

A LARGE-SCALE GAME TEST OF EARLY-DETERMINED GAME FINISHES

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ABSTRACT

Teach and Patel (2007) reported that teams playing CAPSTONE (Smith, n.d.) arrived at their final financial standings early in the game. A recent replication effort could not repeat their results. The effort, however, obtained mixed results when applied to a large game. This paper examines the same large game under conditions that recognize the longer decision time horizons and investment costs associated with such games. Under these considerations the early-determined finishes thesis for first and last place firms was not supported on either a cumulative or round-by-round profits basis.

INTRODUCTION

An important part of Teach and Patel's 2007 ABSEL paper observed that the majority of their CAPSTONE (CAP, Smith, n.d.) companies took and retained their industry's lead in accumulated profits after three playing rounds. Additionally, they found that many of their companies fell to their industry's bottom rank and stayed there after only three rounds of play. Based on these events for each industry's biggest winners and losers, it was concluded many players could feel the game they were playing was unfair while frustrating the accomplishment of course-related learning objectives.

A direct replication effort by Wolfe, Biggs & Gold (In press), however, refuted the early finish thesis using a census of 1,164 CAPSTONE companies. Partial or mixed support of the early finish thesis was found, conversely, for the large game that was studied with a small sample replication.

This paper repeats the large game study using a relatively large sample of 142 teams playing The Global Business Game, World Edition (GBW, Wolfe, n.d.) for a longer series of decision rounds. It was believed such an effort should be undertaken given the GBW's greater complexity, larger industry sizes and longer-term capital development efforts required versus CAPSTONE's relative simplicity, restricted industry size and shorter time horizons. In CAPSTONE's case a maximum of 75 decisions are possible. A reference to this paper's Appendix indicates a GBW round could entail between 24-326 decisions depending on the team's strategic initiatives and tactical applications.

LARGE-SCALE GAME STUDY

Two papers have been previously presented at ABSEL dealing with either a company's early dominance of its industry, or of early first and last-place finishes. Bernard &

de Souza (2009) investigated the early dominance phenomenon using two online games played synchronously (SIND, 2006; SIMCO, 2008) for 7-8 rounds. Although their study defined dominance in the form of the company's stock price, their findings supported Teach and Patel's early standings thesis.

A year later Biggs and Fritzsche (2010) did a similar study using the larger-scale Business Policy Game (Cotter & Fritzsche, n.d.) to investigate Teach & Patel findings. Their study could not repeat those results although they truncated to eight rounds their 20-round playing conditions to emulate the eight rounds used in CAPSTONE. Given this qualification that study's structure, at this point the results are mixed or cloudy regarding whether the early finish observation by Teach & Patel is correct when applied to large games.

This paper retains the presentational form used by Teach and Patel to lend continuity to this research stream. Their effort examined the economic performances of team-based companies in 41 industries playing eight decision rounds. Results were recorded on both a cumulative and round-by-round basis. This paper's study obtained a census of 19 GBW industries comprised of 15 seven-firm industries and 4 eight-firm industries. Student teams were business school students enrolled in an international business degree program at a AACSB accredited West European public university. Six to seven members were randomly assigned to their companies through the university's enrollment process. Course-related grade assignments were made by a combination of a game knowledge examination, a team participation grade and the company's economic performance, mainly in the form of its profitability.

CUMULATIVE PROFITS TEST

Teach and Patel's first test looked at a company's profits to determine in which round it arrived at its ending rank. For this paper's study, the following hypothesis was tested, with "early in the game" defined as by or before four rounds of play in a 10 decision round game.

H₁ The majority of firms will arrive at their industry's ultimate first-place finish early in the game.

Exhibit 1 shows the percentage of firms arriving at their sustained first place finish on a cumulative profit basis. Exhibit 2 presents these results differently. It indicates at the end of which period the majority of the finishes had been determined. In this exhibit it took five rounds of play before a slight majority of all companies had arrived at their first-place finish. Also, by the game's eighth period 5.3% of the first-place companies had not arrived in

first place. On this basis the hypothesis regarding an early-determined first-place finish, based on cumulative profits, was rejected.

Teach & Patel also examined when their firm's arrived at their last place finish. Their hypothesis regarding last-place arrivals can be thus stated.

H₂ The majority of firms will arrive at their industry's ultimate last-place finish early in the game.

Exhibits 3-4 indicate this hypothesis must also be rejected on a cumulative profit basis. As was the case for first-place arrivals, the majority of last place firms had not arrive at their industry's lowest rank until after the fifth round.

ROUND-BY-ROUND PROFITS TEST

Teach and Patel next turned their attention to a firm's ranking on a round-by-round basis. Under this approach they compared the number of times a firm was in first place vs. the number of times it was in other places. By way of

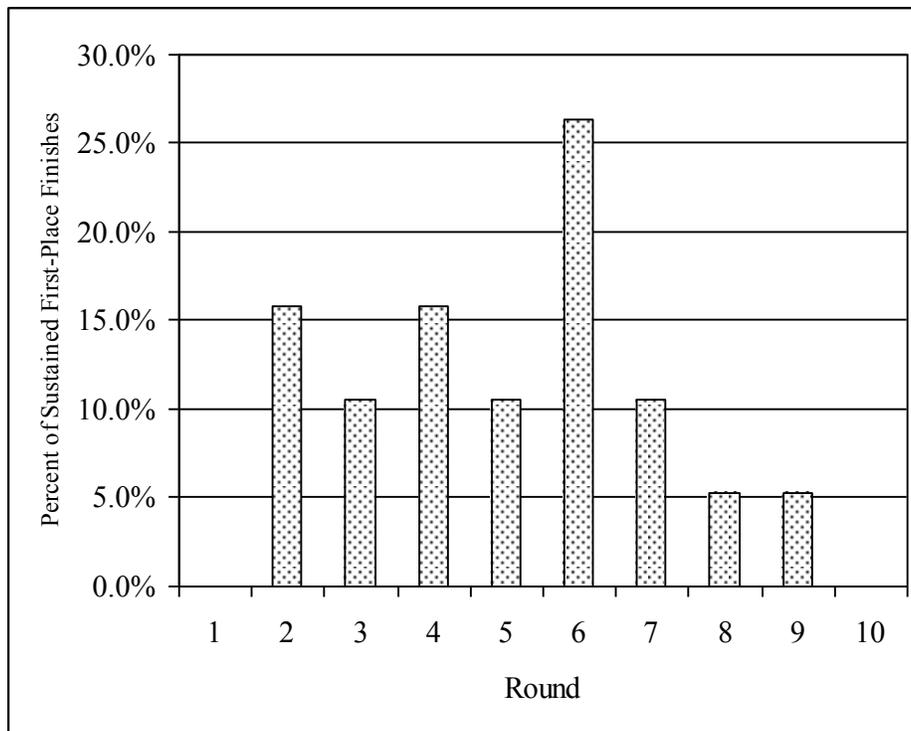
Richard Teach's courtesy, Wolfe, Biggs & Gold (In press) was provided his study's raw data. Because of this the presentation used in this, and the Teach/Patel paper's first section, can be repeated here in bar chart form rather than in their original tables. This also lends continuity to the presentations made in this paper.

For the early finish hypothesis to be accepted more than fifty percent of the ending finishes would have to have occurred by the game's fourth round. Exhibit 5 shows the percent of times a team that finished first was in first place on a round by round basis.

This exhibit, and Exhibit 6 shows that it was not until after the game's ninth period that its winning team's position had been secured. It is also notable that 26.3% of the eventual first-place firms could not be considered the industry's overall earning "winner" until after the game's last decision round. Exhibits 7-8 indicate the early finish hypothesis for last-place companies must also be rejected.

Most interestingly in this case, it was only until after the game's ninth round that the majority of firms were in their final last places. Moreover, it was not until the game's

**Exhibit 1
First-Place End-Game Arrival Round by Cumulative Rank**



**Exhibit 2
First-Place Finish Probabilities by Cumulative Rank**

Final First-Place Finish	Round									
	1	2	3	4	5	6	7	8	9	10
Determined	0.0%	15.8%	26.3%	42.1%	52.6%	78.9%	89.5%	94.7	100.0%	100.0%
Not Determined	100.0%	84.2%	73.7%	57.9%	47.4%	21.1%	10.5%	5.3%	0.0%	0.0%

final period that the industry's remaining 36.8% of the firms knew their finishes.

DISCUSSION

While the Teach/Patel paper emphasized end-states in their extreme forms of first and last places, in a real competition, as in the industrial real world, there are all manners of in between positions. Some firms are in unassailable first places. Others may be second-place companies that are dramatically improving their performances while bottom tier companies could be trying to implement turnaround strategies that might improve their profit rankings. As an example of the amount of turbulence involved, Exhibit 9 shows that the majority of the sample's four middle-ranked companies did not arrive at their sustained finishing rank until after the seventh or eighth periods of play. Therefore there had to be many changes in ranks for most of each game's duration.

Another way to see this, for middle-ranked firms, would be to look at how often each firm resided in its final

ranked position. Exhibit 10 shows that the average third-ranked found itself 26.3% of the time as a third-ranked company. The exhibit also shows that the average sixth-ranked company was in that rank only 8.9% of the time, and 91.1% of the time it was not in sixth place. The fact that the game's companies were often in different ranks by quarters indicates the irregularity of their profit paths. Moreover, the ranges of their profits had to be very wide. This width accordingly provided much leeway for their relative placements within each quarter, and throughout the game. As shown in Exhibit 11, for this study's third-place companies, the average company lost for the game's first four quarters. Simultaneously a few firms actually made a profit in quarters 2-4. Thereafter, the average third-ranked company made money but these profits had wide ranges. In the game's last quarter profits ranged between \$11.2 - \$40.5 millions.

Although this study did not find support of Teach and Patel's early-determined finishes, it should be recognized there *is* a relationship between a firm's early standings and its ultimate placement. Exhibit 12 displays the Spearman rank order correlation coefficients for the all firms on a

Exhibit 3
Last-Place End-Game Arrival Round by Cumulative Rank

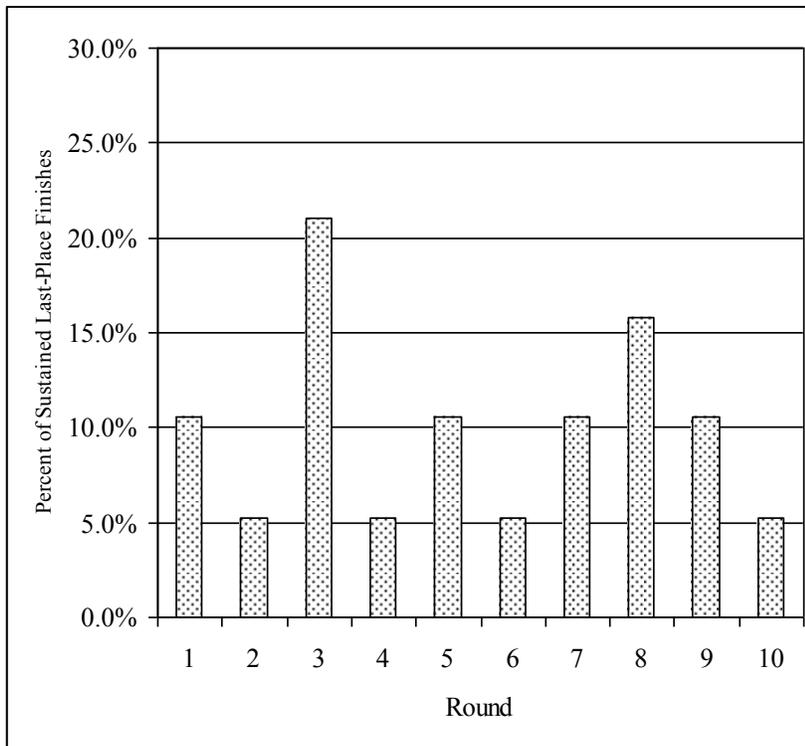


Exhibit 4
Last-Place End-Game Arrival Round by Cumulative Rank

Final Last-Place Finish	Round									
	1	2	3	4	5	6	7	8	9	10
Determined	10.5%	15.8%	36.8%	42.1%	52.5%	57.9%	68.4%	84.2%	94.7%	100.0%
Not Determined	89.5%	84.2%	63.2%	57.9%	47.4%	42.1%	31.6%	15.8%	5.3%	0.0%

quarterly basis. When using cumulative earnings as the firm's performance measure about 54.8% of the variance in a firm's finishing rank could be explained by the end of its fifth quarter of play. If a quarter's profit ranking was used to judge where a firm may find itself at the game's ending, 72.3% of the finishes could be explained at the end of the sixth quarter. Note however, that after this quarter the amount of variance explained falls off so that less can be explained about the firm's finish in the tenth quarter than could be explained in the previous four quarters.

Despite the amount of variance that can be explained later in the game, it is believed, especially when round-by-round profits are considered, that not enough could be known by game's players about their finishing rank to affect their willingness to play. The perceptions of what could be accomplished by a team of players, however, could be dependent on the locus of control (Rotter, 1954) possessed by its decision makers. Some could believe their

fate is no longer in their hands and the glass is half-empty. Others may believe the glass is half full and that their fate is in their own hands as found in a game-based study (Wolfe, 1996).

CONCLUSION

Evidence has been presented here and elsewhere that the early-finish observations by Teach and Patel have not been repeated. A company's early ranked economic performance, when charted either on a cumulative profit basis, or a round by round profit basis, does not accurately reflect or predict its final placement. Depending on a company's attitudes, as well as those of the instructor, some teams may think their competition is over with based on their early game performance, whether those performances are better or worse than their competitors.

Exhibit 5
Round-by-Round Ranks for Final First-Place Firms

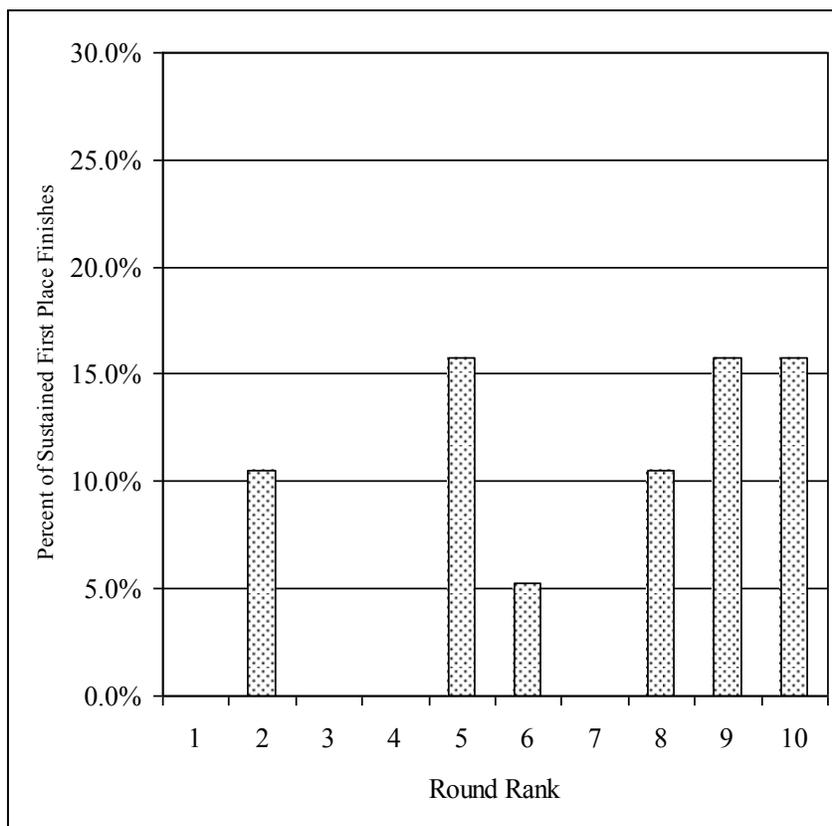


Exhibit 6
First-Place Finishes Determined by Round

Final First-Place Finish	Round									
	1	2	3	4	5	6	7	8	9	10
Determined	0.0%	10.5%	10.5%	10.5%	26.3%	31.6%	31.6%	42.1%	57.9%	73.7%
Not Determined	100.0%	89.5%	89.5%	89.5%	73.7%	68.4%	68.4%	57.9%	42.1%	26.3%

Given the variance in the paths by which firms find their finishing state to be, there is ample opportunity for a team to improve upon their results, or to fail if it begins to pay less attention to the business of running their company. This means that there are numerous and different learning opportunities available throughout a game's life course.

Because of the discrepant findings between the observations by Teach and Patel and those of others, an examination is warranted for them to investigate what in the learning environment they created led to what now appears to be unique results. Additional research should be conducted on other games, both large and small, to see if the Teach and Patel findings can be repeated. It is possible that the results produced in the current study are the ones that are unique rather than being the opposite.

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Exhibit 7
Round-by-Round Ranks for Final Last-Place Firms

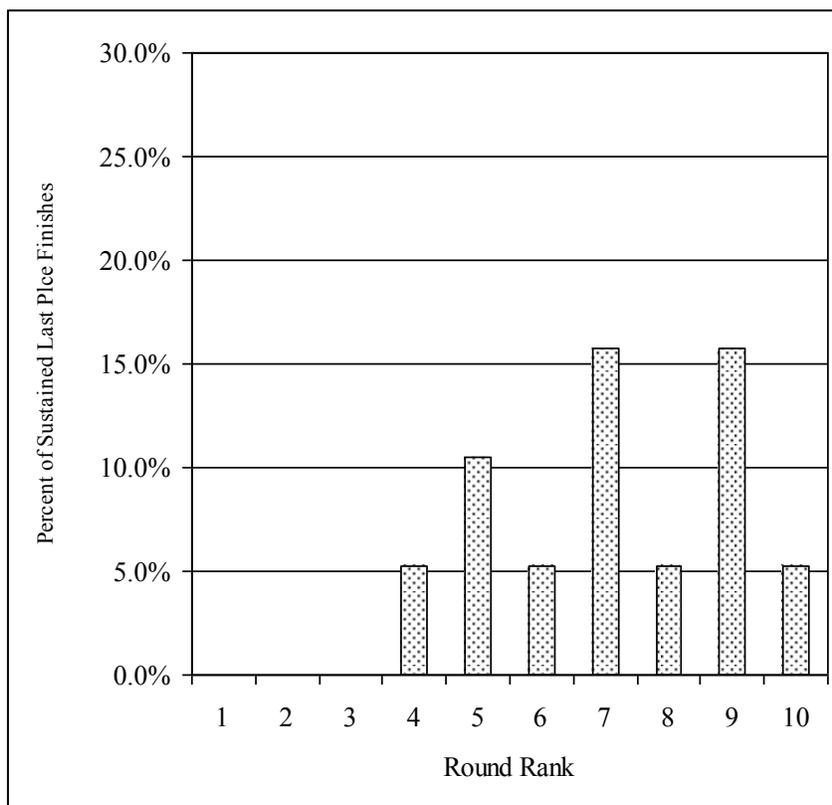


Exhibit 8
Last-Place Finishes Determined by Round

Final Last-Place Finish	Round									
	1	2	3	4	5	6	7	8	9	10
Determined	0.0%	0.0%	0.0%	5.3%	15.8%	21.1%	36.8%	42.1%	57.9%	63.2%
Not Determined	100.0%	100.0%	100.0%	94.7%	84.2%	78.9%	63.2%	57.9%	42.1%	36.8%

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**Exhibit 9
Mid-Ranked Firm-Finish Arrival Round— Cumulative Ranks**

Rank	Period of Sustained Finish										
	0	1	2	3	4	5	6	7	8	9	10
3	5.0%	5.0%	5.0%	5.0%	5.0%	10.0%	25.0%	55.0%	70.0%	80.0%	100.0%
4	0.0%	0.0%	0.0%	0.0%	5.0%	25.0%	40.0%	45.0%	65.0%	75.0%	100.0%
5	5.3%	5.3%	5.3%	5.3%	10.5%	26.3%	36.8%	68.4%	84.2%	94.7%	100.0%
6	0.0%	0.0%	5.6%	5.6%	11.1%	27.8%	27.8%	50.0%	66.7%	83.3%	100.0%

**Exhibit 10
Frequency in Ending Rank**

Finish	Rank	
	Same	Different
3	26.3%	73.7%
4	21.1%	78.9%
5	14.7%	85.3%
6	8.9%	91.1%

Exhibit 11
Earnings Ranges and Profit Paths for Third-Place Firms

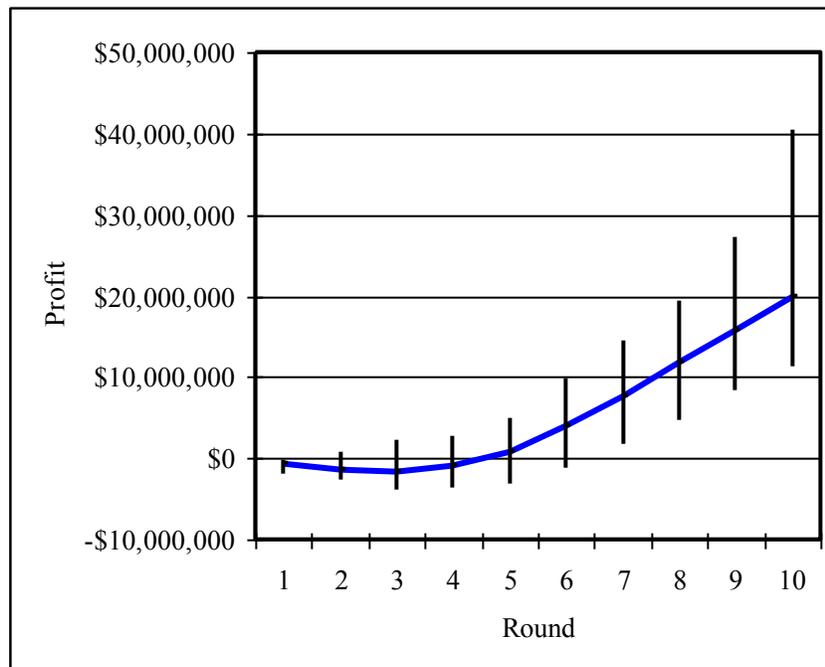


Exhibit 12
Spearman Correlation Coefficients by Round

Correlations by Cumulative Profit

Statistic	Round									
	1	2	3	4	5	6	7	8	9	10
Spearman rho	-0.03	0.16	0.40	0.57	0.74	0.84	0.92	0.96	0.98	1.00
Variance Explained	0.1%	2.6%	16.0%	32.5%	54.8%	70.6%	84.6%	82.2%	96.0%	100.0%

Correlations by Round Profit

Statistic	Round									
	1	2	3	4	5	6	7	8	9	10
Spearman rho	-0.03	0.13	0.32	0.58	0.70	0.85	0.82	0.83	0.86	0.79
Variance Explained	0.1%	1.7%	10.2%	33.6%	49.0%	72.3%	67.2%	68.9%	74.0%	62.4%

**APPENDIX
BUSINESS GAME TEACHING/LEARNING ELEMENTS**

Descriptor	GBW
Number of products	Two but tailored by quality levels for the country markets served.
Product type(s)	25" and 27" television sets
Home country	Can be the United States, Mexico, Germany, Spain, Japan or Thailand.
Active subsidiaries	One in the Home Country plus the addition of up to five more.
Factories	Up to six
Factory operations	Two shifts plus Saturday overtime
Factory maintenance	Yes— By factory and by three types of technologies in each factory
Factory options	Build new, expand, contract, decommission, liquidate or transfer all to other operating units. Can also sell off capacity and subcontract output as a strategic alliance.
Quality Control	Two simultaneous types of programs.
Research and Development	Product development resulting in patentable features with additional slight process benefits.
Factory workers	Experienced and inexperienced with different salaries and training needs scheduled by shift and product.
Factory foreman	Yes— By coverage required in each country.
Robotics	Two types plus attending technicians.
Raw materials	Six— Advance ordering of two major groups with three quality levels in each group.
Capacity options	18 possibilities— Assembly line capacity and two types of robots within each factory.
Funds transfers	Yes
Sales promotion	Budgeted by country markets and products.
Fluctuating exchange rates	Yes
Sales offices	Yes— Options to start-up and shut-down multiple sales offices in each country
Sales force	Country assignments, quits, hiring, firing, training budget, base salaries and commission rates
Employee training	Factory workers, sales representatives and robotic technicians
Distribution Centers	Yes
Wholesalers	Two types
Bonds	Yes— With mandatory quarterly payments. Bond calls possible.
Stocks	Yes— With possible dividends and Treasury Stock purchases.
Short-term loans	90-day loan
Short-term investments	Yes
Minimum decisions	24
Maximum decisions	326
Research Reports	Twelve covering actual unit sales, one-quarter sales forecasts, advertising budgets, quality levels and sales force compensations by products and countries.
Companies per industry	3-9
Computer-generated events	12 Critical Incidents
Strategic alliances	Yes—Patent licenses, capacity sales/purchases and subcontracting
Computer role	Online server
Decision support materials	Built-in <i>Pro forma</i> Income Statements and <i>Pro forma</i> Cash Flow Report and auxiliary spreadsheets for production scheduling, raw materials purchases and currency translations.