A Decision-Support System for Evaluating Sales Prospects and Launch Strategies for New Products

Jean Marie Choffray
Gary L. Lilien

New products are important elements in the success of most industrial enterprises. But they are risky and costly. In this article, we briefly review methods that are used to evaluate the likely sales level for new industrial products prior to launch. Then, we report the results of a study of industrial product diffusion, focusing on those factors associated with successful market penetration. These results led to the development of a microcomputer based marketing decision support system (MDSS) that can be used to help plan the entry strategy for a new industrial product.

Address correspondence to Professor Gary L. Lilien, College of Business Administration, The Pennsylvania State University, University Park, PA 16802.

Industrial Marketing Management 15, 75–85 (1986)

52 Vanderbilt Ave., New York, New York 10017

INTRODUCTION

Few products, whether industrial or consumer, gain immediate acceptance in the marketplace. And few companies appear satisfied with their level of success in that marketplace.

According to Hopkins [9], as many as two thirds of industrial firms consider their success rates "disappointing" or "unacceptable." Cooper [6] reports a mean failure rate of 41% for fully developed new products, i.e., for those which successfully passed through the development process. Almost half of those products failed after market introduction. Booz-Allen and Hamilton [3] report a failure rate of 35% for new products.

0019-8501/86 $3.50

These high failure rates underscore the difficulty of predicting the level of sales for new industrial products with an acceptable degree of accuracy. Such forecasts are critical not only for the production planning process, but also for financial planning. Indeed, severe losses are often observed over the first 4 years following market introduction. Based on a sample of 68 new ventures launched by 35 U.S. companies, Biggadike [1] reports that the median ROI was −40% in the first 2 years and −14% in years 3–4. In addition, early profitability does not necessarily guarantee future success. Most of the time, the key to improving financial results is to balance profitability with rapid sales growth via a suitable marketing program.

In this article we review the development of a new tool called B.E.I.I. for supporting sales forecasting and introducing strategy decisions for new industrial products (B.E.I.I. stands for "Banque d'Experiences d'Innovations Industrielles," International Data Base of Industrial Innovations.) That system—based on diffusion models calibrated with data from a sample of international product launches—is implemented on a microcomputer. The Microcomputer Marketing Decision Support System (MMDSS) provides new flexibility and new insight for industrial product planning and strategy.

FORECASTING INDUSTRIAL PRODUCT SALES PRIOR TO MARKET INTRODUCTION

The past few years have seen an explosion in the number and sophistication of methods used to assess likely sales prior to market entry, primarily for frequently purchased consumer goods. Numerous methods for concept evaluation, test market simulation, early market sales monitoring, and so forth are in regular use [20, 23, 5].

In the industrial products area we see a different state of practice. Piatier [18] reports that 68% of industrial firms who had introduced products during the last 5 years had done so without any prior market assessment. This result is especially striking given Gerstenfeld's [8] finding that those firms using formal methods of technology forecasting experience greater sales growth and profitability than those that do not.

Three broad categories can be used to classify the methods firms use for market assessment:

1. *Subjective methods*, including DELPHI-like assessments, the PATTERN approach, morphological analysis, and other qualitative forecasting methods (Wheelwright and Makridakis [22]) cover procedures that firms use to incorporate the judgments of experts and other relevant past experience in making forecasting judgments. This approach is most useful when the firm is about to introduce a fundamentally new product, bearing little resemblance to previous ones.
2. *Experimental methods* include offering the product for sale or consideration on a scaled-down basis, limited by geography or, perhaps, to a few friendly firms. Prospective buyer reactions are then recorded. These data may be collected at trade shows, exhibitions, or at prospective customer plants. These methods are useful where the target market is well defined and where the focus is on long-term market potential rather than the market penetration time path.
3. *Analogue methods* consider "look-alike" product-market situations and assume that the way a new product is accepted in the marketplace will be close to the way similar products are accepted.

This article reports the development of an MMDSS based on the analogue approach. The drawbacks of the analogue approach have been the limited base of experience any individual has and the determination of an appropriate analogue. Several studies have shown how both these problems can be overcome by (i) pooling a large base of commonly collected information, and (ii) developing analogues along commonly measured product/market dimensions (value-in-use, ROI, number/size of prospective customers, etc.) rather than along physical product dimensions. The ADVISOR models [13, 12] and the PIMS Program [19] provide examples of the use of the analogue approach in the industrial marketing budgeting and

JEAN MARIE CHOFFRAY is Professor of Marketing and Management Sciences at ESSEC, France.

GARY L. LILIEN is Research Professor of Management Sciences at The Pennsylvania State University and Research Director of Penn State's Institute for the Study of Business Markets.

An Analog Approach to Forecasting Sales

strategic planning area. In the next two sections we describe the construction of the "analogue" and how that information has been incorporated into an MMDSS.

DEVELOPING AN ANALOGUE: THE FRENCH STUDY OF INDUSTRIAL PRODUCT DIFFUSION

In 1980, the Center for Research in Management Science at ESSEC (Ecole Supérieure des Sciences Economiques et Commerciales) in conjunction with The French Ministry of Industry and the Novaction Company, a leading European consulting firm, launched a project to provide the basis for developing analogues for sales growth patterns for new industrial products. The approach built on the work of Mansfield [16] who studied variations in the rate of adoption of 12 innovations. He showed that the rate of adoption was higher when (i) the relative profitability associated with the new product was *higher* and when (ii) the initial investment required to adopt the new product was low relative to the average assets of adopting firms. Blackman [2] added to Mansfield's results, showing that there were variations in an industrial sector's propensity to adopt a new product that could be related to general measures of innovativeness in that sector such as R&D spending, new product sales as a percent of total sales, value added, etc.

From the standpoint of the new product manager, these results have limitations. First, they deal with a small set of macroeconomic variables as the driving force for the diffusion process. This is incompatible with the results from the PIMS studies [19] that indicate that a business' performance is closely tied to its marketing strategy, the quality of its products and to the structure of the market with which it deals. Second, the results are based on a small sample of major technological innovations, limiting the generality of the results. As we will see below, relatively few new industrial products can be characterized in this way. Finally, this study does not focus on the initial penetration rate of the product (its sales after a year) but focuses instead on the product's growth rate.

Based on this evaluation, a decision was made to develop a database of individual new products, including information on the development process, the marketing strategy, and the rate of market penetration for a 5-year period.

The products studies represent a convenience sample from a list of 500 industrial firms registered in France, drawn randomly from a national directory in proportion to the importance of top priority sectors for French national policy. Firms were contacted in a two-step procedure. They were selected after a telephone interview, checking whether they had introduced a new product in the last 5 years. Next, selected firms were contacted sequentially and asked to participate in the study, after receiving a statement of the project objectives. The acceptance rate was 83%. The original target was 100 products and the final sample size was 112 due to time lags and some over-sampling. Data were collected by personal interview, requiring about 3 man-days per product. Although these products were mainly developed by French companies, most are marketed in several major industrial countries, including the United States.

Three types of new individual products were distinguished in this study:

1. *Repositioned new products (7%)*, are "me too" products whose physical characteristics are not fundamentally different from those of existing products. The innovative firm tries to change the way potential buyers perceive the product. These would, for instance, correspond to "Repositionings" in the Booz-Allen and Hamilton 1982 study [3].
2. *Reformulated new products (52%)*, are often product line extentions. For these products the innovative firm actually modified physical product characteristics. Such modifications reduce production cost or enlarge the range of possible uses. ("Cost Reductions," "Improvements," "Additions" in the Booz-Allen report.)

3. *Original new products (41%)*, are those new products that constitute "break-throughs" in their field. Products in this category often rely on new technologies never used before in that industry. ("New Product Lines," "New-to-World Products" in Booz-Allen report.)

For each of the 112 products included in the database, over 500 pieces of information were collected on the:

R&D Process: Cost structure, financing, duration, methods of evaluation, types of protection, etc.
Market Introduction Strategy: Bases for decision, success or failure, evaluation criteria, initial marketing mix, etc.
Rate of Product Penetration: Sales volume and $ sales for the new product and its prime competitors, market structure, changes in the marketing mix, etc.

Market penetration information was collected on a quarterly basis, when possible, over a 5-year period after market introduction. Other data include managerial judgments about how the new product performs relative to competition, information on the objectives set for the new product, the way these objectives evolved over time, and how they were achieved.

We have reproduced the distribution of the sample across industrial sectors in Table 1. The electronics and scientific instrumentation area is well represented reflecting both national policy emphasis and the high level of innovation in this sector. The "miscellaneous" sector includes a heterogeneous set of new industrial products, ranging from computer software to tank engines.

The key objective of the project was to identify and quantify the determinants of sales growth for new industrial products. The first step of the analysis was the measurement of:

The Initial Rate of Penetration: the percentage of total industry demand that the new product captured during its first year of commercialization, and
The Rate of Diffusion: the speed with which the new product penetrated the market over time. (See Figure 1.)

For total industry demand, we used the cumulative volume of sales for all products in the market during the 5 years of observation. Following Mansfield [15], Fisher and Pry [7], and Blackman [2], the diffusion rate of each product was then computed assuming a logistic curve of the form:

$$ln\left(\frac{p_{ti}}{M - p_{ti}}\right) = \alpha_i + \beta_i t \,, \qquad (1)$$

where p_{ti} = fraction of industry demand captured at time t by new product i; β_i = diffusion rate of product i over the observed period; M = maximum attainable market share of product i (as estimated by respondent); α_i = initial penetration rate parameter.

For each product (i), we used ordinary least square to estimate the β_i parameter over the 3 to 5 years of available observations. The fit of the model was good, with R^2 averaging 0.87, and with an average standard deviation of 0.08. While other curves might have been used here, the short time-trends available and the robustness of this model form made it the most appropriate candidate for the pure imitation diffusion environment being modeled [11]. A predictive test on a hold-out sample of 15 products yielded an R^2 of 0.77.

Two models were then developed to relate the initial penetration rate (p_{1i}) and the speed of diffusion (β_i), to a set of key descriptive variables [17, 24].

TABLE 1
Major Industrial Sectors Represented in the French Database

Industrial Sector	Number of New Products	Percent of Total
Electronics, electric equipment, scientific instrumentation	43	38
Chemistry, biochemistry	17	15
Construction, earthmoving	15	14
Transportation services	11	10
Metal processing, metallurgy	10	9
Food, agriculture	9	8
Miscellaneous	7	6
	112	100

Initial Penetration Rate Model

This model was developed as follows:

Logit (initial penetration rate) = function of product design and development process descriptors (X_{ki}), and (target market structure descriptors (V_{ji}):

$$ln[p_{1i}/(1 - p_{1i})] = \alpha + \sum_{k=1}^{K} \omega_k X_{ki} + \sum_{j=1}^{J} \gamma_j V_{ji} \quad (2)$$

$$0 < p_{1i} < 1.0$$

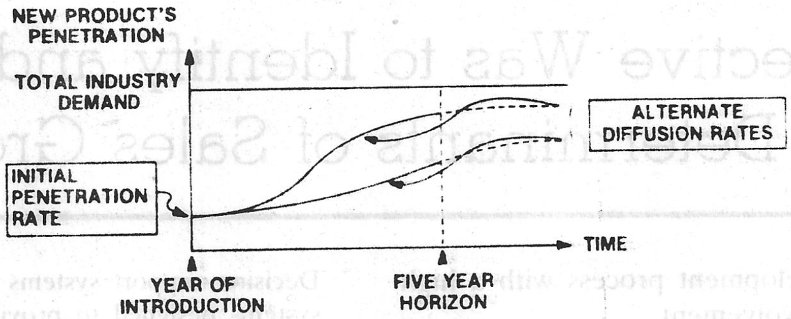

FIGURE 1. Sales penetration curve for a new industrial product and the two key model parameters.

Definitions of the X and V descriptors are provided in Table 2, along with standardized importance weights.

Diffusion Rate Model

This model was developed as follows:

Diffusion rate = function of entry strategy descriptors, and descriptors of changes in the competitive environment:

$$\beta_i = a \prod_{k=1}^{K^*} Y_{ki}^{b_k} \prod_{j=1}^{J^*} c_j^{W_j} \qquad (3)$$

where Y_k refers to ratio-scaled descriptors of the firm's entry strategy; W_j refers to binary descriptors of changes in the environmental after market introduction.

Model (3) was linearized, taking logs, prior to parameter estimation. Definitions of the Y and W variables, along with standardized importance weights are given in Table 2.

Industrial products with high initial penetration rates were characterized by:

TABLE 2
Determinants of the Initial Rate of Penetration and of the Speed of Diffusion of New Industrial Products

	Initial Rate of Penetration (p_1) Descriptors' Definition	Standardized Importance Weight $R^2 = 0.85$
Development Process (X_i)	Duration of the product development process	(−).15[a]
	Original product for which there exists some internal demand	(−).42[b]
	New product originated within the marketing department, and placed under the authority of a given individual	(+).39[a]
Market Structure (V_j)	Few competitive products (order of entry effect) (<3)	(+)5.70[a]
	Relative price during first year	(−)1.25[b]

	Diffusion Speed (β) Descriptors' Definition	Standardized Importance Weight $R^2 = 0.77$
Entry Strategy (Y_k)	Sales force pressure relative to competitors	(+).25[a]
	Relative price (average) over the 5-year observation period	(−).98[a]
	Post launch R&D effort as a percent of sales	(+).15[a]
Changes in Environment (W_j)	Entry of new competitors	(−).18[b]
	Price regulations, limiting new product's margin	(−).26[b]
	Satisfaction level of prospective customers with existing products	(−).19[b]

[a]Statistically significant at the 1% level.
[b]Statistically significant at the 5% level.

Key Objective Was to Identify and Quantify the Determinants of Sales Growth

having a short development process with a high level of personal involvement

being reformulated products without major internal demand

having few competitors of importance

having lower price relative to competition.

Our analysis also indicates that the speed of diffusion will be greater for a new product if:

its sales force pressure is higher than for competitive products

its price in the long run is lower than competitive products

its R&D effort after launch as a percent of sales is low (few technical bugs—a good product design)

no new competitors enter the market

its pricing strategy is free of restriction (important in many European markets)

its customers are not highly satisfied with existing products

The major value of this work lies beyond simply identifying these factors. They were incorporated in a microcomputer-based decision support system that can be used for forecasting sales and evaluating launch strategies prior to new industrial product introduction.

USING THE B.E.I.I. SYSTEM FOR DECISION SUPPORT

The Management Information System (MIS) revolution has given way to the DSS (Decision Support System) revolution [13]. MISs were primarily developed to meet the information needs of large organizations, providing standard, periodic reports that coordinated multiple sources of information in the same firm. In contrast, DSSs stress flexibility and a high level of computer-user interaction in an attempt to solve a decision problem, within a dynamic user-environment.

Decision support systems are small scale interaction systems designed to provide managers with flexible, responsive tools that act, in effect, as a staff assistant, to whom they can delegate more routine parts of their job. DSSs support, rather than replace, a manager's judgment. They do not impose solutions and methods, but provide access to information, models and reports and help extend the manager's scope of analysis (Keen, 1980).

Microcomputers have considerably increased user's access to computing power. In addition, they contribute significantly to managers' feeling of control of the analysis and resolution of decision problems [4]. The key advantages of the microcomputer include:

Availability. Many people have them and can use them.

Friendliness. Not only can it help with new product sales forecasting, it can help balance your checkbook, play games, etc.

Security. The analysis performed on the machine and the associated data can be kept as secure as necessary.

Responsiveness. There is no waiting for a central computer to free up or for a programmer to pay attention to you.

Viability. The set-up cost is low enough to allow for small applications or small organizations to consider its use.

One of the microcomputer's main attractions—as a vehicle for implementing marketing models—is underscored by Maher [14]. "Marketers no longer need to depend on the computer "high-priests"—the data processing department—to procure and array their vital information for them."

Accordingly, B.E.I.I. is a menu-driven, user-friendly system, programmed in Basic Applesoft on an Apple IIe. The system requires the user to specify the characteristics of the product's development process and the competitive structure of its target market. Assumptions are also introduced into the computer about planned entry strategy and anticipated changes in the firm's competitive environment.

Figure 2 gives the general structure of the B.E.I.I. Decision Support System. It is comprised of three modules:

1. *Sales Forecasting Module:* (our focus here) takes assumptions about market structure, entry strategy, and the development process and translates them into a 4-year sales projection (Figure 3).
2. *Product Cost Module:* based on experience curve and economy of scale concepts, projects annual production, marketing, and distribution costs for the product.
3. *Profitability Module:* takes cost and volume projections and translates them into financial projections for the product.

The New Product Forecasting Module estimates the level of first-year penetration and the rate of diffusion. These two parameters are then used to generate the time path of market penetration, including both likely sales and cumulative penetration. An estimate is also provided of the maximum annual sales level likely to be reached at the maturity stage in the year of these peak sales.

This approach provides management with an operational tool to evaluate the market entry strategy and to assess the likely sales impact of changes in the strategy or in the external environment on the economic viability of a new industrial product. As an

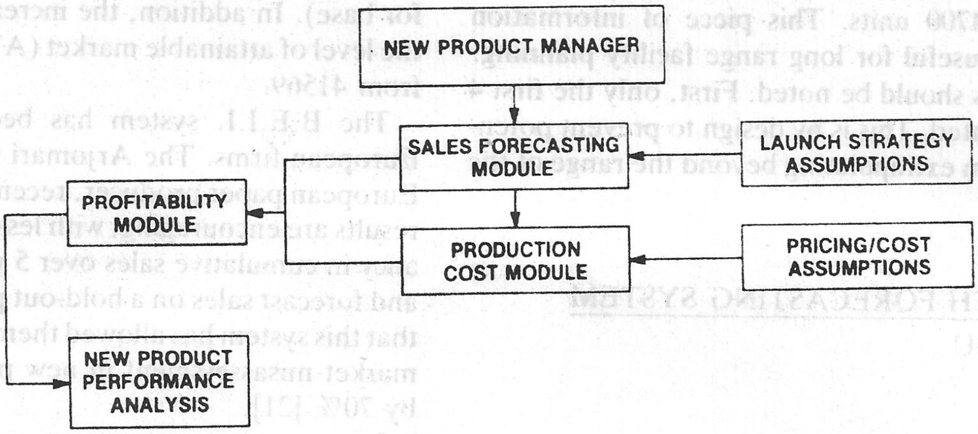

FIGURE 2. Structure of B.E.I.I. decision support system.

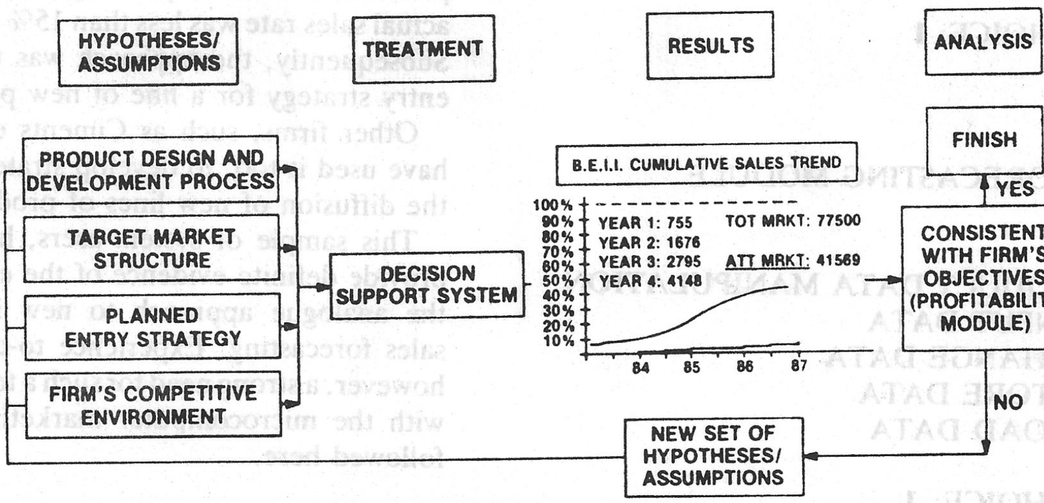

FIGURE 3. Use of B.E.I.I. new product sales forecasting module.

example, we ran a sensitivity analysis for a new type of transportation equipment. The analysis concerned the impact on the new product's sales penetration of possible changes in sales force pressure, and the pricing policy, compared to a base case, reflecting the company's planned entry strategy.

Figure 4 provides samples of screen displays as they appear to the user. Figure 5 gives a more concise listing of the input data for the base case. Note that, given the level of price dissatisfaction in the market, the introduction strategy incorporates a 10% lower price than average for competitors and assumes that 20% of the total selling effort in the market is associated with the new product.

Figure 6 gives output for the base cases, both cumulatively and on an annual basis. The introduction strategy shows a slow penetration (projected peak around 1999). The maximum annual sales levels are around 4700 units. This piece of information might prove useful for long range facility planning.

Two points should be noted. First, only the first 4 years are printed. This is by design to prevent potential users from extrapolating beyond the range of the observed data used for calibration of the model. The system was developed for early forecasts: long-range forecasts can only be made on assumptions of market stability. Therefore, the DATE of MAX SALES and the level need to be taken as rough guides and should be used carefully. Second, the TOT MRKT and ATT MRKT terms are based on the 1984–1988 period of analysis, too.

Several sensitivity analyses were run. Figure 7 shows the effect of a 50% increase in sales force pressure. Projected sales during the first 4 years are 6638 vs. 5148 units or 36% higher. In addition, the level of peak sales (5926 vs. 4705) is 26% higher and likely to occur 3 years sooner (1996 vs. 1999).

Figure 8 shows an analysis of the product priced equal to competition. As expected, the projected 4-year sales level is lowered (2840 vs. 4148 for base) and the time to peak sales is lengthened (2003 vs. 1999 for base). In addition, the increase in price lowered the level of attainable market (ATT MRKT) to 38750 from 41569.

The B.E.I.I. system has been used by several European firms. The Arjomari Company, a leading European paper producer, recently reported that the results are encouraging, with less than a 30% discrepancy in cumulative sales over 5 years between actual and forecast sales on a hold-out product. They report that this system has allowed them to reduce the risk of market misassessment in new product development by 70% [21].

In a recent experiment conducted at Vieille Montagne, a world leader in zinc production and associated technologies, the system was used to simulate the time growth of cumulative sales for a new product introduced 5 years ago. Discrepancy with the actual sales rate was less than 15% over that horizon. Subsequently, the approach was used to help plan entry strategy for a line of new products.

Other firms, such as Ciments et Betons France, have used it too, to develop strategies to accelerate the diffusion of new lines of products.

This sample of system-users, however, does not provide definite evidence of the external validity of the analogue approach to new industrial product sales forecasting. Experience to-date does suggest, however, a strong need for such a tool and satisfaction with the microcomputer marketing DSS approach followed here.

PRELAUNCH FORECASTING SYSTEM
MAIN MENU

SELECT MODULE:
<1> SALES FORECASTING ANALYSIS
<2> PRODUCTION COST ANALYSIS
<3> PROFITABILITY ANALYSIS

YOUR CHOICE: 1

SALES FORECASTING MODULE

NEW PRODUCT DATA MANIPULATION
<1> INPUT DATA
<2> CHANGE DATA
<3> STORE DATA
<4> LOAD DATA

YOUR CHOICE: 1

FIGURE 4. Sample screen displays.

SOURCE OF THE NEW PRODUCT IDEA?
<1> GENERAL MANAGEMENT
<2> R&D DEPARTMENT
<3> PRODUCTION DEPARTMENT
<4> MARKETING DEPARTMENT
<5> CURRENT CUSTOMER
ANSWER: **4**

WHO WAS RESPONSIBLE FOR THE DEVELOPMENT OF THE PRODUCT?
<1> AN INDIVIDUAL
<2> A MULTIDISCIPLINARY GROUP
<3> THE R&D DEPARTMENT
ANSWER: **2**

NEW PRODUCT CATEGORY?
<1> ORIGINAL
<2> REFORMULATED
<3> REPOSITIONED
ANSWER: **2**

SIGNIFICANT INTERNAL DEMAND FOR THE NEW PRODUCT?
<1> YES
<2> NO
ANSWER: **2**

LENGTH OF DEVELOPMENT PROCESS?
<MONTHS>
ANSWER: **16**

NUMBER OF COMPETITORS ON THE MARKET <PRODUCTS SUBSTITUTABLE TO THE NEW ONE>
ANSWER: **5**

MARKET SHARE OF THE THREE LEADERS DURING THE YEAR PRECEEDING THE NEW INTRODUCTION?
ANSWER: **8**

RELATIVE PRICE OF THE NEW PRODUCT DURING THE FIRST YEAR OF SALE?
<PRICE/AVERAGE PRICE OF COMPETITORS>
ANSWER: **9**

SALES FORCE PRESSURE OVER THE 0–3 YEAR PERIOD?
<% OF TOTAL INDUSTRY SELLING EFFORT>
ANSWER: **2**

RELATIVE PRICE OF THE NEW PRODUCT OVER THE 0–3 YEAR PERIOD?
<PRICE/AVERAGE PRICE OF COMPETITORS>
ANSWER: **.9**

INTENSITY OF R&D EFFORT OVER THE 0–3 YEAR PERIOD?
<R&D BUDGET/SALES LEVEL>
ANSWER: **.02**

ARRIVAL OF NEW COMPETITORS OVER THE 0–3 YEAR PERIOD?
<1> YES
<2> NO
ANSWER: **2**

CURRENT LEVEL OF SATISFACTION OF POTENTIAL CUSTOMERS?
<1> NOT AT ALL SATISFIED
<2> . . . . . <6>
<7> COMPLETELY SATISFIED
YOUR ANSWER IN TERMS OF
PRICE :2
TECH. PERFORMANCE :6
RELIABILITY :2
OVERALL SERVICE :7
OPERATING COST :2

PRICE REGULATIONS LIMITING NEW PRODUCT MARGIN?
<1> YES
<2> NO
ANSWER: **2**

CONSIDERING YOUR PLANNING HORIZON,
TOTAL MARKET SIZE
ANSWER: **77500**

ATTAINABLE MARKET SIZE (PERCENT OF TOTAL)
ANSWER: **.5**

YEAR OF INTRODUCTION?
19<??>
ANSWER: **84**

FIGURE 5. Base case data.

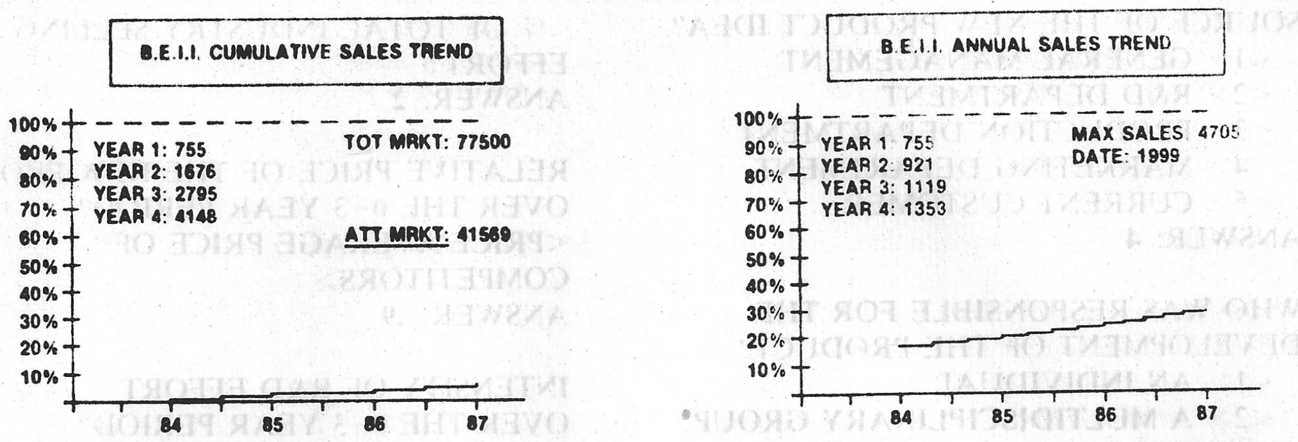

FIGURE 6. **Base Case. Price is 10% below competition, sales force is 20% of total market spending.**

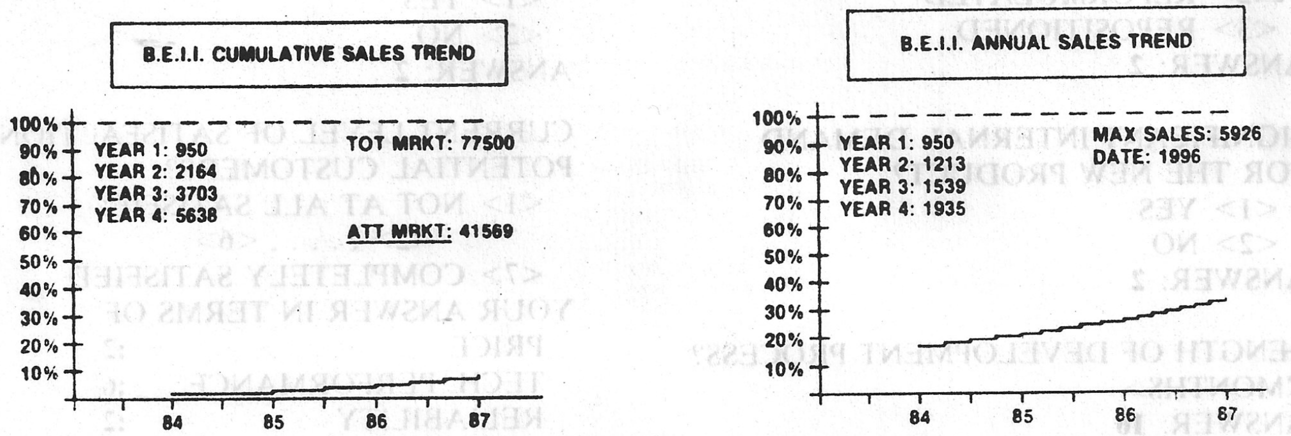

FIGURE 7. **Same as Base Case, but there is 50% increase in sales force spending.**

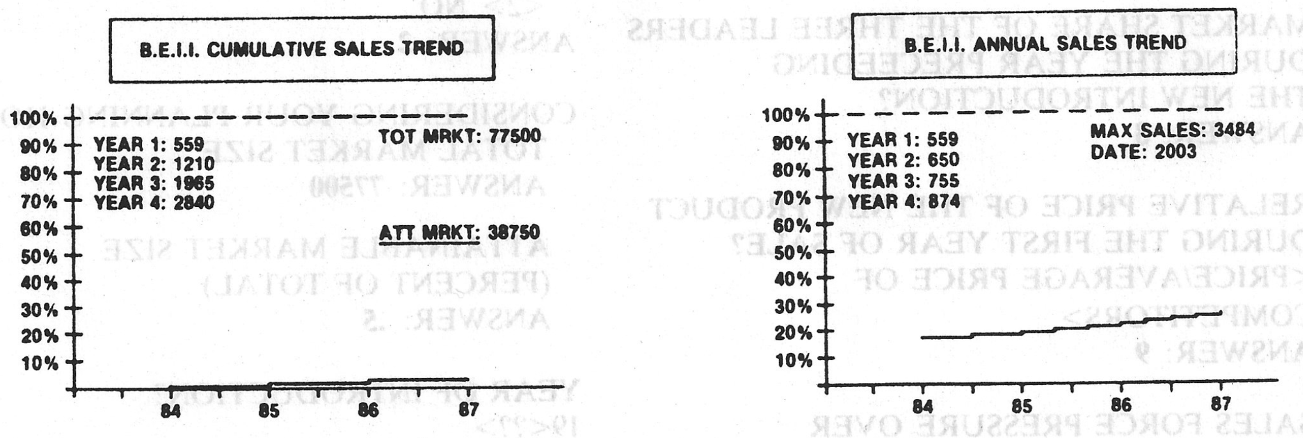

FIGURE 8. **Same as Base Case, but price is equal to competition.**

CONCLUSION

The prediction of sales levels and growth rates for new industrial products is both important and challenging. The empirical work and related MMDSS reported here provide a promising, if experimental, new tool for planning and controlling new industrial product projects.

Our research has some limitations. First, products in our research form a heterogeneous group from a convenience sample of industries. Accordingly, the results might incorporate sampling or selection bias. Second, the analysis is at the level of the individual product-seller, whereas diffusion takes place within the framework of a market-need, bringing together buyers and sellers. Third, our model is based on data collected in a retrospective mode. It might then be biased in the direction of the "wisdom of hindsight."

Nonetheless, the MMDSS and the related analysis provide both new insight into the diffusion process of new industrial product forecasting and control. New data is currently being collected in Japan, in the United States, and in Europe in an attempt to expand the scope and the value of this research.

REFERENCES

1. Biggadike, R., The Risky Business of Diversification, *Harvard Business Review* (May 1979).
2. Blackman, A. W., The Market Dynamics of Technological Substitution, *Technological Forecasting and Social Change* **6**, 41–63 (1974).
3. Booz-Allen and Hamilton, *New Products Management for the 1980's*. Washington, Booz-Allen and Hamilton, Inc., 1982.
4. Choffray, Jean-Marie, Le Micro-ordinateur, Regle a Calcul du Manager, *Harvard L'Expansion* **30**, 78–91 (Spring 1984).
5. Choffray, Jean-Marie and Dorey, F., *Development et Gestion des Produits Nouveaus*. Paris, McGraw Hill, 1983.
6. Cooper, R. G., New Product Success in Industrial Firms, *Industrial Marketing Management* **11**, 215–223 (1982).
7. Fisher, J. C. and Pry, R. H., A Simple Substitution Model of Technological Change, *Technological Forecasting and Social Change* **3**, 75–88 (1971).
8. Gertenfeld, A., Technological Forecasting, *Journal of Business* **44** 10–18 (Jan 1971).
9. Hopkins, D. S., New Product Winners and Losers, *Conference Board* #773 (1980).
10. Lilien, G. L., ADVISOR 2: Modeling the Marketing Mix Decision for Industrial Products, *Management Science* **25**, 191–204.
11. Lilien, G. L. and Kotler, P., *Marketing Decision Making: A Model Building Approach*. Harper & Row, New York, 1983.
12. Lilien, G. L. and Weinstein, D., An International Comparison of the Determinants of Industrial Marketing Expenditures, *Journal of Marketing* **48**, 46–53 (Winter 1984).
13. Little, John D. C., Decision Support Systems for Marketing Managers, *Journal of Marketing* **43**, 9–27 (Summer 1979).
14. Maher, N., Marketers Find New Muscle in Decision Modeling, *Industrial Marketing* 42–44 (July 1982).
15. Mansfield, E., Technical Change and the Rate of Imitation, *Econometrica* **29**, 741–765 (Oct 1961);
16. Mansfield, E., *Industrial Research and Technology Innovation*. New York, Norton, 1968.
17. Novaction, *Les Déterminants de la Diffusion des Produits Industriels Nouveaux*. Paris, Novaction Inc., 1983.
18. Piatier, A., *Les Obstacles a l'Innovation dans les Pays de la Communaute Européenne*. Commission des Communautes Europeenne, 1981.
19. Schoeffler, S., Buzzell, R., Heany, D., Impact of Strategic Planning on Profit Performance, *Harvard Business Review* **52**, 137–145 (1974).
20. Urban, G., and Hauser, J., *Design and Marketing of New Products*. Englewood Cliffs, NJ. Prentice Hall, 1980.
21. Virolleaud, P., Les Ventes des Trois Premières Annees Previsibles a 30%, *Usine Nouvelle* (June 1983).
22. Wheelwright, S. and Makridakis, S., *Forecasting Methods for Management*. New York, John Wiley and Sons, 1980.
23. Wind, Y., *Product Policy: Concepts, Methods, and Strategy*. Reading, MA, Addison-Wesley, 1982.
24. Yoon, E., New Product Introduction/Timing Models: R&D and Marketing Decisions Considering Diffusion Dynamics. Ph.D. thesis, The Pennsylvania State University, 1984.