

ASSESSOR Pretest Market Forecasting: Marketing Engineering Technical Note¹

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Introduction

The ASSESSOR forecasting system is a set of measurement procedures and models designed to help managers forecast the market share of new packaged good product before test marketing, or national introduction. It is typically implemented before a product is introduced into the market, but after the product has been designed, developed, and tested, one or more package designs has been completed, and one or more ads or ad concepts have been developed for introducing the product. The set of inputs required for the model are obtained via surveys and a consumer shopping opportunity in a simulated store (typically set up in a testing facility within a shopping mall) where customers choose the new product when it is displayed along with the competing products. The overall framework guiding the model and the associated measurements are summarized in Exhibit 1.

¹ This technical note is a supplement to some the materials in Chapter 5 of Principles of Marketing Engineering, by Gary L. Lilien, Arvind Rangaswamy, and Arnaud De Bruyn (2007). © (All rights reserved) Gary L. Lilien, Arvind Rangaswamy, and Arnaud De Bruyn. Not to be re-produced without permission.

Design	Procedure	Measurement
O_1	Respondent screening and recruitment (personal interview)	Criteria for target-group identification (e.g., product-class usage)
O_2	Premeasurement for established brands (self-administered questionnaire)	Composition of “relevant set” of established brands, attribute weights and ratings, and preferences
X_1	Exposure to advertising for established brands and new brand	
[O_3]	Measurement of reactions to the advertising materials (self-administered questionnaire)	Optional, e.g., likability and believability ratings of advertising materials
X_2	Simulated shopping trip and exposure to display of new and established brands	
O_4	Purchased opportunity (choice recorded by research personnel)	Brand(s) purchased
X_3	Home use, or consumption of new brand	
O_5	Post-usage measurement (telephone interview)	New-brand usage rate, satisfaction ratings, and repeat-purchase propensity; attribute ratings and preferences for “relevant set” of established brands plus the new brand

O = Measurement; X = Advertising or product exposure

EXHIBIT 1

Overview of ASSESSOR data-collection procedure. Source: Silk and Urban 1978, p. 174, Table 1.

The data obtained from the surveys and the simulated shopping are combined with management judgment for developing two separate models for forecasting the long-term market share for the new product. The two models are: (1) The Preference Model, and (2) The Trial/Repeat Model. If the two forecasts converge, then the manager can feel more confident about the forecast from the ASSESSOR system. If the two forecasts diverge, then there is useful diagnostic information to guide further development and testing of the new product (e.g., Is the discrepancy potentially due to low trial or repeat rates? Could it be due to inadequate advertising?).

The Preference Model

The preference model transforms the measured preferences of the participants (from observations O_2 in Exhibit 1) into choice probabilities indicating the probability that the participants will purchase each of the products in their consideration set:

$$L_{ij} = \frac{V_{ij}^b}{\sum_{k \in C_i} V_{ik}^b}, \quad (1)$$

where

V_{ij} = participant i 's stated preference for product j , measured on a suitable scale;

L_{ij} = an estimate of the probability that participant i will purchase product j ;

C_i = the consideration set of customer i ; and

b = a parameter that is estimated from the data

$L_{ij}=0$ for those products j that are not in the consideration set of participant i . The sum in the denominator is over all the products in participant i 's consideration set. If participants differ significantly in product usage rates, L_{ij} can be weighted by usage index w_i to convert probability of purchase into relative volume of purchase, and further transformed, if needed, into market share (See, also Exhibit 2):

$$\bar{L}_j = \frac{\sum_{i=1}^I w_i L_{ij}}{\sum_{j=1}^J \sum_{i=1}^I w_i L_{ij}} \text{ for } j=1,2, \dots, J. \quad (2)$$

The parameter b in Eq. (1) is an index that indicates the rate at which preferences for products will convert to purchase probabilities for the products. If $b > 1$, then high-preference brands will have disproportionately high probabilities of purchase as compared with low-preference brands. In typical applications b will be between 1.5 and 3.0. The maximum likelihood estimation procedure offers a way to estimate a value for b that maximizes the likelihood of recovering the actual product choices the participants made at *their most immediate previous purchase occasion* (as measured at O_2 in Exhibit 1).

To forecast the purchase probability of the new product, we measure preferences for both the new product and the existing products after the participant has used the new product for a trial period. Because the participants are aware of the new product and have had the opportunity to try it, we can assume that the new product will be in the consideration set of all the participants. We can use an equation similar to Eq. (1) to estimate the probability of purchase for all products, including the new product, after the

participants have had an opportunity to use the new product:

$$L'_{ij} = \frac{V'_{ij}{}^b}{V'_{in}{}^b + \sum_{k \in C_i} V'_{ik}{}^b}, \quad (3)$$

where

V'_{ij} = post-use preference rating by the i th consumer for the j th product;

n = an index to denote the new product; and

L'_{in} = the probability that consumer i will choose the new product, after having used it.

In Eq. (3) we assume that in the laboratory setting all participants will include the new product in their consideration sets. In Eq. (3) b is the estimate we obtain from Eq. (1).

The market share obtained from Eq. (3) for the new product will be an optimistic forecast because not everyone in the marketplace will include the new product in their consideration sets. One way to adjust for this is to obtain estimates of the percentage of those in the target segment who will include the new product in their consideration sets and then adjust L'_{in} as follows:

$$M'_n = E_n \sum_i \frac{L'_{in}}{N}, \quad (4)$$

where

E_n = proportion of participants who include the new product in their consideration set;

M'_n = the projected market share for the new product; and

N = the number of participants in the study.

To assess *draw* and *cannibalization* from other products, we first partition the participants into two hypothetical groups: those who would include the new product in the consideration set (equal to the proportion E_n) and those who would not include the new product in the consideration set (proportion equal to $1 - E_n$). (One estimate of E_n is the proportion of customers in the target segment

who would eventually try the new product—a number that is estimated as part of the trial-repeat model described in the next section.) Then NE_n participants would include the new product in the consideration set, and $N(1 - E_n)$ would not. For those who do not include the new product in the consideration set, the best estimates of their choice probabilities are those provided by Eq. (1), which reflect product choices before trying the new product. Likewise, for those who include the new product in their consideration set, the best estimates of their choice probabilities are those provided by Eq. (3). Thus we obtain the best estimate of the sources of market share for the new product as follows. First we compute the market shares of the existing products j before and after the new product is introduced:

$$M_j = \sum_i \frac{L_{ij}}{N}, \quad (5)$$

$$M'_j = E_n \sum_i \frac{L'_{ij}}{N} + (1 - E_n) \sum_i \frac{L_{ij}}{N}, \quad (6)$$

where

M_j = the market share for product j before the new product is introduced, and $j=1, 2, \dots, J$, where J is the number of existing products in the competitive set (i.e., products that belong in the consideration set of at least one customer); and

M'_j = the market share for product j after the new product is introduced.

In this model M'_j will be equal to at most M_j for all existing products. Given these estimates the extent to which the new product draws from product j is given by

$$D_j = M_j - M'_j \quad (7)$$

Note that the sum of the draws across the existing products (i.e., $\sum_{j=1}^J D_j$) is equal to the market share for the new product (M'_n). The proportion of the new product's sales that is drawn from other products sold by the firm is considered to be cannibalized; the remaining part drawn from competitors' brands is called incremental sales. A new product whose sales are primarily due to

cannibalization has to be further evaluated carefully for its financial contribution to the firm, even though the ASSESSOR model may forecast that it will have high market share.

In Exhibit 2 we provide a numerical illustration of the computations given in Eqs. (1) to Eqs (6).

Customer	Preference ratings								
	V_{ij} (Pre-use)				V'_{ij} (Post-use)				New Product
	B1	B2	B3	B4	B1	B2	B3	B4	
1	0.1	0.0	4.9	3.7	0.1	0.0	2.6	1.7	0.2
2	1.5	0.7	3.0	0.0	1.6	0.6	0.6	0.0	3.1
3	2.5	2.9	0.0	0.0	2.3	1.4	0.0	0.0	2.3
4	3.1	3.4	0.0	0.0	3.3	3.4	0.0	0.0	0.7
5	0.0	1.3	0.0	0.0	0.0	1.2	0.0	0.0	0.0
6	4.1	0.0	0.0	0.0	4.3	0.0	0.0	0.0	2.1
7	0.4	2.1	0.0	2.9	0.4	2.1	0.0	1.6	0.1
8	0.6	0.2	0.0	0.0	0.6	0.2	0.0	0.0	5.0
9	4.8	2.4	0.0	0.0	5.0	2.2	0.0	0.0	0.3
10	0.7	0.0	4.9	0.0	0.7	0.0	3.4	0.0	0.9

Customer	Choice probabilities								
	L_{ij} (Pre-use)				L'_{ij} (Post-use)				New Product
	B1	B2	B3	B4	B1	B2	B3	B4	
1	0.00	0.00	0.63	0.37	0.00	0.00	0.69	0.31	0.00
2	0.20	0.05	0.75	0.00	0.21	0.03	0.03	0.00	0.73
3	0.43	0.57	0.00	0.00	0.42	0.16	0.00	0.00	0.42
4	0.46	0.54	0.00	0.00	0.47	0.50	0.00	0.00	0.03
5	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
6	1.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.20
7	0.01	0.35	0.00	0.64	0.03	0.61	0.00	0.36	0.00
8	0.89	0.11	0.00	0.00	0.02	0.00	0.00	0.00	0.98
9	0.79	0.21	0.00	0.00	0.82	0.18	0.00	0.00	0.00
10	0.02	0.00	0.98	0.00	0.04	0.00	0.89	0.00	0.07
Unweighted market share (%)	38.0	28.3	23.6	10.1	28.1	24.8	16.1	6.7	24.3
New product's draw from each brand (unweighted %)					9.9	3.5	7.5	3.4	
New product's draw from each brand (weighted by E_n in %)					2.0	0.7	1.5	0.7	

EXHIBIT 2

Sample computations associated with the assessor model. There are 10 customers and four brands (B1 to B4). To convert preference ratings to choice probabilities, we used a value of 1.9 for the parameter b (Eq. 1). To obtain the new product's weighted draw from other brands we set E_n , the proportion of customers including the new product in their consideration set, to 0.2.

Trial-repeat Model

ASSESSOR uses a standard chain ratio formula to generate the long-run market share of the new product using the new product trial and repeat measures obtained from the laboratory experiment:

$$M_n = trw, \quad (8)$$

where

- t = the cumulative proportion of the target segment that will eventually try the new product;
- r = the proportion of those trying the new product who will become long-run repeat purchasers of the new product; and
- w = relative usage rate, with $w=1$ being the average usage rate in the market.

ASSESSOR estimates the trial rate (t) as follows:

$$t = \underbrace{FKD}_{\text{those who try}} + \underbrace{CU}_{\text{those given samples}} - \underbrace{(FKD)(CU)}_{\text{adjustment for double counting}} \quad (9)$$

where

- F = the long-run probability of trial given unlimited distribution and total awareness of the new product in the target segment, the proportion of the participants who purchase the product in the simulated store (O_4 in Exhibit 1);
- K = the long-run probability of awareness, estimated based on management judgment and the projected advertising plan;
- D = the long-run probability that the product will be available where the target customers shop, based on managerial judgment and expectations regarding the proportion of outlets that will eventually carry the product;
- C = the probability that a customer in the target segment will receive a sample of the new product, estimated based on the introduction plan for the new product; and

U = the probability that a customer who receives a sample will use it, estimated based on past experience and managerial judgment.

The first term in Eq. (8), FKD , represents the proportion of customers who will be aware of the new product, have it available where they shop, and will then try it. The second term, CU , represents the proportion of customers who will obtain a trial sample. The third term, $(FKD)(CU)$, adjusts for double counting those who both purchase the new product and receive a sample. Unlike the preference model, the trial-repeat model does not provide estimates of draw and cannibalization, which are important to a firm in developing its marketing plan for the new product.

We estimate the repeat rate (r in Eq. (7)) from the information in the post-usage telephone survey (O_5 in Exhibit 1). We first formulate a brand-switching matrix that shows the proportion of customers who switch into and out of the new product at each time period:

$${}^t \begin{bmatrix} {}^{t+1} p_{nn} & {}^{t+1} p_{no} \\ p_{oo} & p_{on} \end{bmatrix} \quad (10)$$

where

p_{nn} = the probability that a customer who purchases the new product at time period t will also purchase it at time period $t+1$, estimated as the proportion of customers who purchased the new product in the test facility and say in the post-usage survey that they will buy the new product at the next purchase occasion;

$$p_{no} = 1 - p_{nn};$$

p_{on} = the probability that a customer who purchases another product at time t will purchase the new product at time $t+1$, estimated as the proportion who did not purchase the new product in the test facility but say in the post-usage survey that they will buy the new product at the next purchase occasion; and

$$p_{oo} = 1 - p_{on}.$$

Given the switching matrix, we are interested in determining what proportion of the customers who bought the new product at some period t would

buy the new product in the next period ($t+1$) if the pattern embedded in the matrix is repeated period after period indefinitely—that is, what would be the equilibrium repeat rate? The answer turns out to be given by a simple formula:

$$r = \frac{P_{on}}{1 - P_{nn} + P_{on}}, \quad (11)$$

The trial-repeat model summarized in Eqs. (7) to (10) provides an independent estimate of the market share for the new product, which one can compare with the estimate obtained from the preference model. When these two estimates are close, they increase managers' confidence in the forecasted market share of the new product.

Implementing and Using the Assessor Model

Exhibit 3 summarizes how the various measurements from an ASSESSOR implementation are used to compute market shares and related financial projections from the trial-repeat model and the preference model. Exhibits 3a and 3b pertain to the trial-repeat model. Exhibit 3a illustrates the effects of planned advertising expenditures in generating awareness for the product in the target segment. Awareness only creates the potential for consumer trial, and actual trial is determined by the planned availability of the new product in various marketing channels accessible to customers in the target segment. Finally, trial only refers to first-time purchase, and it needs to be modified by long-term repeat rates (Eq. (10)) to determine the long-term market share for the product (over repeat purchase occasions). In this example, the planned advertising is likely to result in a market share of 4.9%.

Exhibit 3b shows similar calculations for the effect of the planned sampling program, which in this example, consists of distributing 30 million samples in the market. Only a proportion of these samples reach the target market, and only a proportion of those who receive samples actually use them. We also remove the effects of double-counting -- some customers who receive samples are also exposed to advertising for the product, which also encourages product trial. In this example, the net trial from sampling, after accounting for the double-counting, is 24.5%. Of those customers who try the product via a sample, only some will actually purchase the product (first-time purchase). Finally, to determine long-term share, we need to assess the repeat rate using

Eq. (10). The combined effect of these factors in this example leads to a long-term market share of 1.1% due to sampling. The total long-term market share from advertising and sampling is the 6% (4.9% + 1.1%).

Exhibit 3c illustrates the computations related to the preference model. In this example, the post-entry market share is 24.3% (Exhibit 2 illustrates how this computation is carried out) assuming everyone is aware of the product and everyone who wants to buy the product is able to find it in the stores where they shop. This "full information, full-availability" market share is modified by the actual levels of trial that is achieved by the marketing and distribution plans -- from the trial model; we know only 23.5% of the target population will try the product. Therefore, the net market share from the preference model is 5.7% ($0.243 \times 0.235 \times 100$).

Finally, Exhibit 3d shows how market share estimates are used for developing annual financial projections for the new product. In this example, we take the market share computed from the trial-repeat model (6%) to illustrate how revenue, contribution, and return on sales can be computed. This type of detailed financial analysis is critical, especially in the packaged goods industry, where most new products introduced fail to meet the objectives set for them.

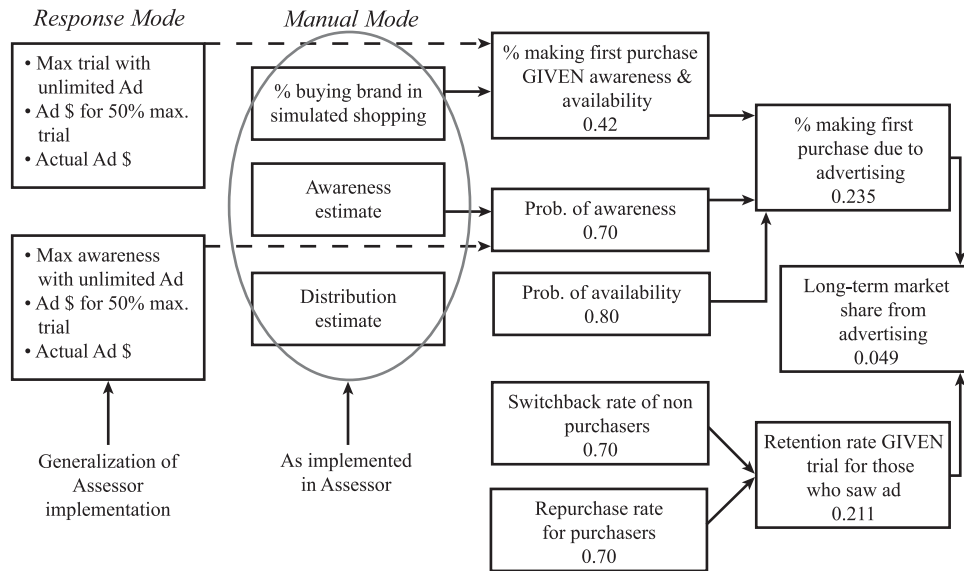
Based on the financial projections derived from the ASSESSOR estimates, the firm can do one of the following:

1. If the financial returns are favorable, and the two forecasts from the trial-repeat model and the preference model converge (as in the example in Exhibit 3), the firm may decide to do a national launch, without doing an in-market test, thereby realizing substantial savings.

2. Drop the product because the financial returns are clearly unfavorable, and the two forecasts give convergent estimates that point to poor performance of the new product. Again, on average, this type of decision to drop the product will lead to substantial savings by avoiding a potentially costly in-market failure.

3. If the two forecasts diverge, or if the financial projections do not point to a clear winner or loser, then we can use the diagnostic information obtained from the ASSESSOR model to revise the product or marketing plans, followed if necessary, by another ASSESSOR test.

Assessor Trial & Repeat Model Market Share Due to Advertising

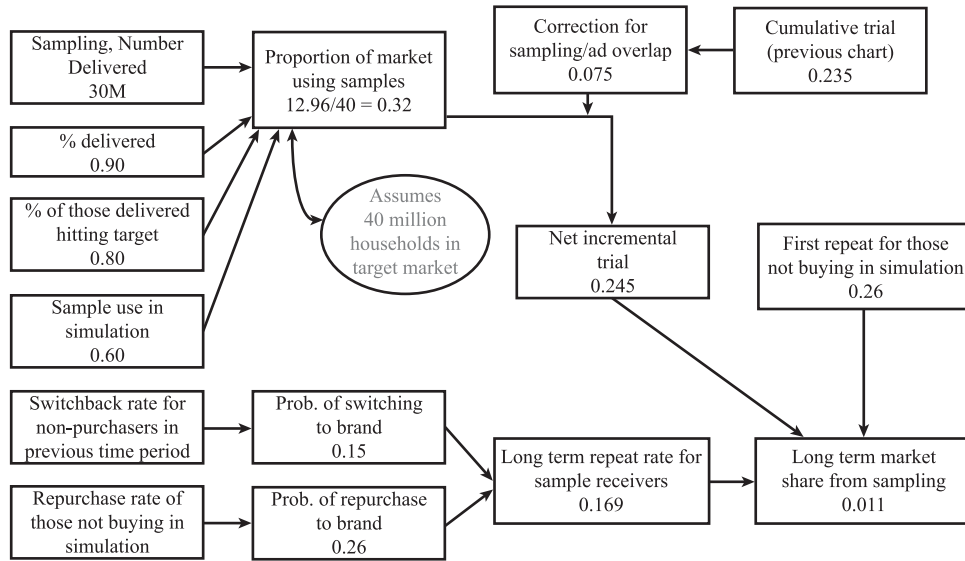


Source: Adopted from Thomas Burnham

EXHIBIT 3a:

This chart shows how the trial-repeat model is used to determine the long-term market share that is generated from the proposed advertising plan for the new product.

Assessor Trial & Repeat Model Market Share Due to Sampling

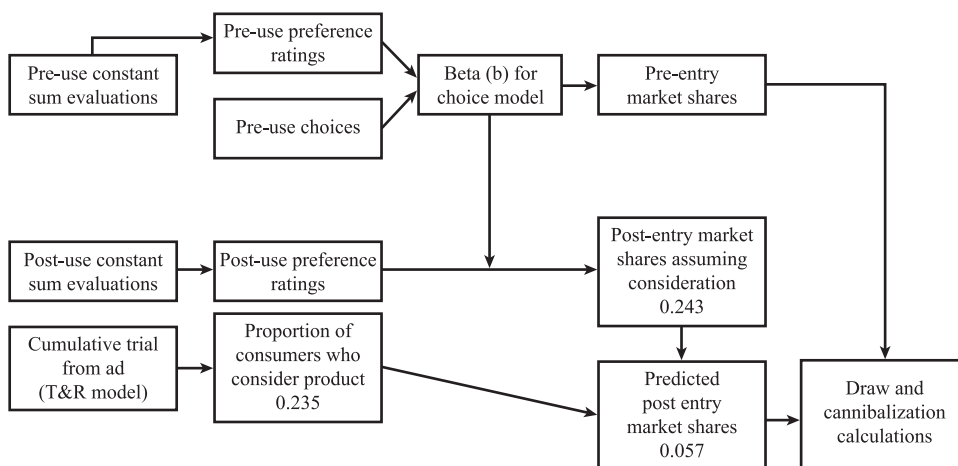


Source: Adopted from Thomas Burnham

EXHIBIT 3b:

This chart shows how the trial-repeat model is used to determine the long-term market share that is generated from the proposed sampling plan for the new product.

Assessor Preference Model Summary



Source: Adopted from Thomas Burnham

EXHIBIT 3c:

This chart shows how the market share estimate for the new product is determined from the preference model. The preference model also provides data on how the new product draws share from the existing products, including other products of the company (cannibalization). See also Exhibit 2.

Assessor Market Share to Financial Results Diagrams

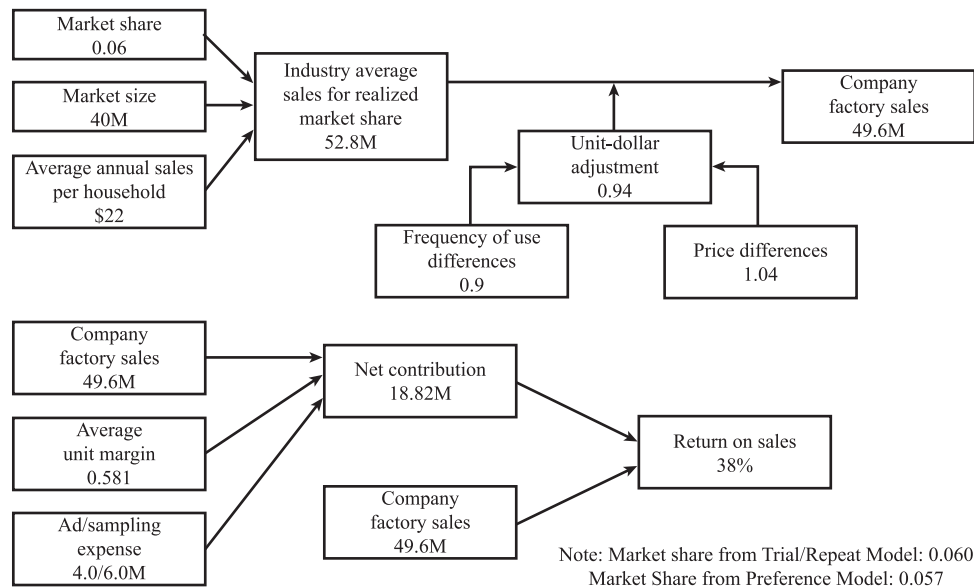


EXHIBIT 3d:

Illustrates how the ASSESSOR market share estimate is translated into the top line (Revenue of \$49.6 million in this example) and bottom line impact on the company's financial statements (Contribution of \$18.82 million in this example).

Summary

The ASSESSOR forecasting system is the most sophisticated approach currently available for developing pre-test market forecasts for new packaged goods. However, the core concepts and general approach to forecasting embedded in this forecasting system has broader applicability beyond packaged goods. If ASSESSOR results suggest either a direct national launch, or dropping the product altogether, then it helps the firm avoid the high cost of an in-market test. The numerous implementations and follow-up evaluations of ASSESSOR attest to its ability to provide reasonably accurate forecasts. If the company decides to launch the product, the diagnostic information provided by ASSESSOR can help focus efforts to improve the market performance of the new product. A noteworthy aspect is the use of two separate models, which offer reasonably independent forecasts of expected long-term market share for the new product.

References

Silk, Alvin J., and Urban, Glen L., 1978, "Pre-test market evaluation of new packaged goods: A model and measurement methodology," *Journal of Marketing Research*, Vol. 15, No. 2 (May), pp. 171–191.