1, n_x) to be redirected to (n_1, n_2), one of the following two conditions has to be satisfied:

$$p > X_p \wedge q > X_q \wedge C(n_1) = C(n_2) \quad (5)$$

$$p > X_p \wedge q \leq X_q \wedge C(n_1) \neq C(n_2) \quad (6)$$

The first condition describes the situation when the network is assortative, and the nodes are of the same type (in an assortative network such nodes connect more often). The second condition is the case when the network is disassortative, and the nodes are of differenty type. One can now flexibly generate random networks with an arbitrary assortativity coefficient by adjusting q as needed. We denote this algorithm with (WSA).

Both WS and WSA aren't suitable for the case when network dynamics have to be simulated (e.g. the establishment of new edges or the disappearance of existing ones). WS and WSA only redirect existing edges in order to remain the number of edges in the network of the network (e.g. the average degree is constant). In the situation of merging two networks, establishing new edges is of particular interest. Thus we introduce another modification to WSA: instead of redirecting edges, for each node new edges are established if one of the conditions from WSA is satisfied. In essence, the difference between this modified algorithm and WSA is that the to be redirected edges aren't deleted from the network. We can now amalgamate two networks $G_1 = (N_1, E_1)$ and $G_2 = (N_2, E_2)$ as follows $G_A = (N_1 \cup N_2, V_1 \cup V_2)$ (the sets of nodes and edges are unified respectively). In order to establish only edges between nodes residing in different networks which are being integrated, we introduce yet another condition: for a new edge (n_1, n_2) to be established in G_A, it must hold that $n_1 \in N_1$ and $n_2 \in N_2$. We denote this new algorithm with WSAA.

In the end of this section about networks, we need to define metrics that will allow us to measure the cohesion of a network. In the following we will presume that network cohesion is desirable in M&As. One of such metrics is the number of attracting components. A component of some graph G is defined as a connected subgraph of graph G. An attracting component of some digraph G is a strongly connected component for which it holds that a random walker, once entering the component will never be able to leave it (Barrat et al., 2008, pp. 5–7). The bigger the number of attracting components, the less cohesive the network since more centers of attraction exist that gather nodes around them.

6. Simulation Experiment of Integrating Networks

To conclude about our hypothesis a repeated simulation experiment of integrating two networks was designed. Analyzed network integrations were of sizes 10×10 , 10×50 and 50×50 which can be seen as small to medium organizational units. A simulation was run for every combination of two networks for probabilities of connecting two similar nodes $q \in [0, 1]$ (step 0.1), and p was set to 0.1 for all simulations. The assortativity coefficient ranged from r_{min} to 1 what confirms the WSA algorithm. Every network was designed to have three node different types (X, Y, and Z) with an arbitrarly picked distribution of $(0.2, 0.3, 0.5)$ respectively. We can interpret X, Y, and Z as characteristics that describe a given node (in the sense of organizational culture artifacts).

Every generated random network represents one organizational unit (department, group, organization etc.) for which one can say that it has a relatively homogeneous mixing pattern with respect to organizational culture. Nodes are individuals (employees) and edges are interpreted as linkages between them (collaboration, communication, mutual responsibility etc.).

Each of the simulation runs had two phases. Firstly, the WSA algorithm was used to randomly generate two networks in a total of 200 intervals. The number of nearest neighbors - m was set to 3 and 10 for networks of 10 and 50 nodes respectively. Secondly, the networks were amalgamated and then the WSAA algorithm was used to integrate the obtained (amalgamated) network, again for 200 intervals. Every run was repeated 100 times to gather representative average data for the final (integrated) network. The following metrics were collected for each integrated network for each run:

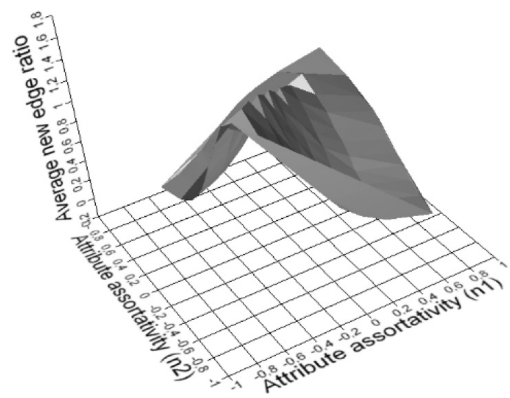
1. Weighted average ratio of new edges between the two networks weighted with the sizes of the participating networks (number of all edges in the integrated network / sum of edges in both networks before integration)
2. The number of attracting components

The simulation was implemented in Python using the NetworkX toolkit, and later analyzed in JMP.

7. Results and Discussion

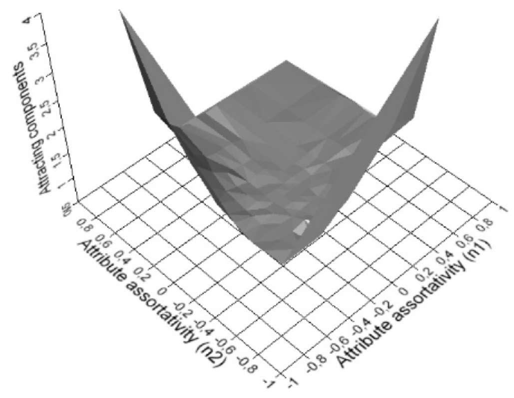
Figure 2 shows the ratio of newly established edges in dependency of the assortativity coefficient of the two integrating networks.

Figure 2: Average new edge ratio / attribute assortativity of integrating networks (integration 50×50)



As one can see from the graph, the greatest ratio of new edges gets established in the case of (approximately) identical assortativity coefficients. From our perspective we consider that a newly established edge in the simulated networks, should be interpreted as a predisposition for a linkage between individuals in a real social network integration. Individuals with similar assortativity are inclined to connect, but for a connection in a real M&A to succeed, the management of the newly established organization has to provide the formal prerequisites including adequate structure, information-communication, transportation, and/or process related relationships. On the other hand, if the ratio of newly established edges is minimal (in a real M&A scenario), according to our calculations, efforts for establishing cohesion are probably condemned to fail. In this case the management should consider minimal integration or no integration at all.

Figure 3: Attracting components / attribute assortativity of integrating networks (integration 50×50)



The number of attracting components in dependency of the assortativity coefficients of the two integrating networks is shown on Figure 3. Again, a regularity can be observed: the more similar the networks' assortativity coefficient (diagonal $(-1,-1)$ to $(1,1)$), the smaller the number of attracting components. Thus the network is more cohesive if the networks have a similar assortativity coefficient. This can be interpreted in a real case M&A as follows: the probability of a power centers' emergence which would attract individuals and create a parallel structure to the formal organizational structure is smaller if the organizations have congruous mixing patterns.

8. Organizational Design Model for M&As

Following the presented formalism and simulation results, we propose the model on figure 4 for social network integration which will maximize network cohesion. The model depicts proposed strategies for the integration of two organizational units, A and B, which social networks have been analyzed for mixing patterns using a common characteristic. It is fairly compatible to the model proposed by Nalbantian et al. (2003).

If both networks are assortative or disassortative the model proposes a complete integration. Since the mixing pattern in both networks is similar (in the first case nodes with equal characteristic connect, in the second nodes with different characteristics), the process of integration will follow this pattern and the networks should be integrated more easily.

Figure 4: Assortativity based integration model

Organizational unit B \ Organizational unit A	assortative	neutral	disassortative
disassortative	minimal integration	partial integration	complete integration
neutral	partial integration	?	
assortative	complete integration		

If one of the networks is neutral to the considered criteria, the model proposes partial integration. In such a situation, regardless if the other network is assortative or disassortative, the neutral network will show no affection to the characteristic, so the connections will more likely be established from the non-neutral side.

If one network is assortative, and the other disassortative, then the model proposes a minimal integration. In this situation the mixing patterns are incompatible which will likely cause possible conflicts during integration.

If both networks are neutral, then the model cannot propose a suitable strategy. In this case we propose to consider another mixing pattern criteria.

9. Conclusion

The main presumption of this paper is that a good deal of M&As success depends on the particular organizational cultures of the organizations which are being integrated. One possible way to analyze organizational culture is through social network analysis, and especially mixing patterns based on artifacts as elements of culture.

The contribution of this work is given in the formal approach to M&A integration processes. We developed a general social network integration model based on network assortativity. Characteristics that can be used to compute network mixing patterns can include demographics (age, sex, nationality, ethnic characteristics, etc.), culture (language, personal style, appearance, etc.), knowledge (profession, education, specialization, experience, etc.), reward systems (salaries, benefits etc.), and other types of criteria. The main hypothesis of this study was that networks which have congruent mixing patterns will integrate more cohesively that those who haven't. To test this hypothesis a simulation experiment of integrating networks with selected levels of assortativity was designed. By using two new modifications of the Watts-Strogatz algorithm (WSA and WSAA).

From our perspective, the networks represented in the simulation can be any organizational units: teams, departments, divisions, whole organizations or even networks of organizations. Analysis of simulation results confirmes: the more alike the mixing patterns are, the more cohesive the integrated network (more new edges, less attracting components).

This conclusion can be of practical use for the scenario of potential mergers and acquisitions. Further confirming the simulation results can be sought on real M&A cases. On the other hand we need to point out that the simulation model is limited in terms of simplicity (only one node characteristic is used for analysis; only two networks are analyzed in one integration), but nevertheless allowed us to propose an organizational design model that proposes strategies in M&A integration processes. In future research we will focus on generalizing this model, possibly by using a greater number of attributes/node types, parallel criteria for assortativity as well as integration of more than two networks.

Acknowledgements

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