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CORPORATE POSITIONING: A BUSINESS GAME PERSPECTIVE

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ABSTRACT

This study employs a business game as a vehicle for strategic network research applications. We examine eight runs of a business game involving 700 graduating MBA student participants and evaluate the following set of network theory characteristics employed in the game: directivity, degree distribution, neighbors, components and network resilience. An analysis of the implications that these characteristics have on performance shows that companies positioning themselves at pivotal points within the network outperform companies that do not. The findings show the applicability of network theory in a business game and indicate the potential for business games to provide a realistic environment for applied research on strategic networks.

INTRODUCTION

One of the key questions in strategy research is where a corporation should position itself within its industry (e.g., see Gulati et al., 2000). Typically, studies address this question by viewing companies as autonomous entities, striving for competitive advantage by means of either external industry sources (e.g. Porter, 1980) or internal resources and capabilities (e.g., Barney, 1991). Our contention in this paper is that the conduct and performance of corporations can be more fully understood by examining the network of relationships in which corporations are embedded instead of just focusing on the autonomous entity. Such a network encompasses the corporation's set of relationships with other corporations in the industry, such as suppliers, distributors, customers, and competitors. One way to deepen the understanding of corporate positioning from this perspective is to investigate this area using a simulation-game-based laboratory experiment.

In conducting simulated laboratory research, the researcher designs controlled experiments in such a way so as to be able to answer specific organizational questions (Burton, 2003; Burton and Obel, 1995). Ein-Dor and Segev (1986) assert that the complexity and the high cost of creating simulated environments encourage researchers to employ field surveys or case studies rather than laboratory experiments. Nevertheless, although all research methods are important and all contribute to the acquisition of knowledge, laboratory experiments are particularly attractive because this approach affords the opportunity to obtain precise measurements and to define and validate findings from the field. These objectives can be achieved by using general-purpose business games as the means by which to establish realistic environments for laboratory research on corporate positioning and as a means by which to foster a heightened awareness of network attributes in order to gain insight into corporation conduct and performance.

The investigation of this area of pedagogy will begin with a review of recent network literature from the perspective of its relevance to the process of learning, following with a section presenting business game simulations. Then, we state the study's hypotheses and methodology. Next, we discuss the value of using the network approach in business game design, followed by an analysis of performance, according to network characteristics. Finally, we discuss the applicability of the findings of the study to the area of business education and propose some future research directions.

NETWORK THEORY

Increasing interest in the area of networks in recent years has resulted in exponential growth across several disciplines in the amount of research being conducted in this area (see Borgatti and Foster 2003 for a comprehensive literature review). Network theory is an interdisciplinary field that searches for a common formalism for networks found in real-life. The goal of network theory research is to gain a greater understanding of the structure and flow patterns within networks.

Networks exist in all aspects of life (see Newman, 2003 and references therein). Some illustrations are as follows: (a) social networks are sets of people with some pattern of interaction between them; (b) citation networks and the World Wide Web (WWW) are examples of information networks; (c) technological networks are man-made networks designed typically for the distribution of some commodity or resource, such as the electrical power grid and the Internet; and (d) biological networks, which contain many biological systems, most classically begin metabolic pathways, where the substrates and products are connected with metabolic processes between them.

Each of the identified networks consists of *vertices* (e.g., people, web pages, power plant and substrates) and *edges* (e.g., relationships, hyperlinks, power lines and metabolic processes), the latter providing the means by which the vertices are connected. The following list of network concepts, along with the accompanying background information, pertaining to some of the other general characteristics of networks will help in understanding how network theory applies to the proposed area of study (also see Newman, 2003):

(a) *Directivity*. An edge can be one way, leading to a directed network (i.e., a network with a defined direction of flow within it) or two ways, leading to an undirected network. Examples of directed networks are the citation networks and electrical power grid.

(b) *Degree distribution*. A degree is the number of edges connected to a vertex. We refer to vertices directly connected to a certain vertex as neighboring vertices. The degree distribution p_k represents the portion of vertices having a specific degree *k*. For example, it has been shown that almost all real-world networks have a power-law degree distribution $p_k \propto k^{-\alpha}$,where $2 \le \alpha \le 3$. The reason for such degree distribution is discussed later.

(c) *Components*. A component describes all the vertices that are connected to one another. For highly connected networks, there exists only one large component, but there can be small components that are disconnected from the others.

(d) *Network resilience*. The resilience of a network is its ability to function, or continue its flow from one vertex to another, after some vertices (and their connections) are removed. Another way to look at it is to see how many vertices must be removed to decompose a large component into several smaller ones. As expected, networks are usually extremely sensitive to a high degree vertices being removed.

(e) *Community structure*. This term refers to groups of vertices with high connectivity between them and few edges between the groups. These community structures are still regarded as one large component, but they are highly susceptible to targeted resilience and can be fractured into separate components by the removal of just a few vertices.

(f) *Network Dynamics.* Another important theme of network theory is its construction. Most of the networks are not constructed a-priori, but grow slowly through a process of construction. The citation network and the World Wide Web are good examples of how networks grow dynamically. Moreover, it has been shown that growth patterns yield the power-law degree distribution observed in real-life networks.

BUSINESS GAME SIMULATIONS

A general-purpose business game is, by definition, a highly complex man-made environment. The objective of a business game is to offer students the opportunity to learn by doing in as authentic a management situation as possible and to engage them in a simulated experience of the real world (e.g., Garris et al., 2002; Martin, 2000). This approach to business-game design enhances the characteristics of the game as a simulation of real-life so that participant behavior observed may be generalized to reality (e.g., Babb et al., 1966; Lainema and Makkonen, 2003).

The area of business simulation games is extensively covered in the literature. In 2001, a special issue of *Simulation & Gaming* (Volume 32, no. 4, 2001) was dedicated to the state of the art and science of simulation and gaming. Wolfe and Crookall (1998) assessed the state of simulation and gaming as a scientific discipline. In 2003, a special issue of *Communications of the ACM*, named "A Game Experience in Every Application," was dedicated to simulation games in diverse applications. Over the years, researchers have reported on the extent of usage of simulation games in academe and business (e.g., Asakawa and Gilbert, 2003; Dasgupta, 2003; Dickinson et al., 2004; Dickson et al., 1977; Eldredge and Watson, 1996; Faria, 1987, 1998; Haapasalo and Hyvonen, 2001; Larréché, 1987; Lucas and Nielson, 1980; Muhs and Justis, 1981).

However, simulations created especially for research purposes are usually oversimplified and less realistic. Most involve only a single decision maker interacting with the computer program facing rather uncomplicated structured problems in a relatively restricted time period. For example, Brozik and Zapalska (2000) explored the "Restaurant Game," a single-period simulation that provides students the opportunity to plan and implement a strategy in a competitive environment. When playing the game, the game instructor can demonstrate how a simple mathematical model leads the decision maker to an optimal solution.

Overall, the business game method enables students to "learn by doing" (Garris et al., 2002). A business game provides students the opportunity to take on the roles and responsibilities of executives, to become deeply involved in decisions faced by real people in real organizations, to feel the pressure and to recognize and to assume the risks. Moreover, this method is an excellent tool to test the understanding of theory, to connect theory with application, and to develop theoretical insights in a laboratory environment. The students are provided the opportunity to develop some useful practical skills and to practice the tools, techniques and theories they have learned in previous classes.

HYPOTHESES AND METHODOLOGY

THE GAME EMPLOYED

This study employs the international version of a widely used business game developed in the United States and commonly known as the International Operations Simulation Mark/2000 (hereafter INTOPIA™). The prime purpose of this business game is to increase students' understanding of strategic management of international operations in general and those of the multinational corporation in particular. Furthermore, the game is designed to yield substantial payoff in general management training. It forces participants into a stream of truly entrepreneurial top management decisions of business philosophy and a search for logic and synergy in the business objectives-strategy-implementation sequence (Thorelli et al., 1995).

The game is played for a full semester and is operated by up to 25 competing companies with headquarters located in Liechtenstein; the consumers' markets are similar to the markets in the United States (US), the European Union (EU) and Brazil, wherein each company can operate a local branch. "Operated" is a broad concept and covers any one or any combination of the functions of manufacturing, marketing of one's own products or selling to overseas distributors, serving as a distributor or a subcontractor, exporting, importing, financing and licensing. The incoming participants enter a "going concern" with 4 periods of simulated history and play 6 to 10 additional game-periods. The task of the companies is to make decisions which will guide operations (simulated by the easy to realize computerized system) in the forthcoming period and which will affect operations in subsequent periods.

Decisions are made once a week and are e-mailed to the game administrator to be fed to the computer program. After the program runs the data, it generates company outputs that include financial reports (e.g., a balance sheet, an income statement), production reports and market researches. These outputs are then e-mailed to the companies and are used for decision making in sequential periods. The length of the each time period simulated is usually referred to as one year. Dozens of decisions, covering the entire range of a typical business, are required of a company in each period. The decision-making process is based on an analysis of the company's history as presented to players at the beginning of the game, interaction with other companies and external agents of the game (e.g., bankers, board of directors), and the constraints stated in the player's manual (e.g., procedures for production, types of marketing channels available). Usually, each student is taking an executive role and is responsible for the decision making in his/her expertise domain and for the decision coordination with his/her colleagues in adjacent areas (e.g., the chief operations officer makes operation decisions and coordinates them with both the chief financial officer and the chief marketing officer).

The performance of a company in each period is affected by its past decisions and performance, the current decisions, simulated customer behavior, and the competition – the other companies in the industry.

The game has become highly realistic as a result of the efforts invested in it to simulate the total environment. Students participating in the game immerse themselves in this artificially created world. They form small teams, allocate responsibilities for specific functions, and work to achieve common goals which they themselves define. While each of them becomes a specialist in his or her function, a joint effort is required to pursue the common objectives of the company.

SUBJECTS

The study was carried out at the Faculty of Management, Leon Recanati Graduate School of Business Administration in Tel-Aviv University. The participants were senior MBA candidates. The study was conducted during eight different semesters. About 90 students participated each semester in the business game classes starting the fall semester of 2002 till the spring semester of 2005.

The formation of the teams and allocation of executive roles within teams proceeded without external intervention or manipulation, and were reported to the game administrator before the game itself began. Our game experience shows that executive roles are usually allocated according to the participants' expertise in certain functional areas (e.g., accountants and bankers are usually assigned the role of chief financial officers).

HYPOTHESES

As indicated above, the main goal of this study is to address the question of corporate positioning. We focus on the practical aspect of networks and measure their influence on corporate performance. As economic environments become more competitive, corporate positioning assumes enhanced strategic importance to performance. There is a growing body of research in strategy that is coming to terms with the economic consequences of companies participating in strategic network (e.g., Gulati, 1999; Gulati et al., 2000; Harrigan, 1985; Jarillo, 1988; Kogut, 1988). This underlines the importance of understanding business networks, and highlights the need for focusing research in this area.

However, while there has been growing attention paid to understanding the formation of inter organizational relationships, less attention has been paid to the implications of such networks for the companies embedded in them (Gulati et al., 2000). For example, traditional models of competition (e.g. Porter, 1980) have simply focused on scale, advertising intensity, product similarity and interdependence along value chains to understand companies' profitability differences. Yet, the location of companies within the networks is also considered an important element (Gulati et al. 2000).

Similarly to previous studies (e.g., Cool and Schendel, 1988; Piskorski, 1999), the hypotheses in this study relate concepts of network theory to corporate performance.

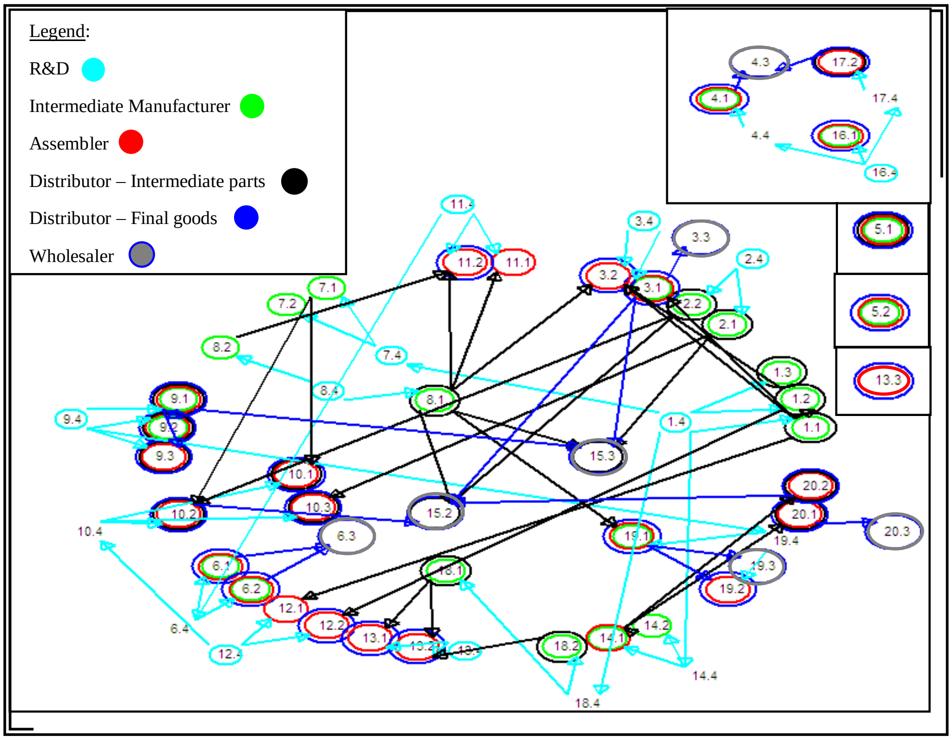

Figure 1. Network Structure of a Sample Run of the Spring Semester of 2003. The Industry Consists of 63 Companies and Exhibits a Complex Network.

The first hypothesis relates component size to performance:

Hypothesis 1: Corporations cooperating with other corporations outperform corporations that work alone.

The next hypothesis examines the business game network resilience:

Hypothesis 2: Corporations having the biggest impact on network resilience outperform the average corporation.

We also investigate the corporate performance versus the number of its suppliers and distributors:

Hypothesis 3: The larger the number of a corporation's suppliers, the better its performance.

Hypothesis 4: The larger the number of a corporation's distributors, the better its performance.

INTOPIA NETWORK ANALYSIS

This study proposes analyzing the INTOPIA business game as networks, with all of the associated implications being acknowledged. We consider the network on two levels: (1) the corporate level, where the performance of each corporation is analyzed according to its network characteristics, and (2) the company level, where each multinational corporation can run several local companies operating and making transactions with one another. The corporate level is discussed later, whereas the company level is detailed in this section. As each corporation usually operates several local companies, the company network is more complex than its corporate counterpart.

We consider the INTOPIA business game as another kind of directional information network, where each company serves as a vertex and its directed relation with another company is considered as an edge. The flow of the network through all the companies is by the traditional vertical supply chain, starting with R&D companies and ending with wholesalers marketing to end-customers. Next, we analyze the game using the aforementioned concepts of network theory. Throughout this section we use a sample run of the game from the spring semester of 2003. In section 6 we present the full aggregate analysis of all semesters.

DIRECTIVITY

The network in the INTOPIA business game is a directed one where the edges are directed "upward" towards the vertical supply chain, starting with innovating R&D companies up to intermediate manufacturers, assemblers, and ending with end-consumers wholesalers. Figure 1 illustrates the network structure of the spring semester of 2003. The industry was made of 20 corporations, each of which could operate companies in all four areas (USA, EU, Brazil and Liechtenstein). As not all companies operated in all areas, the result was a 63-company game. Figure 1 demonstrates the complexity of the network structure in the game: A vertex number is composed of a corporation number (1 through 20) and an area number (1, 2, 3 and 4 for

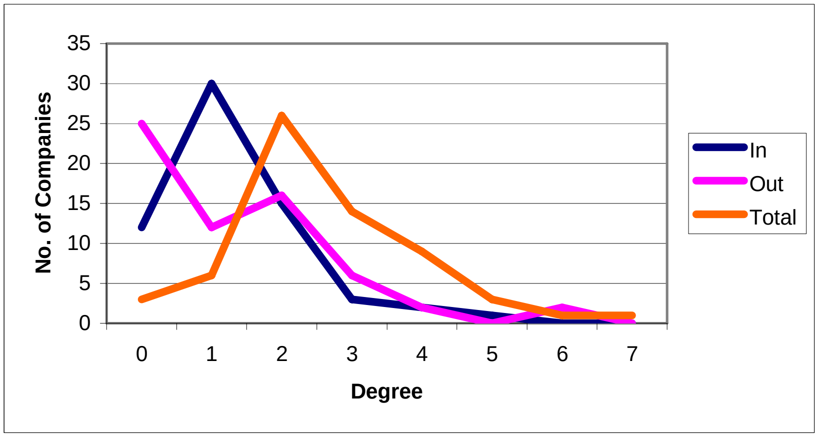

Figure 2. Degree Distribution for the Sample Run of the Spring Semester of 2003 for Ingoing, Outgoing and Total Number of edges.

USA, EU, Brazil and Liechtenstein respectively). For example, company 3.3 means the Brazilian company of corporation number 3. Furthermore, each company is color-coded according to its function in the value chain, and the arrows connect companies that employ any kind of relationship between each company pair. As can be seen in Figure 1, the "flow" along the directed edges is up the vertical value chain.

DEGREE DISTRIBUTION

In a directed network, there are three groups of edges: (i) ingoing edges, (ii) outgoing edges, and (iii) total number of edges. The ingoing degree distribution indicates the structure of the influenced companies, namely the extent to which a company depends on other companies (in goods or technology). The outgoing degree distribution indicates the structure of the influencing companies, namely how a company's influence is exerted. All these measures have a power-law distribution, meaning that there are only a few companies which are highly influential within the industry and many which have a low level of influence. The power-law concept also applies to business games.

Figure 2 demonstrates the degree distribution of the number of ingoing edges, outgoing edges and total edges of the sample 2003 spring semester network presented in Figure 1. The minimum number of edges observed in that run is 0 and the maximum is 7. Two aspects should be noted: First, degree 0 denotes the companies that have no edges of any specific type (i.e., companies that are disconnected completely from all other companies). These companies are seen in the upper right-hand side of Figure 1 as isolated components. Second, the power-law distribution for degrees 2 to 7 yields $\alpha = 2.85, 2.85, 2.02$ for ingoing, outgoing and total number of edges respectively. Degrees 0 and 1 do not mathematically accommodate the power-law distribution expression $p_k \propto k^{-\alpha}$ (k=0,1) and are thus disregarded. These results indicate that there are many companies with a small number of edges and only a few that are highly connected.

Our analysis also reveals that the average number of ingoing or outgoing edges for each company in all the runs examined was 1.27, resulting in a total average of 2.54 edges per company. This result shows that on average, the companies were connected to two companies, with only a small number of companies having more than three connections. Another interesting result is that the companies with the most ingoing (outgoing) edges had only ingoing (outgoing) edges, meaning they were solely functioning as distributors (suppliers). This indicates that the business game network does not behave like the hub usually found in man-made networks (Amaral et al., 2000), where there is only one central company which connects to all others, but rather behaves like a set of ingoing and outgoing vertices.

COMPONENTS

An important characteristic of a business game is that it has each component of the entire supply chain – starting from R&D and ending with wholesalers marketing to end-consumers. The number of components within a game may vary from one big component, including all the playing companies and up to the entire *n* playing companies, each being fully integrated, without conducting any business contacts with other companies. We obtained three kinds of components in the 2003 spring semester game: (i) a large component with 53 companies; (ii) a medium-size component with seven companies; and (iii) several unconnected single companies. A very large component, consisting of 73%-92% of all companies, existed in seven out of the eight examined runs, whereas in one, run a component composed of 56% of the companies existed along with many small disconnected components. This implies that the industry usually consolidated into a single major component with interconnections between most of its constituents companies, with only a small number of independent satellite companies. Also, we revealed a

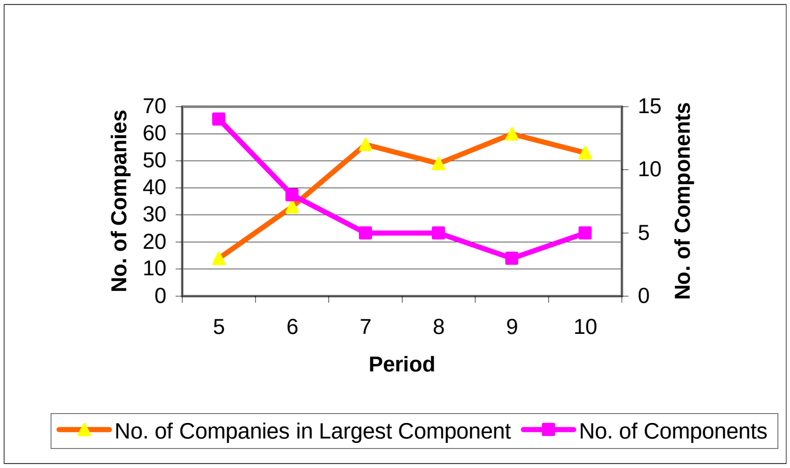

Figure 3. Network Dynamics along the Different Periods of the Game.

community structure, which will be explained in the next section.

NETWORK RESILIENCE

Understanding the concept of network resilience is important to "keep the game flowing." It demonstrates, for example, the dependency of companies on other companies and reveals the concept of centered or pivot companies and ineffectual or weak companies. The removal or collapse of the centered or pivot companies may lead to a network breakdown, whereas removal of the ineffectual or weak companies does not significantly affect the flow of information or goods within the network. The network resilience is a measure of the number of central companies within the business game network and their position. In our sample 2003 spring semester run, the collapse of company 15.2 will result in a large dysfunction of the game, as it is a major center of influence within the largest component. On the other hand, the removal of company 6.2 will have little effect on the "flow" of the game, as it is a small satellite of the large component.

DYNAMICS

During the course of the game, the network slowly builds itself and consolidates into a more structured and connected form. As can be seen in Figure 3, the number of components, presented by the right Y-axis, decreases from 14 to 5 by consolidation to a more structured and connected network as more companies are incorporated into the largest component (from 14 to 53), presented by the left Y-axis. The network stabilizes after three game-periods and remains almost constant throughout the game. Given this latter state of affairs, it is only necessary to consider the last played period for the analysis of performance.

To summarize, the usage of network theory terminology helps in understanding the basic structure and the relationships between companies in a business game. It can also help extract important information from it (e.g., revealing significant companies in the game, etc.). It also presents the dynamics of the game by elucidating the construction of the major component and resulting stabilization after a small number of periods.

Corporation No.	Performance (in %)
1	437.7
2	-137.7
3	12.6
4	78.0
5	-282.1
6	212.5
7	-94.9
8	-185.5
9	381.6
10	-96.9
11	-6.5
12	-113.0
13	-191.1
14	-308.2
15	79.3
16	104.5
17	46.4
18	142.7
19	165.9
20	-245.2

Table 1. Performance (Relatively to the Average Corporation) of Corporations in the Sample 2003 Spring Semester.

PERFORMANCE ANALYSIS

This section examines corporate performance versus network characteristics. In all of the studied semesters, a corporation's performance was measured by its accumulated retained earnings (i.e., the accumulated profits) in the entire run. In each run, each corporation is compared to the average corporation's performance in that specific run. For example, Table 1 exhibits the performance (relative to the average corporation) of all participating corporations in the sample 2003 spring semester. Note that corporations that were not able to achieve positive profits present a performance worst than -100%. The results in the following sections are aggregated and are analyzed using the network characteristics and their correlation of each of these variables with the performance of the corporations.

PERFORMANCE VERSUS COMPONENT SIZE

In Section 5 we examined the components forming the business game network, concluding that a very large component, consisting of about 85% of the companies, existed in every run. In this section we report on the components' performance in relation to their size.

Table 2 exhibits the average performance of the components in all the examined runs, according to their size. Performance is exhibited as a percentage in relation to the average corporation performance in the game. It should be noted that we do not specify the sizes of the medium and the largest components as the number of their constituents varies in every run. Also, a deeper investigation revealed that the smaller the largest component, the better its average performance.

Component Size	Average Performance (in %)
Single Company	-9
Medium	75
Largest	18

Table 2. Performance of Corporations versus Components Size.

The results reveal that corporations that did not participate in alliances with other corporations usually had below-average results. Moreover, although, on average, the largest component outperformed the average company, corporations within the component itself performed very differently, and some even performed much worse than the average company in the game. The medium size components significantly outperformed all other component sizes. Furthermore, we found that each of the medium size components' constituents outperformed the average corporation.

PERFORMANCE VERSUS NUMBER OF NEIGHBOR COMPANIES

In Section 5.2 we assumed connectivity by the ingoing and outgoing edges. In this section we examine the influence of connectivity of corporations on their performance.

Figure 4 exhibits the dependence of performance on the number of a corporation's suppliers, or ingoing edges (assuming linear correlation). As can be seen, the larger the number of suppliers, the better the performance of the corporation. While this result can be explained by several factors, it is mainly due to the reduction in risk that is associated with the increase in the number of suppliers, which leads to greater competition among the suppliers and, thus, an increase in the negotiation power of the supplied corporation (i.e., the corporate buyer).

Contrary to the ingoing edges results, we did not find a clear trend in examining the outgoing edges, assuming linear correlation (see Figure 5 where R^2=0.0719). The findings are not unequivocal; sometimes it is better to be a distributor to a small number of companies (e.g., one company) and sometimes to a large number (e.g., four companies).

PERFORMANCE AND NETWORK RESILIENCE

Section 5.4 showed that network resilience can be analyzed by removing companies from the network and ascertaining whether the large component has disintegrated into smaller ones. This section analyzes the performance of the corporations whose removal resulted in the greatest fragmentation of the largest component. Using a computer program, we found that when only one corporation was targeted and removed, it outperformed the average corporation by 118.7%. When two corporations were

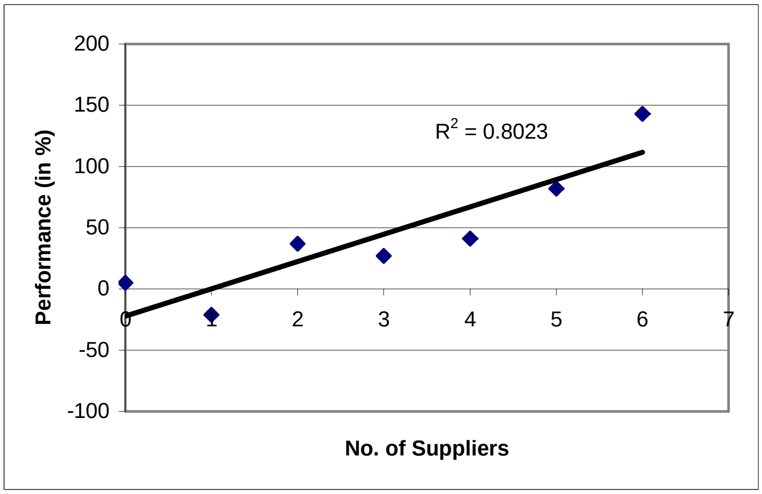

Figure 4. Performance of Corporations According to the Number of Their Suppliers.

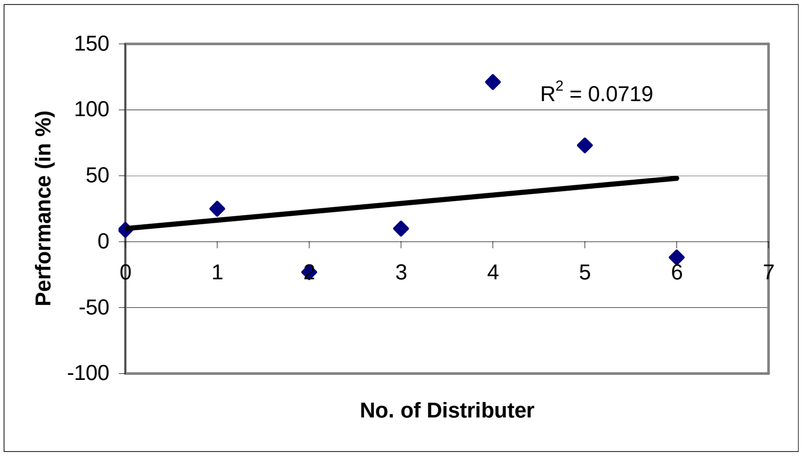

Figure 5. Performance of Corporations According to the Number of Their Distributors.

removed, those resulting in component collapse outperformed the average corporation by 60.3%. This shows that those corporations which are at the heart of the connection between components are those that benefit most and outperform the average corporation. They exploit their centrality and importance to the network resilience to their own benefit and thus enhance their performance.

DISCUSSION AND CONCLUSIONS

This research used network theory concepts to better understand corporate positioning. For that, simulated companies were formed. Although the general environment was mutual to all participants, the companies became differentiated: each assumed considerably a different strategy, different operating decisions, and a different approach to cooperation with other companies. Leaving the decision on network strategy to the groups resulted in a variety of behaviors toward other companies in the industry: fully integrated companies that conducted the entire value chain themselves, wholesalers that developed dependency in manufacturers, innovating companies that sold their R&D products, etc. It appears that these companies reflect most real-life business approaches.

Beyond the creation of simulated companies and industries, this study tested four hypotheses relating network characteristics and companies' performance. The first three hypotheses were fully confirmed; however, the last one was not. These results replicate previous studies which also addressed the impact of networks on the performance of companies (e.g., Piskorski, 1999). However, previous research mainly focused on field study. For example, Goerzen (2005) studied multinational corporations, mainly Japanese, and Zaheer and Zaheer (1999) considered banking firms in a global electronic network. Nevertheless, the complexity and uncontrollability (from the researchers' point of view) of real organizations frequently obscures the significance of data collected in the field and makes the discrimination of causalities extremely difficult. In the game environment, the complexity is somewhat reduced and many of the variables are controllable, at least to some extent. Systematic variation of the controllable variables would permit much clearer delineation of the associations between them. Relationships delineated in the game context might then be more confidently identified in real situations. Thus, business games could be used as vehicles for strategic network research for discovering new relationships, which can be then sought in real organizations, or as laboratories for achieving a clearer understanding of relationships already observed in the field.

Also, we showed the promise of a network perspective in the dynamics or evolution of corporations and industries over time. A network perspective can provide important insights to better comprehend these dynamics, because they provide a way of understanding why some companies coalesce into components while others suffer from conflict. We suggest that this notion be further explored in future research.

The findings, furthermore, complement and extend traditional strategy frameworks and perspectives. They shed light on our main question of where a corporation should position itself with regard to other corporations in the industry. The answer is complex and has several aspects: (a) being a part of a medium-size component entails better than average performance, implying that a close relationship with a relatively small number of companies results in an improved performance; (b) the larger the number of suppliers, the better the performance, suggesting that risk reduction increases performance; and (c) positioning a corporation at the junction between two highly interconnected communities gives a performance-related advantage.

Combining these aspects, we come to the following answer: "position the corporation at the pivotal point of the network." This can be done by implementing one of the following strategies: (i) working with a few known business partners; (ii) working with numerous suppliers in a large component; or (iii) being the "keystone" between two components.

Although a business game presents sufficient complexity to provide a realistic network simulation, no business game can seize all aspects of real-life networks. As more data from real organizations become available, it will be easier to determine the extent to which game situations replicate reality. This information is necessary to validate inferences about the real-world based on game results. Therefore, the applicability of the findings to the real-world must be examined with caution. Also, there is a need to determine how business games can be applied in studying various aspects of networks: performance can be easily measured, but the evaluation of a symbiotic cooperation between companies is as vague in the game as it is in real-life.

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