Structure Emergence in Corporate Mergers

NECSI Project

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Problem Statement

Mergers and acquisitions are becoming more common in today's business environment. The dynamics involved in the process of mergers represent a complex system and result in many intricacies. As a result, the diverse number of possible scenarios that can emerge from two corporations merging provides rich opportunities for complex system analysis. In this paper we propose a model that characterizes a merger between two small companies and offers a number of observations at the level of the individual employee.

Literature Review

In Norman (2000) a merger model was produced to evaluate how a 2-firm merger may effect overall competitive relations within the market to satisfy the concerns of anti-trust authorities of the Federal Trade Commission. The study explored the deficiencies of the spaceless and homogenous Cournot model in determining the effects of mergers. Bushnell (1998) seeks to highlight the potential for market power congestion as a consequence of a merger in the electricity market using an oligopoly framework and a modified Cournot-Nash equilibrium model. The Cournot-Nash model despite its assumption of least-cost dispatch ignores the dynamic aspects of competition. Amir (1996) explores the strength of Stackelberg's concept of two natural stages in entry deterrence models with the incumbent firm or the government as leader, and the economic agent as follower.

Management problems after the merger in terms of local-scale dynamics and organizational structure can be strongly influenced by employee dissatisfaction with feedback and performance evaluations. According to Walker (1994) the social forces determining who will be cut in the process of a merger may come down to a disparity in formal education, previous leadership experience, and even perhaps the fact that manager A or B feels threatened by the other due to past conflicts. Managers may make unilateral design changes to company structure irrespective of the results of a simulation because they are human and susceptible to emotion. There are very few studies on industry sociology after a merger, and Collins (2002) makes an attempt by introducing three observations. First, that mergers produce redundancies within the internal labor force and as a result employees will find themselves having to compete with peers to keep their job. Second, if an employee "wins" their job and a close friend is let go he/she may feel "survivor guilt" which dilutes performance. Finally, the general lack of cross-training in an organization produces initial inefficiency which may take longer to overcome then expected. In general these effects produce real weaknesses in an otherwise robust business network which can be easily overlooked. Wollin (1999) introduces the idea of multilevel complex adaptive system structure which has relational dependencies in biological, social, and cyber systems. Interdependencies determine the level of efficiency in a newly self-organized system.

Waugh (1992) explores the coalescence of two vortices exhibiting quasigeostrophic shallow-water dynamics. The efficiency of the merger of the two vortices is determined by calculating the loss of globally conserved quantities to filaments and small-scale structures. Several interesting dependencies

emerge from the analysis, including initial inter-centroid separation, radius of deformation, and the background potential vorticity. Can a jovian turbulent flow model be used to analyze company merger dynamics? Interdisciplinary analysis can certainly lead to further understanding of the most contributory relationships contained in a complex system. In terms of general complexity and chaos theory, several popular publications were produced during the 1980's, including: Wheatley (1994) relating new forms of leaderships and their understanding of such complex events in the business environment, Gleick (1998) contributing to the observation of chaos events in natural systems, and Waldrop (1992), documenting the historical background of the Santa Fe Complex Studies Institute for studying such events across the various fields.

Model Definition

Based on the problem statement described above and the current theory on merger models we propose an implementation of a model that describes (1) the makeup of employees and (2) hierarchical structure of the resulting organization. The model was implemented in MS Excel and was governed by numerous logical statements to implement pre-established rules.

The model was meant to demonstrate the complex behaviour of two small firms and includes with the following 7 assumptions:

1) Firms A acquires firm B
2) Both firms are in the same market
3) Each firm has 6 employees
4) The end result (firm C) is made up of 7 people
5) Firms A & B are not symmetrical in terms of their organizational structure
6) Only 1 CEO can exist in Firm C
7) Any employee is only willing to work at or above his/her own level at the previous firm. Thus, an employee who was at level 2 in Firm A, say, will prefer to lose his job than work at level 3 in the new Firm C.

Assumption 1 was created to establish a scenario where one firm is dominant over the other. Assumption 7 is based on the Keynesian theory that salaries are sticky upwards, i.e., firms fire people before giving them a salary cut.

The probability of an employee being employed by Firm C is driven by the following five attributes:

Performance. Each employee has a performance score to represent their historical work performance in their home firm, for the last measured time period. This number was generated from a normally

distributed random number generator to represent the idea that most employees are average while small percentages are either over performers or under performers.

Internal Connections. Individual employees were assigned a number of internal connections, or links, based on the network structure of their home firm. Firm topologies were selected based on actual firm structures in the real world. The more connections an individual has represents more links to other individuals within the firm, and indicates the 'networking' value of the individual.

Level in Hierarchy. In order to capture each employee's level in the firm, a number was assigned to represent their level in the hierarchy. Low numbers represent a higher level (the CEO is level 1) and high numbers represent lower level in the hierarchy of the original firm.

Specialization. Recognizing that each individual provides a special skill to the firm and this skill needs to be preserved in the new firm, a specialization attribute is assigned to each individual. The resulting firm should contain a balance of the appropriate range of specializations required to run the firm.

Interaction between Performance and Specialization. This factor captures the idea that having a good performance is more critical to the fortunes of a firm at the higher level, than it is at the lower level.

The combination of these parameters and the appropriate rules adequately provide a combination of employees for the new firm that will adequately meet the needs of the firm.

The weights currently chosen are to exemplify the possible weights that can be used to make decisions such as these. Changing these weights generates some interesting scenarios about how Firm C will look. We used a simple linear function to generate the 'Valuation' variable for each employee in both firms. This can be easily modified into the following non linear function:

$V_i = a_1 * (\text{Performance}_i) + a_2 * (\text{Internal Connections}_i) + a_3 * (\text{Hierarchy}) + a_4 * (\text{Specialization}_i) + a_5 *(\text{Performance}_i * \text{Specialization}_i)$

Where a_1 - a_5 represent the weights assigned to each of the attributes.

Results

We have analyzed the case where Firm C has 7 employees. The output of the individual values for each employee is shown in Table 1.

Table 1. Individual values per employee of Firms A & B

a1	a2	a3	a4	a5	a6	b1	b2	B3	b4	b5	b6

2.18	1.17	1.2	1.47	1.18	0.63	1.84	1.52	1.32	0.65	0.33	1

The seven highest-rated employees are a1 (2.81), b1 (1.84), b2 (1.52), a4 (1.47), b3 (1.32), a3 (1.2), and a5 (1.18). As a result, these seven employees were selected to be part of Firm C. Based on these values and the rules (assumptions) mentioned above, the model yields the layout of Firm C shown in Figure 1.

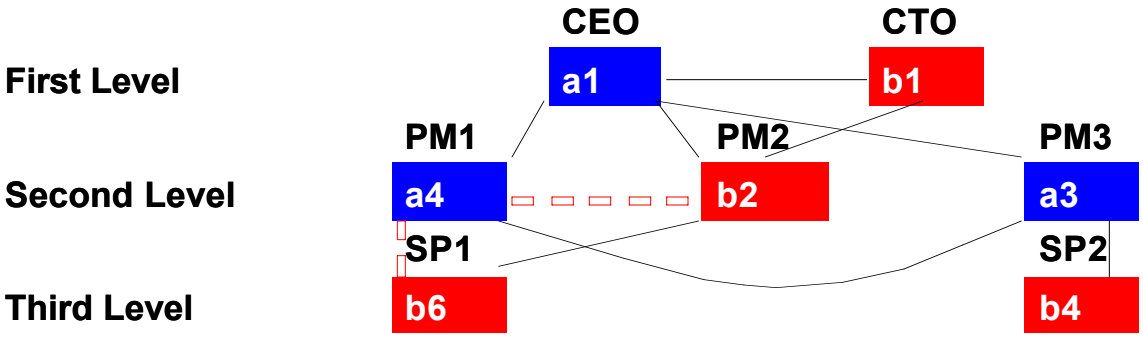

Figure 1. Layout of Firm C

As can be seen, the new firm is comprised of 3 Firm A employees and 4 Firm B employees. The reason for this is that only Firm B has employees with knowledge of the third level. In practical terms, this may mean that firm B has salespeople who are better, while Firm A has people who may be better at innovation (R&D) / management. This has been reflected in the fact that 3 of 5 employees in the 'senior' levels are from A while both the salespeople are from B. The number of links between employees was taken directly from the number of links they had in their home firm. In the case where a certain individual brought more links to Firm C from their home firm (as in a4) we represented the net increase in links by drawing them as dotted red lines. We find that the total value of Firm C, as well as value per employee, improves as compared to Firms A and B as shown in Table 2.

Table 2. Values of Firms A, B, & C

	A	B
Total Firm Value	**7.82**	**6.65**
Value/person	**1.30**	**1.10**

	C
Total Firm Value	**10.86**
Value/person	**1.55**

The total value of Firm C (10.86) is greater than the total value for Firm A (7.82) and Firm B (6.65) showing a productivity advantage resulting from the merger.

Conclusions

The major learning from this exercise is that internal connections play a very important role in determining firm value for the new firm. Simultaneously, these connections are also critical for individuals to keep their jobs after the merger. We find that in general, individuals who have higher internal connections (well

networked) are more likely to retain their jobs post merger. Figure 2 shows the change in firm value per employee for various weighting parameters for performance, internal connections, hierarchy, specializations and the interaction term. As is clear, firm value is most sensitive to internal connections and least sensitive to the interaction term. Moreover, the influence of hierarchy in the model is also significant as it proves that upper level management with connections with the right people have a better chance of keeping their jobs.

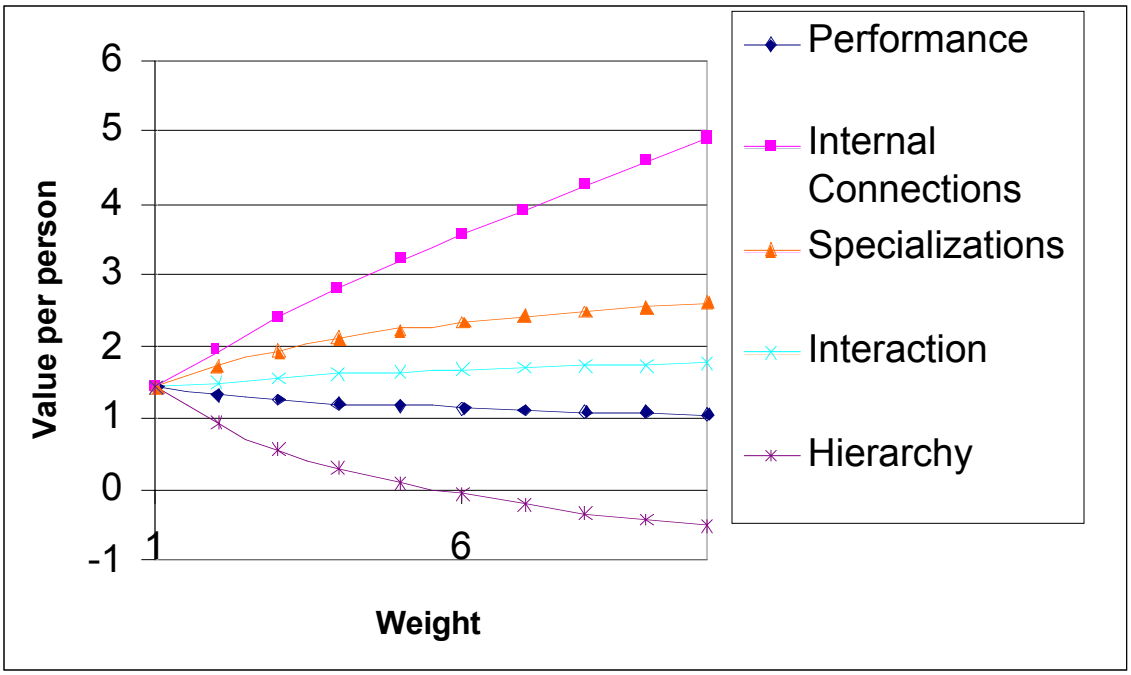

Figure 2. Attribute Comparison

Our work can be extended in numerous ways, such as finding the optimal number of employees for the resultant firm, modelling different parent firm topologies, and varying specializations or levels. The model can also be re-run with varying numbers of employees for Firm C. An additional approach would be to find an ideal number of employees at each level, so as to maximize the value per employee of firm C.

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