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STRATEGY LEARNING IN A TOTAL ENTERPRISE SIMULATION

Patz, Alan L.
University of Southern California
alanpatz@home.com

ABSTRACT

Biased total enterprise (TE) simulations are helpful in determining what is learned and not learned and who does and does not learn it. This is shown using one TE simulation over a large number of industries and participants. In general, the learning of and attention to strategy ratings led to superior and large performance differences between winning, first place teams, and losing, last place ones. Other variables, such as prices, do not matter. The ones that do are broad or focused product line, quality, service, brand image, low cost, market share leadership, superior value, and global or focused coverage.

In a recent article (Goosen, Jensen, & Wells, 2001), the authors note that the learning attributed to total enterprise (TE) simulations is affected by the simulation designer(s) biases.

In the development of business enterprise simulations, designers use as their knowledge base theories and business fundamentals drawn from accounting, finance, marketing, economic, production, and management courses. A problem exists, however, as each discipline has alternative procedures, theories, and unresolved issues. Because the simulation designer must choose specific procedures and theories, the personal bias of the designer enters the picture and cannot be avoided even if the designer attempts to avoid bias. The learning benefits of a specific simulation are thereby by what is and is not chosen as the knowledge base.

Nevertheless, if it can be shown that a particular TE design emphasizes strategy over the usual price and cost factors, a major step has been taken in the discovery of how learning does and does not take place. An earlier attempt to demonstrate this (Patz, 2001) was preliminary, but it did point in the desired direction. Therefore, the purpose of this paper is to demonstrate the feasibility of discovering TE learning effects.

SIMULATION SPECIFICATIONS

The TE simulation employed was THE BUSINESS STRATEGY GAME (Thompson & Stappenbeck, 1999, 2001). It has an eight-point strategy rating system that emphasizes broad or focused product line, quality, service, brand image, low cost, market share leadership, superior value, and global or focused coverage. This rating system is one of six dimensions that determine an overall performance score for each run and the cumulative performance of the simulation. The other five are sales revenue, after tax earnings, return on equity, bond rating, and company value.

In all trials of this simulation, the importance of each dimension in the overall percentage performance ratings is as follows: sales revenue, 5; after tax earnings, 15; return on equity, 20; bond rating, 20; company value, 20; and strategy rating, 20. The sum, of course, is 100%; and, as a result, each team received a current period and game to date score between 0 and 100.

HYPOTHESES

Because this simulation has an important strategy emphasis, and due to the results of the preliminary study, several hypotheses are paramount using the standard equation $\pi = pq - c(q)$ where π = profit, p = price, q = quantity sold, and c(q) = cost of manufacturing and marketing. Each hypothesis refers to a comparison between first place and last place firms (winners and losers or **W** and **L**).

H1: Price is not an important **W** and **L** distinction.
H2: **W** firms will experience higher quantity demands than **L** firms.
H3: **W** firms will have lower unit manufacturing costs than **L** firms.
H4: **W** firms will have lower unit marketing costs than **L** firms.

Most important, is the strategy dimension:

H5: **W** firm strategy ratings will exceed those of **L** firms.

Of course, the first test will be whether or not the performance ratings of **W** firms exceed those of **L** firms. This consideration is obvious and will be the first result presented.

METHOD

A TE simulation was conducted in 11 sections of an undergraduate, capstone policy course over a period of 11 semesters. Each section formed an independent industry, and a total of 495 students participated. All students were

seniors majoring in the various fields of business administration..

SIMULATION PROCEDURES

After one class session devoted to the clarification of simulation rules, evaluation procedures, and decision-making mechanics, a two-year practice decision sequence was completed. Questions pertaining to the results of each session were answered, and the evaluation procedure was restated. That is, students were reminded that the cumulative scores at the end of the simulation were the figures of merit.

The importance placed on ending cumulative scores rather than current period results emphasizes long- rather than short-term strategies. Moreover, attention was direction to three specific conditions. First, the actual ending period of the simulation would remain unknown. (Each period is a year in the THE BUSINESS STRATEGY GAME, and the length of the semester allowed for a maximum of ten periods of play.) Second, all teams were expected to end their management tenure with a going concern, not a firm stripped of long term potential in order to gain short-term ranking enhancements. Third, 20% of the semester grade for the course depended on ending cumulative score rankings.

Decisions were due at specific times, processed by the simulation model, and the results were available to participating teams within two days. This allowed five days before the next set of decisions, required on a weekly basis.

SIMULATION SCORING

The participants were privy to the algorithm that determines cumulative scores in the simulation. These scores depended upon how each team's cumulative results compared with the leading team's results on each of the above noted six dimensions and their percentage weights.

For example, if the cumulative sales of the leading team are 100, and the second place team's cumulative sales are 80, then the second place team's score on that dimension is (80/100)(5) or 4 where 5 is the above percentage weight assigned to sales revenue. Each team received a weekly (one year) summary of their year and game-to-date results, and prepared their next decisions based upon these statistics and a vast amount of other data provided by the TE participant's program.

RESULTS

Six years of actual decisions were completed, and the key findings from this study are presented in Tables 1 and 2 and Figures 1 through 5. For example, the two-factor repeated measure analysis of variance shown in Table 1 indicates that on a 0 to 100 performance scale, the overall average result for winners (W) over the six years, 81.2, was significantly higher than the 28.4 average for losers (L), $F = 131.2$, $p < .0001$. This was true for each of the six years, $F = 5.2$, $p < .0003$; and the significant performance by years interaction, $F = 15.1$, $p < .0001$, emphasizes that the performance differences increased as the simulation progressed. All of this is shown graphically in Figure 1.

Table 1

Performance Analysis of Variance Summary

Source	SS	df	MS	F	p
Between Ss	105932	21			
Performance	91956	1	91956	131.2	<.0001
SS w. Groups	13975	20	699		
Within Ss					
Years	3593	5	719	5.2	<.0003
Performance x Years	10482	5	2096	15.1	<.0001
Years x Ss w. Groups	13866	100	139		

Table 2

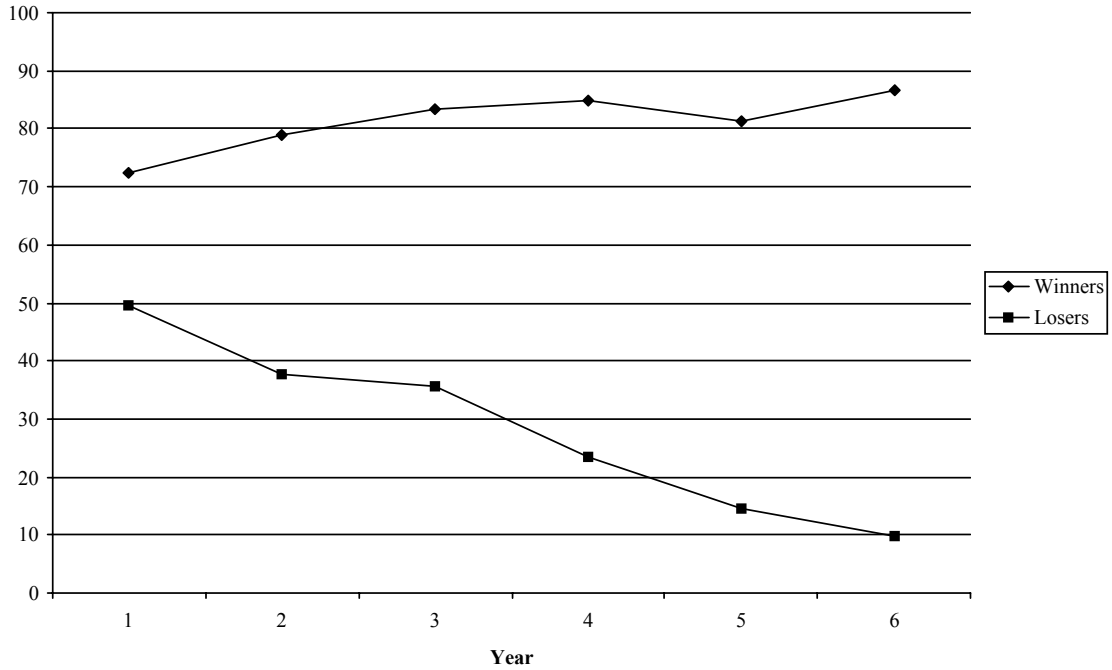
Other Results Summary

Factor	Average Scores Winners	Losers	F	p
Price - North America	41.74	37.76	0.512	0.4896
Price - Europe	43.69	43.82	0.0014	0.9704
Price - Asia	39.65	42.28	0.8727	0.3613
Quantity Demanded	6688	3076	49.2	<.0001
Unit Cost - Manufacturing	19.38	44.48	10.5	<.0041
Unit Cost - Marketing	5.12	9.13	6.3	0.0211
Strategy Rating	82.8	36.9	31.3	<.0001

THE BUSINESS STRATEGY GAME is a multinational TE simulation that permits the competitors to manufacture and market athletic shoes in North America, Europe, and Asia. Hypothesis ***H1*** notes that the pricing will not be an important W and L distinction. This is the case as noted in the first three lines of Table 2. Using the same type of repeated measure analysis of variance, there are no significant average price differences in all three regions.

The remaining four hypotheses indicate that W firms will have higher quantity demand, lower unit costs of manufacturing and marketing, and higher strategy ratings. Again, using repeated measure analyses of variance, this is the case as shown in the last four lines of Table 2. W firms had more than twice the demand of L firms, $F = 49.2$, $p < .0001$. Therefore, it is not surprising that W firms had a lower unit cost of manufacturing, $F = 10.5$, $p < .0041$, and marketing, $F = 6.3$, $p = .0211$.

Figure 1. Performance Averages



But, in the absence of significant pricing differences, it is especially noteworthy that the average strategy rating difference, 82.5 for W firms and 36.9 for L firms, is significant, $F = 31.3$, $p < .0001$. These results are graphed in Figures 2 through 5

Figure 2. Demand

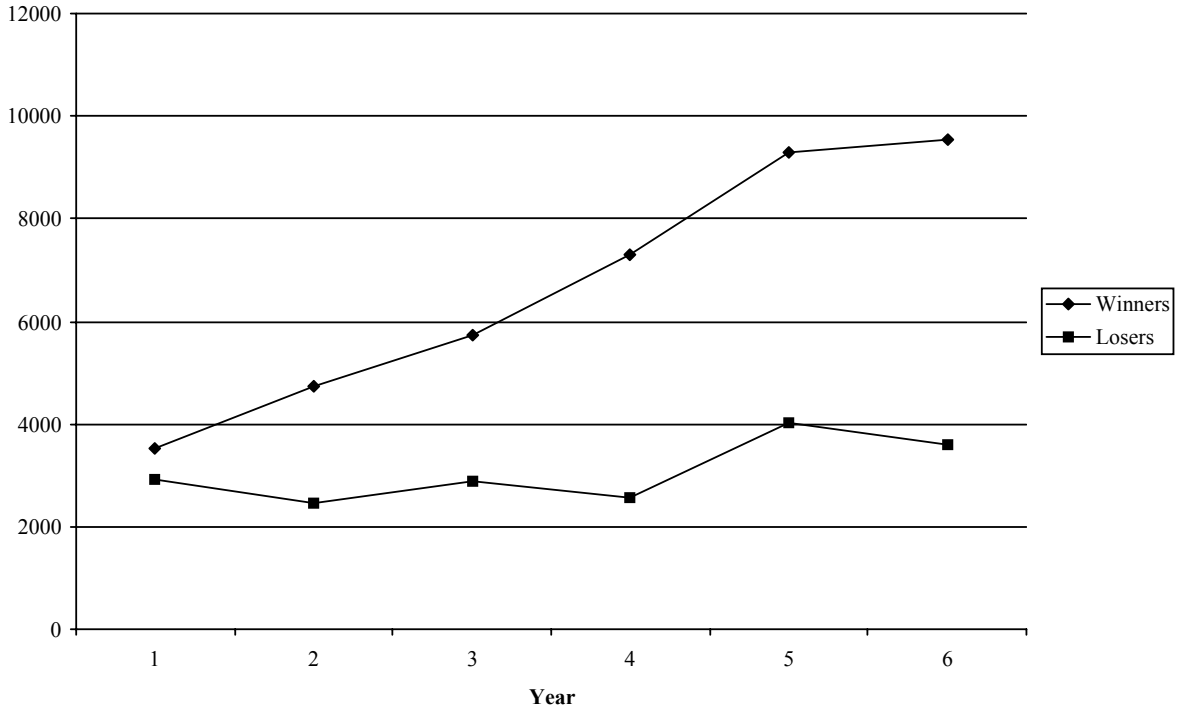


Figure 3. Manufacturing

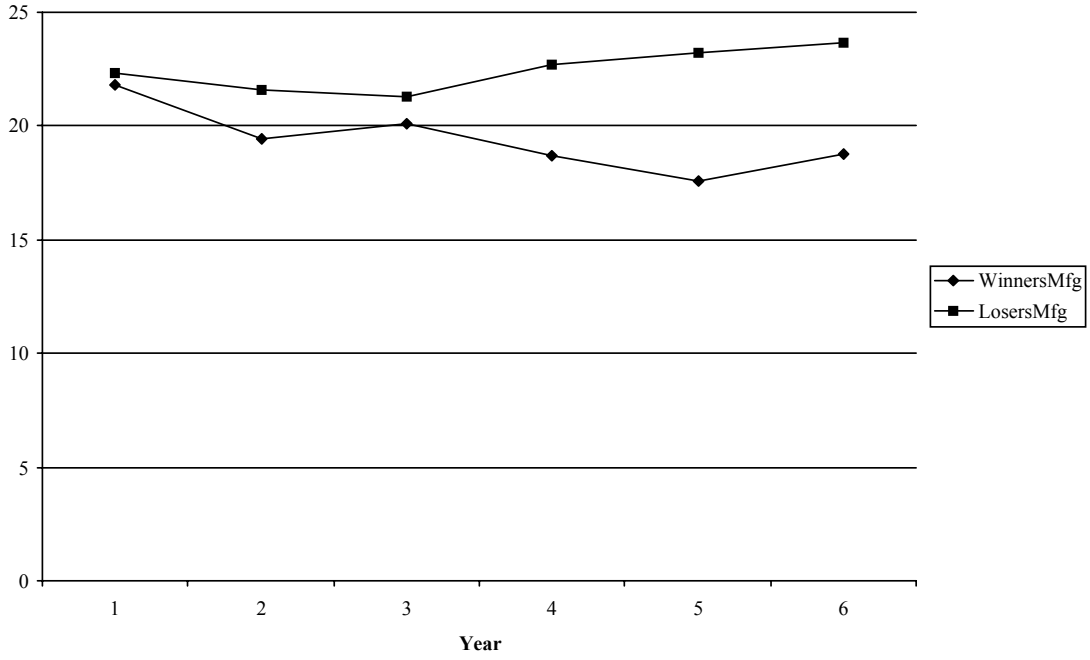


Figure 4. Marketing

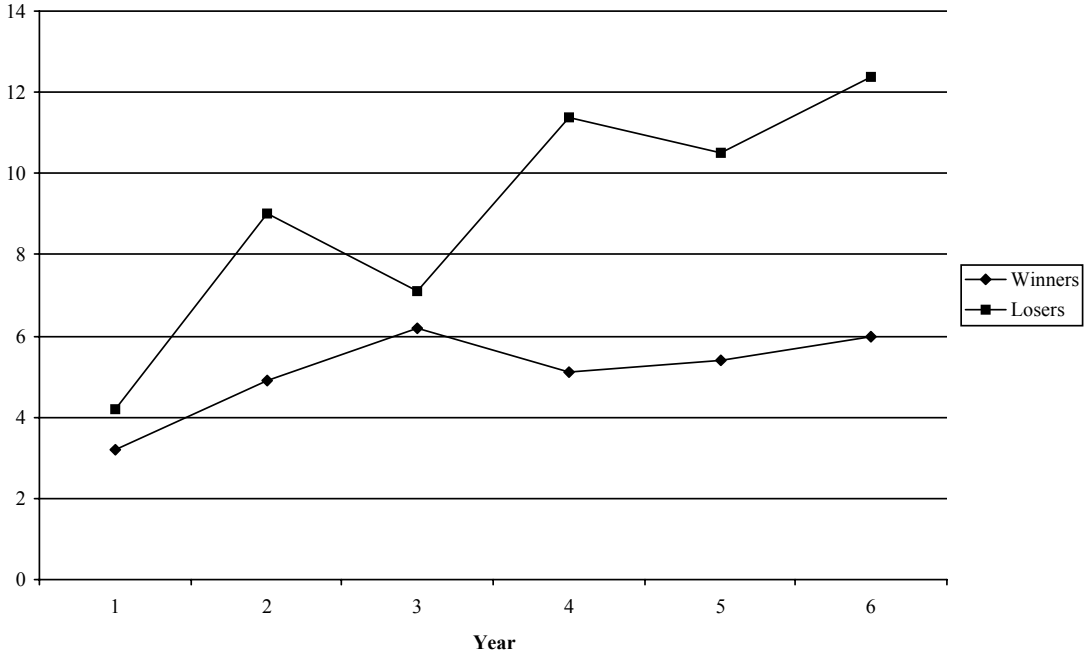
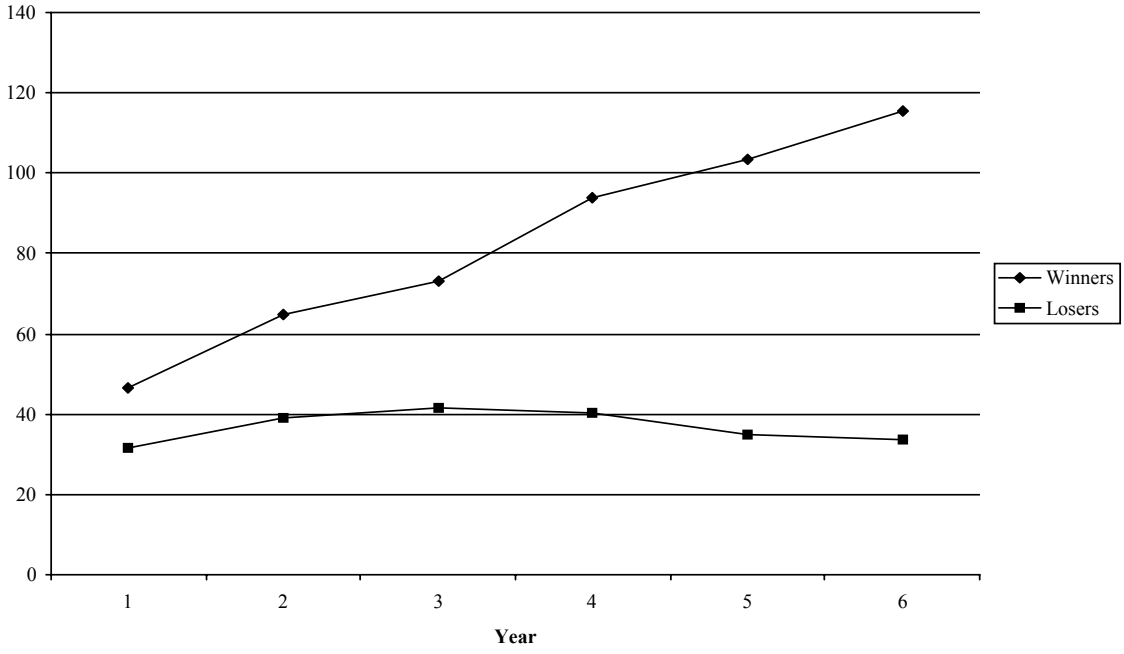


Figure 5. Strategy Rating



DISCUSSION

Experienced TE simulation users are well aware that the participating teams watch carefully each competitor's pricing. But, as the results of this study show, the winning or W teams are farmore careful than losing or L teams with the strategic considerations. Certainly, as noted at the beginning of this article, the authors' biases reflect their choice of strategic variables. However, their choices are not unusual. Broad or focused product line, quality, service, brand image, low cost, market share leadership, superior value, and global or focused coverage are typical dimensions in the analysis of almost any market.

In short, THE BUSINESS STRATEGY GAME provides a researcher with the beginning tools necessary to determine what kinds of individuals and teams prove to be the W types or L types. Grade point averages, individual and group composite personality measures (Patz, 1992), and decision-making styles (Harrison, 1999) are among the most obvious candidates for consideration.

If the phenomena reported here tend to repeat, that is strategy ratings continue to be the dominant learning issue, then the path is open to study the correlates of learning in this type of situation. Repetition will be conducted as the next research step since a parallel set of 11 industries is now available for data analyses.

Moreover, it can be stated that the TE simulation biases noted at this paper's beginning are assets not liabilities. If simulations can be designed that consistently produce a dominant winning dimension, then learning research will not be muddled by endless interactions among the included variables. Single variable learning research can be taken one step at a time and multiple variables combined in a single TE simulation when the correlates of learning have been demonstrated.

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