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TECHNOLOGICAL CHANGE AND INTERTEMPORAL MOVEMENTS IN CONSUMER PREFERENCES IN THE DESIGN OF COMPUTERIZED BUSINESS SIMULATIONS WITH MARKET SEGMENTATION

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ABSTRACT

A mathematical approach is developed to model new products in demand functions that takes into consideration the complexities of time, technological change and consumer preferences. The demand function was found to behave in a consistent and stable manner. Incorporating new product development in contemporary business simulations allows for a number of enrichments including: the inclusion of direct market influences from technology as well as intertemporal changes in consumer preferences; creation of market segment diversity in a single product simulation; structure that permits firms to target specific markets with different characteristics, inclusion of fact-based data for customer satisfaction surveys; and modeling of other quality factors to be set up as attributes in the simulated demand function.

INTRODUCTION

Rapid technological changes in the market in recent years, have brought about significant changes in product attributes, and have become an important explanatory factor in the variation of demand within and between industries and markets. By the year 2000, 50% of business profits will come from products less than 5 years old (Lin and Dwyer, 1995). New product development is no longer an occasional activity undertaken by business, but one of top priority, continuously pursued (Cooper, 1994). Although these dynamic changes are of growing importance and influence in the market, little attention has been given in the simulation and gaming literature to these considerations. Innovation and new product design is of paramount importance in today's market. Business simulation designers and users need to focus more of their attention on these issues.

In a path-breaking article Teach (1990) identified some serious concerns with the way in which demand is modeled in computerized business simulations. Most business simulations use simple assumptions regarding demand in the market. The products are generally presumed to be standardized, and common marketing variables such as price, promotion, R&D, and the size of a sales force within a single market segment determine the firm's demand. If multiple market segments are used, it is assumed they are independent. An ideal set of product attributes is assumed, and the demand is allocated based on the difference between a firm's attribute mix and the ideal. The problem with this methodology is that it ignores the dynamics of the market and the reality that different market segments value different sets of product attributes. Marketing theory since the 1970s has shown that customers are heterogeneous in their product preferences (Wind, 1978; Plank, 1985; and Kotler, 1991). Exacerbating the problem is the rapid change in technology in recent years, bringing about an abundance of new products with distinct product attributes and associated changes in consumer preferences.

PURPOSE

Management simulations are designed to represent the "real world" market environment and are used extensively for business education and training. Users are supposed to gain insight into the workings of the "real world" market system through the simulation. As a result it is necessary for the algorithms contained within simulations to be consistent with economic and marketing theory. Although these underlying principles and theories are well-known, the task of modeling and quantifying these relationships in a simulation is not straightforward. The last decade has *seen rapid changes in technology,* new product development, and consumer preferences as the driving forces behind variations in market and firm demand. Yet the way in which such phenomena are modeled in computerized business simulations is largely ignored in the literature.

This paper offers an approach to the modeling of new product development in demand functions that takes into consideration the complexities of time, technological change and new product attributes. Thavikulwat (1989) argued that a comprehensive demand function in business simulations must model several time-related factors including: trend, stages, cycles, seasonality and transient effects. In reference to product attributes, Carvalho (1995) indicated a need for computerized business simulations to be product/market specific and stated "demand functions for different classes of services seem to pose opportunities for years of challenging work.... Without such effort, to get simulations designed for specific product/markets or services, we are forced to rely on questionable empirical models or constructions." (p.90) More recently, Thavikulwat (1996) pointed out the extant literature on *temporal* issues in management has *not* developed to the point where its findings may easily be applied to the design and administration of gaming simulations." (p.121) By directly addressing intertemporal changes in consumer preferences and new product attributes, this paper should contribute to the relevance, application and use of simulation models in business and education.

The purpose of the research paper is to:

(1) Review the recent literature on the modeling of demand in computerized business simulations, focusing on the dynamics of time, technological change and intertemporal movements in consumer preferences.

(2) Develop an effective way to incorporate time and associated changes in consumer preferences and new product development in a simulated demand system.

(3) Detail a set of equations (consistent with demand theory) which are needed to derive the parameters of such a system. The parameters will be based on the simulation designer's apriori specifications relating to the nature of the industry, and the market-and firm-level elasticities.

(4) Demonstrate how the suggested demand system works by developing a set of examples, solving for the parameters of the system, and simulating the business market.

REVIEW OF LITERATURE

The most significant research contribution in the modeling of product attributes in computerized business simulations is from Teach (1984,1985, 1990). Teach developed a model of demand which allows for differences in product attributes with multiple market segments. A gravity flow model is adopted and the level of demand is a function of the distance (Do) between the firm's product attribute mix and the ideal level in terms of consumer preferences.

(1) $D_{ij} = \left[(P_i A_1 - S_j A_1)^2 + (P_i A_2 - S_j A_2)^2 \right]^{.5}$

where:

D_{ij} = Distance between Product i and Segment j.
P_iA_1 = Product i level of attribute 1
S_jA_1 = Segment j *ideal* level of attribute 1
P_iA_2 = Product i level of attribute 2
S_jA_2 = Segment j *ideal* level of attribute 2

The inverse of the distance of the firm, relative to the total distance of all firms in the market, determines the market share. There is much theoretical support for this type of function based on the expectancy-confirmation framework described by Oliva, Oliver, & MacMillan (1992). In this framework, satisfaction and consumer demand depends on the degree to which expectations meet or do not meet product performance. Consistent with this is the well known diffusion model in marketing developed by Bass (1969). The diffusion model explains and predicts first-purchase sales from innovations and the product life cycle.

Since 1969 economic variables such as price and advertising have been incorporated into diffusion models to enhance their explanatory powers as discussed by Mahajan, Muller, and Bass (1990). Similarly, Teach (1990) linked economic variables to his model by integrating it with the equation system developed by Gold and Pray (1984). But concerns were raised about demand models using these types of functional forms by Carvalho (1995). To be consistent with cardinal utility theory, Carvalho argues, a power function with constant elasticity is necessary to model the law of demand. Teach's demand model has variable price elasticity. As an alternative Carvalho advocates the use of the gamma probability distribution.

A more recent article by Gold & Pray (1997) raises a number of other concerns with the model developed by Teach. *First,* in Teach's model, the aggregate level of industry demand is assumed fixed along with the distribution between market segments. *Second,* the use of "shadow products" discussed by Teach is not clearly defined. A shadow product is a good that is valued by the consumer but is not offered in the market. But the way in which the shadow product is linked to the gravity flow demand and its implications are left uncertain. *Third,* the dynamics of changing market preferences and product attributes are mentioned as a benefit of the model but Teach does not show how such phenomenon could be simulated.

Gold and Pray (1997) refined Teach's gravity flow model and developed a system of equations which allow for differences in the level of aggregate demand and the distribution among market segments. The use of a shadow attribute (A_3) is also directly linked to the demand system by extending equation (1) as follows:

(2) $d_{ij} = \left[(P_i A_1 - S_j A_1)^2 + (P_i A_2 - S_j A_2)^2 + (P_i A_3 - S_j A_3)^2 \right]^{.5}$

where:

d_{ij} = Distance between Product i and Segment j.
P_iA_1 = Product i level of attribute 1
S_jA_1 = Segment j ideal level of attribute 1
A_3 = Shadow (new) attribute

The distances (do) and the average distance for all product attributes within a market segment is used as variable inputs in the Market Demand System.

Instead of Teach's approach, which utilizes the normalized inverse of the distance to determine firm-level demand, Gold and Pray (1997) opt for the functional form described in Gold and Pray (1984). It is composed of a weighing function and is modified to include both economic and attribute distance variables.

$$(3)\ w_{ij} = k_o (p_{ij})^{-(k1 + k2\,pi)} (m_{ij})^{+(k3 + k4\,mi)} (d_{ij})^{-(k5 + k6\,di)}$$

where:

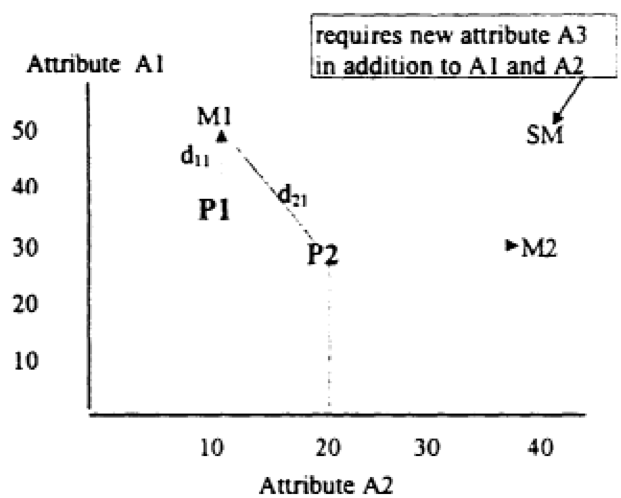
- w_{ij} = weight for firm i segment **j** used to calculate market share
- p_{ij} = exponentially smoothed price for firm i segment j
- m_{ij} exponentially smoothed marketing $ firm i segment **j**
- d_{ij} distance from the ideal for firm i segment j
- k_0 = scaling factor

Although Gold and Pray (1997) extend Teach's model to account for variations in industry and market demand with the direct inclusion of shadow attributes, the dynamics of time, the development of intertemporal changes in preferences and the use of ideal product attributes, is still not addressed. Important questions pertaining to the way in which time and the introduction of new products impact the model need to be addressed. Thavikulwat (1996) notes the treatment of time can differ along three dimensions: scale, synchronization, and drive. Bluedorn and Denhardt (1988) argue time may be causal or consequential, and may be expended sequentially or simultaneously. The way this is done in a simulation and how it is linked to the system significantly affects the internal and external validity, and stability, of the demand model. A review of the simulation and gaming literature indicates an important need for more research in this area.

THEORETICAL MODEL AND EXPECTED OUTCOMES

The theoretical model and expected outcomes can be illustrated with the help of a two-dimensional space configuration, FIGURE 1, similar to the one developed by Teach (1990), but including two products (P1, P2);two known market segments (M1, M2); and a shadow market segment (SM) that does not currently exist. Product 1 (P 1) has 35 units of attribute Al and 10 units of attribute A2. Product 2 has more of attribute A2, 20 units but less of attribute Al, only 30 units. Market segment 1 (Ml) consists of consumers who (ideally) prefer products with 50 units of Al and only 10 units of A2. Consumers in market segment 2 (ideally) prefer much more of A2 but less of Al. There is also a market segment that would like a product with more of both attributes (SM) combined with a new attribute called A3, but the product does not exist. (Products 1 and 2 do not contain attribute A3).

FIGURE 1
SPACE CONFIGURATION OF PRODUCTS AND MARKET SEGM ENTS



Assuming no attribute A3, the distance between products P1 and P2 and market segment M 1 may be calculated using equation 1:

$$d_{11} = \left[(50 - 36)^2 + (0)^2\right]^{.5} = [196]^{.5} = 14.0$$

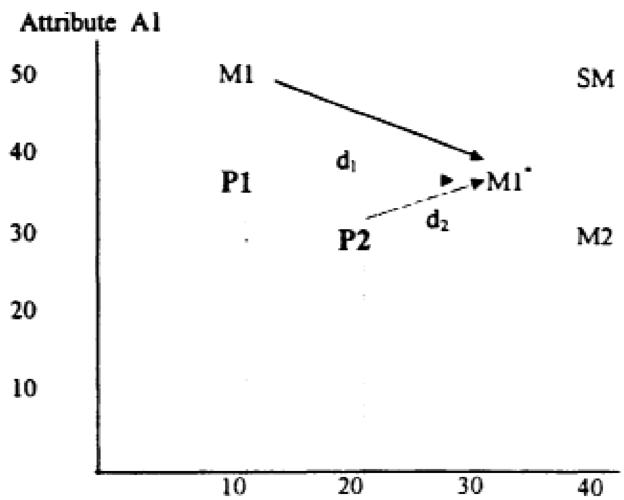
$$d_{21} = \left[(50 - 30)^2 - (20 - 10)^2\right]^{.5} = [400 + 100]^{.5} = 22.4$$

Although product I does not have the ideal mix of attributes for the preferences of market segment s I or 2, consumers in these markets are still willing to buy the products since they must choose between products 1 or 2. The closer the product attribute mix is to the ideal in the market segment, the greater will be the firm's demand or market share.

Given the scenario illustrated in FIGURE 1, it is expected that product P1 will have a greater share of demand of market segment Ml than product P2. This can be shown by looking at the linear distance between the product and market segment. The linear distance between P2 and Ml is d_{21} , which is greater than the distance d_{11} for product P1. *Ii is expected that the quantity demanded within a market segment will vary inversely with the linear distance between the product's attribute mix and the ideal attribute mix.*

What happens as consumer preferences change over time? The impact of intertemporal changes in consumer preferences is shown in FIGURE 2. Assuming the attribute mix of products P1 and P2 do not change, a change in consumer preferences in market segment I is seen as a movement over time from Ml to M1* In this situation the demand for product P2 will increase relative to P1 since product 2 is now closer to the preferences of the consumers in market segment Ml. The linear distance (d_2) between P2 and M1* declines while the linear distance (dl) between P1 and M1* increases. *As the preferred attribute mix of consumers within a market segment changes over lime, it is expected the relative market shares will change inversely to the change in the linear distances between the product attributes and the ideal.*

FIGURE 2
INTERTEMPORAL MOVEMENT OF
MARKET **SEGMENT 1**



Attribute A2

The impact of *new product development* can also be viewed graphically by referring to the shadow market segment (SM) in FIGURE 1. The consumers in the shadow market (SM) do not find products P1 or P2 close enough to their preferences to make a purchase, but are "potential" customers if the right product comes along. Consumers in market segment SM prefer higher levels of both attributes Al and A2, compared to consumers in market segments Ml and M2, and require a certain ideal level of attribute A3. If some level of a new attribute, A3, is included in the attribute mix of products P1 and P2, consumers in market segment SM will start buying the product, even though A3-may not be at the ideal level, i.e. a new market has opened up!

What expected impact would the inclusion of attribute A3 have on sales in market segments

Ml, M2, and SM? Assume zero is the preferred level of A3 in markets Ml and M2. If some level of A3 is added to product P1, the product will be further away from the ideal mix in market segments Ml and M2 but will be close enough to the preferences of SM to start selling in the shadow market. In this case, “new” product P1 will lose some sales in markets Ml and M2 but gain in the market segment SM. Product P2, with zero A3, will now be closer to meeting the needs of some of the consumers in Ml and M2, relative to P1. Product P2 should gain some market share in segments Ml and M2, but will not be able to compete in market segment SM. Through time, if consumers in market segments Ml and M2 begin to acquire a taste for attribute A3, *it is expected* new product P1 (with some A3) will gain market share relative to P2. *Market share in each segment is inversely related to the linear distance among all attributes and the ideal level, including the introduction of a new attribute.*

INTERTEMPORAL CHANGES IN PRODUCT ATTRIBUTES AND CONSUMER PREFERENCES BY MARKET SEGMENT

The mathematical algorithm utilized in this study extends the approach developed by Teach (1990) and Gold and Pray (1984,1997) by incorporating time directly in the model, i.e. intertemporal changes in product attributes and consumer preferences by market segment. The system we are recommending is composed of three parts; (1) Distance function to measure the impact of product attributes and preferences; (ii) Market Demand Function; and (iii) Firm-level Demand Function.

Distance Function

The gravity flow model including the *dimension of time* directly may be specified as:

(4) $$d_{ijt} = \left[\left(P_i A_{1t} - S_j A_{1t}\right)^2 + \left(P_i A_{2t} S_j A_{2t}\right)^2 + \left(P_i A_{3t} - S_j A_{3t}\right)^2 \right]^{0.3}$$

where:

d_{ijt} = Distance between Product i and Segment j at *time t.*

P_iA_1 = Product i level of attribute 1 at time t.

S_jA_1 = Segment j ideal level of attribute 1 at time t.

The distances d_{ijt} and the average distance of all products for the segment j at time t (D_{jt}) will serve as the variable inputs in the Market Demand System.

(5) $$D_{jt} = \frac{\sum_{i=1}^{n} d_{ij}}{n}$$

Market Demand Function

The full market demand system developed by Gold and Pray involves 10 equations and is described in detail with examples in Gentry . For purposes of this paper only the modifications to the market demand equation including the time dimension are discussed. The market demand at a point in time may be expressed as:

(6) $$Q_{jt} = g_1 P_{jt}^{-(g2+g3Pjt)} M_{jt}^{+(g4-g5Mjt)} D_{jt}^{+(g6+g7Djt)}$$

Where:

Q_{jt} = market demand for the segment j at *time t.*

P_{jt} = harmonic average price of all products in segment j at *time t.*

M_{jt} = average marketing expenditure for all products in segment j at *time t.*

D_{jt} = average distance of all products for the segment j at *time t.*

g_k = market demand parameters k.

To solve for the parameters of the market demand equation the administrator must specify' the desired elasticities of each independent demand variable at two different levels. The elasticity formulas are as follows:

(7) $Ep_{jt} = g2 + g3 P_{jt}(1 + \ln P_{jt})$

(8) $Em_{jt} = g4 + g5 M_{jt}(1 + \ln M_{jt})$

(9) $Ed_{jt} = g6 + g7 D_{jt}(1 + \ln D_{jt})$

where:

Ep_{jt} = price elasticity for segment j at *time t.*

Em_{jt} = marketing expenditure elasticity for segment j at *time t.*

Ed_{jt} = distance elasticity for segment j at *time t.*

Selecting two levels for the industry over a reasonable range gives two equations with two unknowns and allows the determination of the system parameters g_k (for k=2,7). The selection of g1 determines the initial market size for that segment. Unlike the constant segment proportion assumed by Teach, relative market segment size is influenced by the economic variables, average distance, and the elasticities established apriori.

Firm-Level Demand Function

Instead of using Teach's approach, which utilizes the inverse of the distance and then normalizes them to determine firm-level demand, we use an approach similar to the firm-level model described in Gold and Pray (1984) but which includes time and the distance variable d_{jt} directly.

(10) $w_{ijt} = k_o(p_{ijt})^{-(k1+k2pit)}(m_{ijt})^{+(k3+k4mit)}(d_{ijt})^{-(k5+k6dit)}$

Where:

w_{ijt} = weight for firm i segment j at *time t.*

p_{ijt} = exponentially smoothed price for firm i segment j at *time t.*

m_{ijt} = exponentially smoothed marketing $ firm i segment j at *time t.*

d_{ijt} = distance from the ideal for firm i segment j at *time t.*

k_0 = scaling factor

The values assigned to the parameters kl,k2,k3...k6 depend on the designer's specification concerning the firm level elasticities. Equations (8-10) below are used to determine the values and are solved in the same manner as equations (4-6).

(11) $E_{pjt} = k1 + k2Pjt(1 + \ln P_{jt})$

(12) $E_{mjy} = k3 + k4 M_{jt}(1 + \ln M_{jt})$

(13) $E_{mjt} = k5 + k6 D_{jt}(1 + \ln D_{jt})$

where:

E_{pj} = firm price elasticity in segment j at *time t.*

E_{mj} = firm advertising elasticity in segment j at *time t.*

E_{dj} = firm attribute distance elasticity in segment j at *time t.*

The share equation and firm-level demand calculations are given in equations (11 and 12).

(14) $Sijt = w_{ijt} / \sum_{i=1}^{n} w_{ijt}$

(15) $q_{ijt} = S_{ijt} * Q_{jt}$

where:

S_{ijt} = share for firm i segment j at *time t.*

q_{ijt} = firm demand segment j at *time t.*

Q_{jt} = total demand (all firms) segment j at *time t.*

Total industry demand *at time t* is the sum of all segments demands (j):

(16) $Q_t = \sum_{j=1}^{n} Q_i$

The firm as total market share, considering all three market segments at *time t,* is

(17) $S_i \sum_{j=1}^{n} q_{ij} / Q_t$

ILLUSTRATION OF DEMAND MODEL

The system will be described via a set of simple examples. To determine the market and firm-level demand for each segment, equations 6 - 16 are used for each segment. Price is set up to vary between $25 and $35; advertising/marketing expenditures, between $500 and $1200. Gravity flow distances (d_{ijt}) ,based on the scales, have their elasticities controlled over the range from 0 to 5.

The elasticities and the starting values are assumed to be identical over each segment. Exponential smoothing is ignored and simple arithmetic averages are employed. The value of the elasticities and parameters are described in an earlier work by Gold and Pray .

In the examples described below all of the economic variables are held constant. The focus is on (1) intertemporal movements in attribute variables and (ii) the introduction a new product based on a new technology, i.e. a new attribute.

Three Products and Three Attributes

The example assumes a simulation of an industry with three firms (i = 1,2, or 3), each producing a product (P_1) but with different mixes of two attributes (A_1 and A_2). There is a hidden or latent attribute desired by all customers in all markets, but it has not been discovered or invented until the third scenario. There are three different market segments (M1,M2, and M_3) with different ideal preferences, but consumers are willing to purchase any product. Market segment 1 prefers only small amounts of attributes I and 2. Market segment 2 prefers a large amount of attribute I with only a small amount of attribute 2. Market segment 3 prefers a large amount of attribute 2 and a mid-level amount of attribute 1.

Table 1 displays the "ideal" levels of product attributes in each Market (M_1). Table 2 shows the actual levels of attributes 1 and 2 by firm (P_i)•

TABLE 1
IDEAL PRODUCT ATTRIBUTE LEVELS BY MARKET

	Ideal Attributes	
Market (Mi)	1	2
1	1.00	1.75
2	4.00	0.50
3	2.50	3.50

TABLE 2
PRODUCT ATTRIBUTE LEVELS BY FIRM

	Attributes	
Firm(Pi)	Al	A2
1	3.00	1.50
2	2.00	3.00
3	3.75	5.00

Three Scenarios

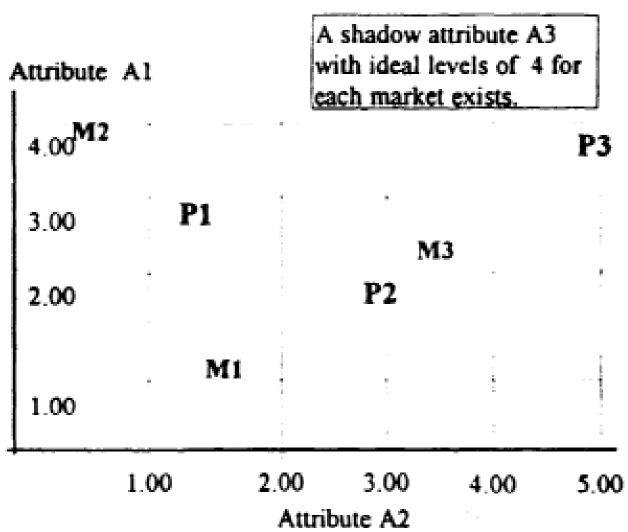
In the first example it is assumed market Ml changes its ideal attribute mix over time. Market Ml's ideal level of attribute Al increases by 20% per period over the eight periods that are simulated, with all other things being held equal.

In the second scenario, Firm 1, with product P1, notices the ideal mix for Market (M3) is changing, and increases both attribute levels, Al and A2, by *5%* per quarter.

In the third scenario, Firm 3 introduces a new product P3', based a new attribute called A3.[i] Firm 3 increases the amount of the new attribute by 0.5 each period over the eight periods, thereby coming close to the ideal mix for market M3!

Graphically the starting position for three scenarios looks as follows:

FIGURE 3: SCENARIO STARTING POSITIONS



Scenario # 1

In the first scenario, attribute Al for market Ml is increased by 20% per period starting at 1.00 and ending with a value of 4.29. All other attribute levels and firms decisions are held constant.

The results are consistent with apriori expectations based on FIGURE 2. Industry and market segment sales levels increases through the sixth period, but then starts to decline as the ideal customer requirements move beyond the current firms' offerings. Demand for Products P1 and P3 in market Ml grow through the six periods, but only P3 continues to grow both share and demand in Ml market through the eight periods. Table 3 reflects the results.

TABLE 3
THE FIRST SCENARIO
20% GROWTH IN A1 FOR M1

Period	1	4	6	8
Ml Ideal Al	1.00	2.07	2.98	4.29
Industry-Sales	5848	5976	6009	5921
Ml-Sales	1914	2042	2075	1986
P1-Sales in Ml	691	764	792	761
P1-Share%	36%	37%	38%	38%
P3-Sales in Ml	460	548	617	681
P3-Share %	24%	26%	30%	34%

Scenario # 2

As in the first scenario, attribute Al for market segment Ml is increased by 20% per period starting at 1.00 and ending with a value of 4.29. In the second illustration, Firm I increases both attributes 5% per period, from 3.0 and *1.5* for Al and A2 to a final a mix of 4.43 and 2.21 respectively.

In this scenario, the MI market segment continues to grow throughout the eighth period, whereas the industry starts to fall off after the sixth period. Both products P1 and P3 benefits in share and demand growth over the eight periods while P2 starts to rapidly lose volume and share!

TABLE 4
THE SECOND SCENARIO
20% GROWTH IN Al FOR M1 PLUS 1
5% GROWTH IN P1 ATTRIBUTES

Period	1	4	6	8
Ml Ideal Al	1.00	2.07	2.98	4.29
P1 -Attnbute Al	3.00	3.64	4.02	4.43
-Attribute A2	1.50	1.82	2.01	2.21
Industry-Sales	5848	5955	5982	5912
Mi-Sales	1914	2142	2157	2173
P1-Sales in Ml	691	704	748	822
P1-Share%	36%	34%	36%	41%
P2-Sales in Ml	764	750	679	528
P2-Share%	39%	37%	33%	26%
P3-Sales in Ml	460	563	630	661
P3-Share%	24%	27%	31%	33%

Scenario # 3

In the final example, Firm 3 introduces a new product called P3', based on a new attribute A3. The firm increases the value of attribute A3 from zero to the ideal level of 4.00 over the eight periods.

This new product causes the industry demand to increase As would be expected, Firm 3, with the new product, significantly increases both its sales level and market share in market segment M3 as well as throughout the entire market.

TABLE 4
THE THIRD SCENARIO FIRM 3
INTRODUCES A NEW PRODUCT P3'

Period	1	4	6	8
Ideal A3	4.0	4.0	4.0	4.0
P3-A3	0.0	2.0	3.0	4.0
Industry-Sales	5848	6484	6731	6837
P3-Sales	1703	3238	3874	4144
P3-Sales in M3	712	1408	1730	1840
P3-Share % in M3	34%	60%	70%	73%
P3-Share %	29%	50%	57%	60%

CONCLUSIONS

Simulations have improved dramatically in recent years due to improved demand and cost modeling algorithms. Designing product attributes in the demand function of computerized business simulations will enhance their pedagogical effectiveness. The attribute approach allows for intertemporal changes in customer preferences and new product introductions based on new technology within single-product models. We found the demand function reacts in a consistent and stable manner when attributes are changed or added to the product line.

Product attributes in a single product model allows for a number of enrichments to a simulation with standard attributes including intertemporal changes in consumer preferences, technological change bringing about new product attributes, market segment diversity in a single product simulation, firm targeting of specific markets with different characteristics, fact-based data for customer satisfaction surveys provided by the simulation output, and other quality factors to be set up as attributes in the simulated demand function. These are briefly described below.

Segment Diversity and Target Marketing

By using the system described above in each market segments, significantly different scenarios can be simulated in each segment. Consumer preferences can change in each market segment causing the demand for specific products (with constant attributes and prices) to change over time. Adding technological change and the development of new products (creating new attributes) can simulate the opening of new markets, which changes the allocation of demand in existing market segments.

Economic parameters maybe changed by market segment. One segment might be price elastic; another can be relatively inelastic. Each segment can have different price ranges, different elasticities and different segment sizes. This system allows for multiproduct marketing concepts to be addressed in a single-product simulation. Firms can be forced to select specific targeted markets and expand their strategic choices.

In most single-product games, the economic variables such as advertising, service and product R&D are generally continuous variables and are applied to a single-product industry demand function. With the segmentation approach, firms can direct a percentage of these economic variables toward a specific attribute conventional wisdom that often happens at university-level play.

The game can be enhanced by have changing ideal attributes as the game proceeds. The game administrator can "tighten" or move the ideal locations, thus simulating that customer requirements are changing or getting more difficult to satisfy. No longer can firms be successful by relying on extrapolations of past demand to plan production levels. Customer satisfaction surveys and other forms of market research can be added, giving teams feedback on how well they are meeting the segment customer requirements -- through the attributes and/or the economic variables. The customer surveys can also suggest the need for additional attributes.

Customer satisfaction indices and/or percentages can be quantified as a percentage of an ideal. With this type of fact-based information, firms may set customer satisfaction goals. Effective teams will search for what is the nature of the changing customer requirements and make adjustments to their economic variables toward a specific attribute and/or segment. Firms would then need to specify the dollar amount and the targeted customer in their decision process.

Different segments may be affected by economic and seasonal factors in different ways. One segment may be extremely seasonal; whereas, another may be immune to seasonality. If more than one firm focuses on a small segment, the level of competition prevents a competitive advantage. The beauty of the system is that many different scenarios can be arranged to be consistent with modern economic and strategic management theory. Segments can easily be altered semester to semester, thus eliminating the strategy and tactics. Firms that fail to do this will fall prey to the TQ-focused competitors.

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ENDNOTES

[i] For the purposes of the simulation a hidden or latent attribute called A3 with ideal level B of 4 for each market is embodied throughout the three scenarios to be presented. This new attribute is desired by the market segments but will not be Introduced until the third scenario.