CHAPTER 5

Structural Leverage in Marketing

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The concept of networks is no stranger to the field of marketing. There is much emphasis on the quality of supplier and customer relationships as a means for improving marketing and sales positions vis à vis the competition. But the premise of much of this thinking is that one only has to pay attention to one's own relationships (to customers, suppliers, sources of capital, and so on). What the field of social networks can bring to this idea is the importance of looking at the entire constellation of relations in a system (see Galaskiewicz, Chapter 3, this volume). Thus, it is not sufficient to say that you have established quality relations with each one of your suppliers and customers. There is also decided benefit to knowing (Krackhardt, 1990, 1992) and positioning (Burt, 1992) yourself within the web of relationships among those suppliers, customers, and even competitors.

These advantages of knowing the structure and positioning within the structure are not restricted to one unit of analysis. Such structural advantages occur at the micro level (e.g., within small groups, Shaw, 1964; at the organizational level, Krackhardt & Brass, 1994; and all the way to the national industrial level, Burt, 1983). Nor are these advantages strictly the purview of organizational scientists (see Wasserman & Galaskiewicz, 1994 for a review of many fields that have benefited from network analysis). In this chapter, I would like to provide one small example of how understanding the structure of

the social system in which one does business can have a decided impact on marketing strategies.

THE FREE SAMPLE PROBLEM

Consider this simple hypothetical example. Suppose that you are the marketing manager of a large domestic products firm. A new product (Theta) was just developed by your R&D group. You have found that the product sells itself—once people try it, they tend to adopt it with a reasonably high probability. Thus, you decide to market this product by sending free samples to a random sample of potential buyers. (I will refer to this randomly selected set of people as "focal persons.") Now, suppose further that there is a friendship ripple effect. That is, given that a focal person is given a free sample and then adopts Theta, he or she subsequently coaxes his or her friends into using Theta also, and each one of these friends also adopts Theta with a particular probability. With this ripple effect, we get added returns to our investment in the sense that the focal recipient of the free sample, on liking and adopting the product, has spread by word of mouth his or her support and thereby influenced these close associates to become customers also. Studying such networks makes explicit the structural process of opinion leaders and the diffusion of innovation (cf. Bass, 1969; Coleman, Katz, & Menzel, 1969; Feick & Price, 1987; Reingen & Kernan, 1986; Rogers, 1962).

The Random Sample Model

We can formalize this process as follows:[1]

α: The probability that an individual who is given a free sample of Theta will adopt Theta as a product.

β: The probability that an individual who is a friend of the another adopter (who had been given the free sample) will also adopt Theta.

F_i: The cardinal number of the set of i's friends.

The central question of interest becomes, what is the expected number of customers (people who adopt product Theta) derived

from each free sample distributed? Each focal person has the probability α of becoming a customer, and each friend of the focal person has the joint probability $\alpha\beta$ of becoming a customer. Let C_i indicate the expected number of customers that will result from i being given the free sample. Then, the number of expected customers given focal person i is selected through the random sampling process is as follows:

$$C_i = \alpha + F_i\,\alpha\beta.$$

Assuming each person i has an equal probability of being selected as a focal person, then the expected number of customers resulting from a campaign of randomly distributed free samples is as follows:

$$E(C) = \frac{1}{N} \sum_{i=1}^{N} (\alpha + \alpha\beta F_i) \tag{1}$$

The Structural Leverage Model

There is nothing inherently structural about the previous model [1]. All that is necessary is to know how many friends people have. We need to know nothing about to whom they are connected or what the overall structure of friendships is to solve this problem. Suppose, however, that we alter the sampling procedure slightly in the following way: We randomly approach a set of people as before, but this time we ask them each to nominate a friend of theirs. We then give the sample to the friend they nominate instead of to the focal person.

On the surface, this appears to be an innocuous change in procedure. But the effect of this small change can be fairly dramatic, depending on the structure of friendships.

To formalize the effect, I will make one simplifying assumption: A focal person will nominate with equal probability any one of his or her friends. With this additional assumption, we can calculate the expected number of customers resulting from this modified sampling procedure—if we know the structure of the friendships. To demonstrate why knowing the structure (as opposed to simply knowing the number of friends everyone has) is important, I will proceed stepwise through an example.
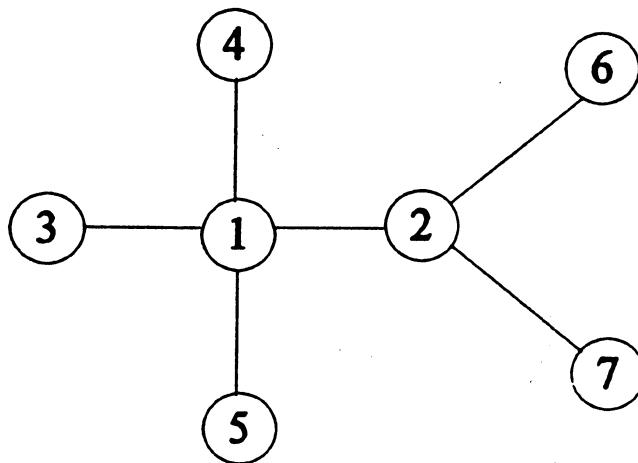
Figure 5.1. Friendship Pattern

Consider the structure of friendships provided in Figure 5.1. Suppose we were to randomly select Person 1 as the focal person. Then Person 1 would randomly select either Person 2, 3, 4, or 5 as a friend. If Person 1 selects Person 2, then drawing on the same principles derived for model [1], the expected number of customers would be α plus $3 \times \alpha\beta$ (Person 2 has three friends, including Person 1, all of whom are potential ripple-effect adopters). On the other hand, if Person 1 selects Person 3, then the expected number of customers would be only α plus $\alpha\beta$ (Person 3 has only one friend, the focal person). By extension, the expected number of customers, given that we have selected Person 1 as a focal person, is one fourth the sum of the expected number of customers we would get across each of the four friends that Person 1 might nominate.

Before we generalize this, it should be obvious that we need to know more than simply how many friends the focal person has to solve this problem. In particular, we need to know how many friends each of the focal person's friends has. I will represent the set of friends of individual i as S_i.

Calculating the effect of the leverage model is straightforward. I will use the subscript i to designate the person who was originally selected through the random sampling process. I will use the subscript j to designate a friend of i's. I will use C^L_i to indicate the expected number of customers that result from i being selected in the leverage model. That is, C^L_i is the expected number of customers

TABLE 5.1

i	Fi	Ci	C_i^L
1	4	1.7	0.95
2	3	1.4	1.1
3	1	0.8	1.7
4	1	0.8	1.7
5	1	0.8	1.7
6	1	0.8	1.4
7	1	0.8	1.4

$E(C) = 1.014$

$E(C^L) = 1.421$

Payoff = 40.1%

given that i was asked to nominate a friend, who in turn was given the sample and through a ripple effect may have influenced her friends to become customers. Then, for any given i,

$$C_i^L = \frac{1}{F_i} \sum_{j \in S_i} (\alpha + F_j \alpha \beta)$$

The expected value for the leveraging strategy as a whole is simply the expected value of these sums:

$$E(C^L) = \frac{1}{N} \sum_{i=1}^{N} \left[\frac{1}{F_i} \sum_{j \in S_i} (\alpha + F_j \alpha \beta) \right] \tag{2}$$

HYPOTHETICAL EXAMPLE

To illustrate the effect of these two sampling strategies, I will calculate them for the structure of friends revealed in Figure 5.1. For purposes of demonstration, I will arbitrarily set $\alpha = .5$ and $\beta = .6$. Table 5.1 shows the calculations for both the randomly sampled strategy and for the structural leverage strategy. At the bottom of the table are

TABLE 5.2

β	Figure 5.1 Structure			Star Structure			Circle Structure		
	E(C)	E(C^L)	Percentage Payoff	E(C)	E(C^L)	Percentage Payoff	E(C)	E(C^L)	Percentage Payoff
.1	0.585	0.653	11.5	0.585	0.764	30.4	0.6	0.6	0
.2	0.671	0.807	20.2	0.671	1.028	53.1	0.7	0.7	0
.3	0.757	0.960	26.8	0.757	1.292	70.7	0.8	0.8	0
.4	0.842	1.114	32.2	0.842	1.557	84.7	0.9	0.9	0
.5	0.928	1.267	36.5	0.928	1.821	96.1	1.0	1.0	0
.6	1.104	1.421	40.1	1.014	2.085	105.6	1.1	1.1	0
.7	1.100	1.575	43.1	1.100	2.350	113.6	1.2	1.2	0
.8	1.185	1.728	45.7	1.185	2.614	120.4	1.3	1.3	0
.9	1.271	1.882	48.0	1.271	2.878	126.4	1.4	1.4	0

three important totals. The expected number of customers ($E(C)$) for the random sample strategy is 1.01 customers per free sample. The expected number of customers ($E(C^L)$) for the leverage strategy is 1.42. The expected payoff percentage for using the leverage rather than the random sample strategy is

$$Payoff = 100 \times \frac{E(C^L) - E(C)}{E(C)} = 40.1\%. \tag{3}$$

That is, we can expect that, in a population characterized by the structures as represented in Figure 5.1 and probabilities of adopting Theta given by $\alpha = .5$ and $\beta = .6$, we will garner 40% more customers by using the leveraging strategy rather than the random sampling strategy to distribute free samples of Theta.

EXPLORING MODEL RESULTS

The question remains, what factors will affect this payoff ratio? That is, does this handsome return depend on α, β, or the structure?

First, in the simple model proposed here, it can be easily shown that the payoff ratio does not depend on the value given to α, as long as $\alpha > 0\$$ (the α's cancel in an expansion of [3]). The payoff does,
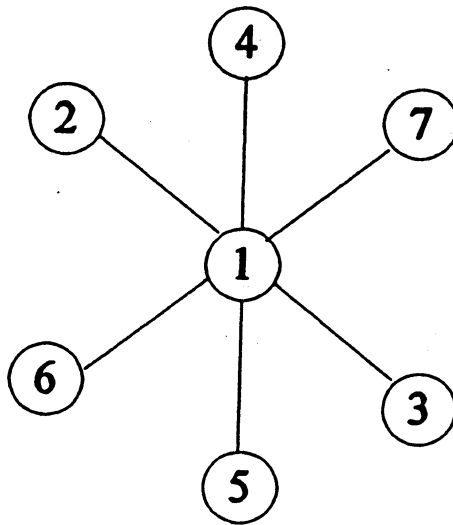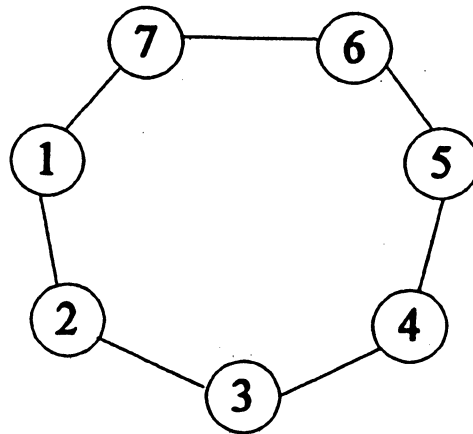
Figure 5.2a. Friendship Pattern in a Star Structure

however, depend on β and the structure of the friendships. These effects are readily evident in Table 5.2, which shows the payoff ratios for values of ß ranging from .1 to .9 and for three different structures (shown in Figure 5.2). The three structures are the one described in Figure 5.1 that we have already examined; a "star" structure, wherein friendships are highly centralized to one very popular person (Figure 5.2a); and a "circle" structure, wherein the friendships are organized in a circle (Figure 5.2b).

The first result is that higher β values increase the payoff of using the leverage structure. This is true for any structure in which there is at least some advantage for leveraging (which will be most of the time). For the Figure 5.1 structure, the payoff ranges from 11% to 48% as β increases from .1 to .9. For the highly centralized star structure, the payoff ranges from 30% to 126% as β increases from .1 to .9.

But, the more critical result is the sensitivity to the structural features of the population we are sampling. In the extreme case of no structural differentiation among (Figure 5.2b), there is no payoff at all for using a leveraging strategy. But, given any particular level of β, there are marked differences as the structure becomes more centralized. For example, at a modest β = .4, the decentralized structure provides 0% payoff for leveraging, the moderately central-ized structure provides 32% payoff for leveraging, and the highly

Figure 5.2b. Friendship Pattern in a Circle Structure

centralized structure provides a 85% payoff for leveraging. The key to the degree of leverage provided by a leveraging strategy is the extent to which the structure of the population from which the sample will be drawn is centralized.

DISCUSSION

The results of this introductory analysis can be summarized by the following propositions:

P1. For any given value of α and β, and for any given structure, the expected number of customers in a leveraging strategy will always be greater than or equal to the expected number of customers in a random sampling strategy.

P2. The payoff for using a leveraging strategy is independent of the probability that the individual who is given the sample will become a customer.

P3. The higher the value of β, *ceteris paribus*, the higher the payoff for using a leveraging strategy.

P4. The payoff is most sensitive to the structure of the friendship relations. The more centralized the structure, *ceteris paribus*, the higher the degree of leveraging advantage there will be for the leverage strategy.

It should be noted, however, that the door is not closed on this problem. There are several questions left unexplored here (due to space limitations). For example:

1. What are the effects of allowing the ripple effects to extend beyond just one friend? In the real world, we would expect such affects to propagate beyond just one friend (friends of friends may buy also). One could explore such effects by plotting the expected number of customers under the two models against time, in which each time period allowed for further diffusion of the product Theta through the network of friends.

2. What is the functional relationship between the payoff ratio and standard measures of network centrality? There is a large literature on network centrality (Scott, 1991) and many measures (Bonacich, 1987; Freeman, 1979; Mizruchi, Mariolis, Schwartz, & Mintz, 1986). In the examples I provided in this chapter, there is an apparent relationship between the two, although I have purposely left out of my analysis any articulate definition of what I meant by "centralized." To be fair, it is unlikely that this relationship is perfectly linear or even perfectly monotonic over all structures, depending on the particular centrality measure used. Exactly which dimension of centrality is illuminating to this problem is left to future research.

3. What happens if we make the model more complicated (and realistic)? For example, suppose that the probability that one becomes a customer is a function of the number of other friends who have already adopted Theta. Or suppose that the probability of adoption itself is a function of the rate at which one sees one's friends adopting. In combination with allowing the ripple effect to continue beyond just the immediate set of friends, this could create system dynamics that are difficult to anticipate. Exploring such dynamics could prove useful in better understanding how the structure would affect payoffs for different strategies.

4. What other strategies could be devised to take advantage of structural differentiation in the market? At a minimum, I can think of one strategy, which, when used in combination with a leverage strategy, would result in negative payoffs (i.e., one would be better off with the original simple random sample strategy). That is, suppose that we were to stratify the population such that high-status people were given a higher probability of being selected in the random sample process. In such a case, people at the center might be more likely to be sampled originally as focal persons. If we were to give the free sample to one of

sample would more likely be given to someone on the periphery, resulting in fewer adoptions through friends. There is a wealth of questions to explore here, matching strategies to friendship structures.

CONCLUSION

The purpose of this chapter is not to suggest that the four summary propositions above amount to proof that the leveraging strategy is the marketer's new best friend. Rather, it is to demonstrate that the *structure* of social and influence relationships is an important and relatively unexplored area within a broad array of marketing questions and problems. Although the field of marketing has historically recognized that dyadic relationships play a significant role in an organization's success, I hope to convince the reader that focusing on isolated dyads isn't enough. Relationships are embedded in a structural context, and the shape of this context can provide critical insight into these social and marketing phenomena.

NOTE

1. For the moment, I will restrict myself to a one-step ripple effect; that is, I will only consider the effects of immediate friends of the focal person.

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