An Empirically Derived New Product Project Selection Model

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Abstract—**The idea screening stage or R&D project selection decision is a deficient decision area in the new product process. Most quantitative and economic models focus on the commercialization stages, while idea screening models are largely speculative and arbitrary. This paper presents an empirically derived and validated new product screening model. Typical screening variables were measured for each of 195 actual new product projects. Thirteen dimensions were found to describe the screening domain. A multiple regression model was derived from the data, and when validated using a cross-split-half method, yielded a predictive accuracy of 84 percent.**

INTRODUCTION

FAR MORE new product projects are conceived than there exist resources to develop and commercialize them. Moreover, the great majority of these projects probably are unfit for eventual commercialization. The necessary high attrition rate of new product projects[1] together with the desire to maximize returns from R&D programs points to careful project selection as a critical new product task.

This paper presents an empirically based screening model for new industrial product R&D projects. To date, most rigorous product evaluation models have focused on the commercialization stages of the new product process, while initial project selection models, based on arbitrarily developed checklists and variables, are less valid. The lack of a proven screening decision model (empirically derived and empirically validated) coupled with the pivotal nature of the screening decision suggests the need for a screening model whose factors and weightings are based on actual experience.

THE PROJECT SELECTION DECISION

The screening stage is the initial GO/NO GO decision of a new product project. It is the decision point at which management *first commits* significant resources towards the development of a new product. Since it is the first selection decision in the new product process, the screening decision's outcome is either an initial but tentative commitment to the new product project or an outright rejection of the proposal. In fact, the majority of projects are rejected; an estimated seven out of eight new product ideas never reach the R&D stage [5].

The effectiveness of the screening decision is crucial to the success of the firm's R&D program. From a strategic viewpoint, the screening stage largely decides the character and direction of the firm's development program and its eventual product portfolio. Moreover, it is at this early stage that management can take steps to maximize returns on product development. Too weak a screening process fails to weed out the obvious "losers," with the resulting misallocation of scarce developmental resources and the possibility of a "creeping commitment" to the wrong projects. The other error, that one which is inherent in too strong a screen, results in many viable projects being rejected, and is equally costly to the firm in terms of lost opportunities. Albala [1] notes that the problem is *not* the achievement of absolute certainty; the total avoidance of product failure could only be achieved by rejecting *all* new projects.

Screening techniques or R&D project selection models often involve the use of a simple checklist [2], [6], [11], [15], [17] or a quantified extension of a checklist, such as scoring models. The checklist approach consists of a list of important variables that are likely to impinge on the new product's suitability and success. A number of such models have been developed [8], [13], [18], [27], [28], and recent years have witnessed the following notable improvements in the checklist scheme:

- rating scales or multichotomous responses rather than dichotomous answers (e.g., YES/NO or High/Low) so that the degree of existence of a characteristic can be measured [6], [18];
- scoring models that assign weights to reflect the importance of each scale and provide a method (usually linear-additive) to combine the weighted ratings to yield a composite score [2], [3], [12], [17], [18], [20];
- methods for developing cutoff criteria [17], [21], [29];
- techniques for combining the judgments of several different evaluators;
- incorporation into a statewise model [1], [14].

Checklist and scoring models are used not because they work so well, but because the manager has little else to turn to. The ultimate criterion for most firms in the selection of projects is profitability; but the input information required for the usual profitability calculations–sales, profit margin, in-

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[1] Booz, Allen, and Hamilton [5] report that for approximately every 58 new product ideas, only two are commercialized. Bogaty [4] notes that 2-3 percent of original consumer product ideas survive to commercial success.

vestment, etc.–is *simply not known* for many new product projects still at the idea stage. Thus the evaluators must turn to qualitative, nonfinancial, and known variables in order to make this first GO/NO GO decision [1], [6].

The checklist or scoring model is essentially an attempt to lend rigor and consistency to what amounts to an investment decision made in the absence of financial data. The premise is that there are a number of qualitative variables that are proxies for (or correlated with) new product success and profitability. For example, O'Meara's [19] model considers Marketability, Durability, Productive Ability, and Potential as the major classes of variables; and within Marketability are such specific variables as the product's degree of superiority, its price advantage, and the degree to which it utilizes existing company distribution channels.

In spite of their popularity, checklist and scoring models are plagued by difficulties. Such models rely on the subjective ratings of managers and, hence, may not be very accurate. However, at the screening stage, management opinion is often the only "data" available; moreover, ratings from several evaluators together with confidence scores can be combined to yield a composite and more reliable value for each variable.

Other serious criticisms tend to be of a technical nature. Often, scoring models are seen as oversimplifications, since they attempt to reduce a complicated decision situation to a simple equation yielding a composite score [6], [16], [18]. A major deficiency is that importance weightings assigned to individual variables are arbitrarily determined. Such weights or coefficients ideally should be obtained from empirical data (past successes and failures). Simon and Freimer thus propose the use of linear discriminant analysis to identify the weights to attach to each screening variable [26].

Another weakness is the fact that many of the variables or factors are not independent. For example, if one of the variables is "compatibility with distribution channels," then it certainly is not independent from the "compatibility with current products" measure.[2] Shocker, Gensch, and Simon [24] note that factor analysis of the many screening variables to reduce them to a subset of independent (orthogonal) factors could be used to eliminate the interdependence of ratings. Also there are no generally accepted cutoff criteria against which product scores can be compared. Alone, the overall project score thus has little value. It can only be used as a comparitive measure among the several projects under consideration [6], [7], [12], [13].

AN EMPIRICALLY DERIVED SCREENING MODEL

What is missing in R&D project screening methods is empirical or field data to develop and validate the scoring model approach. To date, developers of scoring models have only been able to guess at answers to such critical questions as:

Which variables should be included in the scoring model?
What weightings should be attached to each variable?
What cutoff criterion should be used?

2 Taken from O'Meara's [19] model: the first two variables.

Recent empirical research has probed the new product success/failure question. Project SAPPHO compared matched pairs of new product successes and failures to conclude that a great many factors determine product outcomes [22]. Many of these are within the control of management, including: knowledge of users' needs, efficiency of development, effectiveness of communications, and magnitude of marketing efforts. Rubenstein's study of North American success and failure products identified 54 significant facilitators for success, including the existence of a product champion, marketing factors, strong internal communication, improved data gathering, analysis and decision-making techniques, and planned approaches to venture management [23].

These and other success/failure investigations have shed much light on the keys to new product success. What remains is to analyze past successes and failures with the specific objective of developing a project selection model.

This paper presents the results of such an analysis. The model is based on data from a total of 195 actual industrial new product successes and failures. A deductive descriptive framework that explained new product outcomes [9] yielded a list of 48 new product characteristics of interest for a screening model. These possible screening variables are listed in the Appendix and fall into one of the following five categories:

1) Resource Compatibility:	Degree to which there is a good project/company fit in terms of a number of resource and skill areas (R&D, engineering, distribution, financial, etc.).
2) Newness of the Project to the Firm:	How new the project is to the firm in a variety of ways (new markets, technologies, product class, etc.).
3) Nature of the Product:	What the product would offer the customer (unique features, cost reductions, etc.).
4) Nature of the Market:	Characteristics of the new product's market, including size, need level, competitiveness, maturity, etc.
5) Nature of the Project:	Characteristics of the project itself: for example, source of idea; innovatativeness; magnitude of project; etc.

A mailed questionnaire was prepared, pretested, and sent to 177 randomly selected industrial product firms known to be active in product development. A total of 103 firms replied, after telephone follow-up, for an effective response rate of 69 percent (after correction for inappropriate firms). In each firm, the manager was requested to select two typical and recent new product projects for discussion (one a commercial success, the other a failure), characterize both projects on each of the 48 variables (agree/disagree, 0 to 10 scales–see the Appendix), and finally rate each product's commercial success (on a –5 to +5 scale). Commercial success was defined in terms of the degree to which the product's profitability exceeded or fell short of the minimum acceptable profitability for this type of investment. Data were eventually obtained on 102 successes and 93 failures, a total of 195 new product projects.

RESULTS: SCREENING MODEL DIMENSIONS

Factor analysis first was utilized in order to reduce the 48 interrelated variables to a more manageable subset.[3] As Shocker, Gensch, and Simon [24] suggested, a problem of intercorrelation among screening variables did exist, with correlation coefficients as high as 0.8 and often over 0.4, pointing to the need for factor analysis.

A total of 13 meaningful dimensions were found to describe the multivariate domain of the screening problem. These 13 factors, with eigenvalues in excess of 1.0, were easily identified and labeled. Moreover, variable loadings in most cases were substantial, while the 13 factors explained 69.3 percent of the variance of the original 48 variables. The factors are listed in Table I with the higher loadings indicated in Table II.

A review of the dimensions that underlie the screening domain reveals few surprises. Three of the dimensions, namely

Product Superiority and Uniqueness
Product Uniqueness and Innovativeness (First to Market)
Economic Advantage of the Product

can be thought to describe the differential advantage of the new product offering. These three dimensions come close to portraying "the degree to which the product has marketability by virtue of a unique competitive advantage." Such *marketability* measures are usually part of most intuitive screening models.

Four dimensions measure the project/company fit. These include measures of project newness to the firm as well as resource compatibility:

Newness to the Firm
Overall Project/Company Resource Compatibility
Production and Technological Newness
Technical Resource Compatibility.

Such measures are often found in screening models because they purport to gauge the project's synergy with corporate resources, the "do-ability" of the project, and the degree of experience and knowledge the firm has for this particular type of project. The existence of these attributes–synergy, "do-ability," and experience–is thought to be related to success and profitability.

Another three factors describe the nature and magnitude of the market:

Market Need, Growth, and Size
Market Competitiveness
Competitive Strength.

Such dimensions are common in screening decisions, and can be said to gauge collectively the "market opportunity." Market Need, Growth, and Size is a proxy for the magnitude of the potential market, while Market Competitiveness and Competitive Strength describe the ease of market entry (or lack of resistance) for the new product.

The final dimensions are descriptors of the new product situation and, hence, are classification factors. They include

[3] Principal factors with iterations; Varimax rotation; SPSS routine.

TABLE I
FACTORS UNDERLYING SCREENING VARIABLES

Factor Name	% Variance Explained[a]
1. Newness to the Firm	19.6
2. Overall Project/Company Resource Compatibility	17.2
3. Product Superiority and Uniqueness	12.3
4. Market Competitiveness	11.3
5. Product Technical Complexity and Magnitude	8.9
6. Product Uniqueness and Innovativeness (First to Market)	6.1
7. Competitive Strength	4.9
8. Market Need, Growth and Size	4.8
9. Product Determateness	3.6
10. Production and Technological Newness	3.4
11. Technical Resource Compatibility	2.9
12. Product Customness/Specialization	2.7
13. Economic Advantage of Product (lack of)	2.1

[a] By each factor, after Varimax rotation.

the following:

Product Determinateness (degree to which the product specifications and the technical solution were known at the outset)
Product Customness/Specialization
Product Technical Complexity and Magnitude.

These factors can be thought of more as moderating dimensions than "direct causes" of success or failure. For example, whether a product is a custom one or not might affect the *type* of screening model to be used, and perhaps the variable weights.

In summary, four major classes of screening dimensions have been identified from the results of the factor analysis. Three of these are

Marketability
Product/Company Fit
Market Opportunity

and parallel closely O'Meara's [19] original four classes of variables. The fourth grouping contains classification dimensions. These four sets of factors represent the key categories of screening variable dimensions that should form part of any screening model.

RESULTS: SCREENING MODEL RELATIONSHIPS

The analysis now focuses on the development of a relationship between success/failure and the 13 underlying dimensions previously identified. Multiple regression analysis[4] was utilized to derive a relationship with the degree of success or failure–a continuous variable[5]–as the dependent or criterion variable. For each new product case, the 13 factor scores were deter-

[4] Linear discriminant analysis, as suggested by Simon and Freimer [26], was also used, yielding a virtually identical model, but with somewhat inferior predictive ability to the regression model outlined here.

[5] Although not normally distributed. Nonetheless, the robust nature of regression analysis together with the excellent validation results (reported later) would appear to justify the use of regression on these data.

TABLE II
FACTOR LOADINGS (13 FACTORS)

FACTOR	VARIABLES LOADING ON FACTOR	TYPE OF VARIABLE	VARIABLE LOADINGS
1. NEWNESS TO THE FIRM	New customers to the firm	Newness	0.696
	New product class to firm	"	0.759
	New types of customer needs	"	0.742
	Production process new to firm	"	0.398
	Product technology new to firm	"	0.413
	New distribution/sales force to firm	"	0.745
	New type of advertising/promotion to firm	"	0.732
	New competitors for the firm	"	0.664
2. OVERALL PROJECT/ COMPANY RESOURCE COMPATIBILITY	Had adequate financial resources for project	Resource Compatibility	0.563
	Had compatible R & D resources	"	0.405
	Had compatible engineering skills	"	0.427
	Had necessary marketing research skills	"	0.790
	Had needed managerial skills	"	0.798
	Had compatible production resources	"	0.402
	Had compatible salesforce/dist. resources	"	0.785
	Had adequate advertising/promo. skills	"	0.698
3. PRODUCT SUPERIORITY & UNIQUENESS	Highly innovative product, new to market	Project	0.422
	Product had unique features	Product	0.772
	Superior to competing products	"	0.845
	Product let customer reduce his costs	"	0.431
	Product did unique task for customer	"	0.538
	Product higher quality than competitors'	"	0.745
4. MARKET COMPETITIVENESS	Highly competitive market	Market	0.780
	Intense price competition in market	"	0.793
	Many competitors in market	"	0.754
	Many new product introductions	"	0.475
	Changing user needs in market	"	0.400
5. PRODUCT TECHNICAL COMPLEXITY & MAGNITUDE	A high technology product	Project	0.845
	A high per unit price - "bit ticket" item	"	0.616
	Mechanically, technically complex product	"	0.877
6. PRODUCT UNIQUENESS & INNOVATIVENESS (FIRST TO MARKET)	Highly innovative, new to market	Project	0.642
	Product did unique task for customer	Product	0.458
	Product first in the market	"	0.676
	Potential demand only (no existing demand)	Market	0.488
7. COMPETITIVE STRENGTH	Existence of a dominant competitor	Market	0.539
	High loyalty to competitive products	"	0.843
	Customers satisfied with competitors' products	"	0.534
8. MARKET NEED GROWTH & SIZE	Customers had great need for product type	Market	0.521
	Market size (dollar volume) was large	"	0.673
	High growth market	"	0.704
9. PRODUCT DETERMATENESS	Product clearly specified by market	Project	0.881
	Technical solution clear at outset	"	0.698
10. PRODUCTION & TECHNOLOGICAL NEWNESS	(Did not)have compatible production resources	Resource Compatibility	-0.423
	Production process new to firm	Newness	0.702
	Product technology new to firm	"	0.578
11. TECHNOLOGICAL RESOURCE COMPATIBILITY	Had compatible R & D resources for project	Resource Compatibility	0.755
	Had compatible engineering skills	"	0.712
12. PRODUCT CUSTOMNESS/SPECIALIZATION	Market derived new product idea	Project	0.251
	A custom product	"	0.432
	(No)mass market for product	Market	-0.627
13. ECONOMIC (DIS) ADVANTAGE OF PRODUCT	Product did(not)let customer reduce his costs	Product	-0.436
	Product priced higher than competing product	Product	0.613

mined from the original 48 variables and the factor score coefficients; these factor scores became the predictor variables.

A total of eight of the thirteen factors entered the regression solution, and seven were strongly related to product outcome. In order of inclusion, these were

1) Product Superiority and Uniqueness (PSU)
2) Project/Company Resource Compatibility (RC)
3) Market Need, Growth, and Size (MN)
4) Economic Disadvantage of Product (negative) (ED)
5) Newness to Firm (negative) (NF)
6) Technological Resource Compatibility (TC)
7) Market Competitiveness. (MC)

An eighth variable, Product Customness and Specialization (PC), although not strongly related to outcomes, did improve

TABLE III
MULTIPLE REGRESSION RESULTS: NEW PRODUCT SCREENING MODEL

Factor Identification	Factor Name	Regression Coefficient	Standardized Regression Coefficient	F-Value
3:PSU	Product Superiority & Uniqueness	1.744	0.463	68.7
2:RC	Overall Project/Co. Resource Compatibility	1.138	0.307	30.0
8:MN	Market Need, Growth & Size	0.801	0.199	12.5
13:ED	Economic (Dis) Advantage of Product	-0.772	-0.179	10.2
1:NF	Newness to the Firm	-0.354	-0.956	2.9
11:TC	Technological Resource Compatibility	0.342	0.088	2.5
4:MC	Market Competitiveness	-0.301	0.080	2.0
12:PC	Product Customness/Specialization	-0.225	-0.054	0.9
	Constant	0.328		

R^2 = 0.420

Adjusted R^2 = 0.395

F(8,186) = 16.83

Std Error = 2.73

TABLE IV
RESULTS OF SCREENING MODEL VALIDATION

	Actual Success	Actual Failure	Total
Predicted Success	90* (82.6%)	19 (17.4%)	109
Predicted Failure	12 (14.0%)	74* (86.0%)	86
Total	102	93	195

Numbers are numbers of cases. Astericks indicated correctly classified cases. Percentages (in parenthesis) are row percentages (add to 100% across a row) and indicate conditional probabilities, e.g. P (Success/ Predicted Success) = .826

the regression relationship.[6] Regression coefficients are shown in Table III.

The multiple regression relationship itself is a strong one, and was able to account for 39.5 percent of the variance in the degree of success/failure.[6] All the predictor factors in the solution (Table III) are significant at the 0.10 level, except the last factor. The relationship itself is highly significant with an F of 16.8 (an F of 3.27 is significant at the 0.001 level).

VALIDATION OF THE MODEL

The ultimate test of a predictive model is its ability to predict, utilizing new data. The high cost of gathering data on new product projects precluded this type of validation, but a similar approach, namely the cross-split-half method, was utilized.

The sample of projects was randomly split into two halves, and separate regression models were developed for each half. Next, the data from one half were utilized to test the model developed from the other half, and vice versa. In this way, the models developed from each half of the data were both tested with new data.

The results were positive. First, the two models developed were virtually identical: similar factors, coefficients, and explained R^2. Second, when tested with new data, both performed very well and almost identically. A sign test—ability to correctly predict successes (positive sign) or failures (negative sign)—was used as a test of predictability. The two models had predictive abilities of 85.6 and 82.7 percent (Table IV).

Since data from both halves yielded almost identical results, one is justified in combining the data to derive the predictive model already outlined in Table III. The results from the validation suggest that the derived screening model has an overall accuracy of 84.1 percent and a mean error[7] of 2.47 (on a 10 point, −5 to +5 scale). The screening model is somewhat

[6] As measured by the adjusted R^2. Since prediction and not statistical significance is of prime concern, the solution was truncated at the point where the adjusted R^2 reached its maximum.

[7] The error is the square root of the mean squared deviation of actual versus predicted success/failure outcomes for both halves of the data in the validations.

more accurate in predicting failures than successes. The probability of success occurring when a failure is predicted is only 14 percent while the probability of a failure occurring when a success is predicted is 17.4 percent.

An analysis of the incorrectly predicted cases yielded no statistically significant pattern. (The statistical analysis was limited by the few misfit cases available.) Nonetheless, certain tendencies were detected. Successful products that were predicted to be failures tended to be marginal successes. Overall, incorrectly predicted cases were more often found in firms with a poorer total new product performance. These firms had a lower percentage of company sales derived from new products; they rated their own new product performance lower than other firms; and finally, these companies had a lower commercial success rate of new products developed. But there were no differences by size of firm, industry, R&D expenditures, or corporate strengths. No other project or product characteristics were found that described the incorrectly predicted cases.

IMPLICATIONS OF THE RESULTS

A review of the screening model reveals that dimensions from all four major classes should play a role in the project selection decision. Not only did a wide diversity of factors enter the model, but the signs or direction of effect of these factors are, without exception, exactly as expected.

	In the Model	Not in the Model
Marketability	Product superiority and uniqueness Economic advantage of product	Product uniqueness and innovativeness (first to market)
Product/Company Fit	Overall project/co. resource compatibility Newness to the firm (negative) Technical resource compatibility	Production and technological newness
Market Opportunity	Market need, growth, and size Market competitiveness (negative)	Competitive strength
Moderating	(Product customness/specialization—weakly negative)	Product technical complexity and magnitude Product determinateness

For marketability, it is critical to achieve a differential advantage either through the product design itself or by virtue of the product's economics. Variables or attributes, such as unique product features, product superiority, reduction of customer costs, higher quality product, unique task ability, and lower priced product, loaded heavily on these two marketability dimensions. The dominant role of product strategy—the need to win success through product and/or economic advantages—is once again supported by this analysis.[8] On the other hand, merely having a "unique product" which is "first to market" does not appear vital to successful product outcomes.

Company/product fit measures have an important place in the screening model. Having an overall resource compatibility (all resources, but heavily weighted on marketing and managerial—see Table II) and a technical resource compatibility are both desirable. Overall resource compatibility is about three times as important as technical resource compatibility, however, strongly suggesting the need for balanced resources.

A product that is new to the firm, i.e., new markets, new customers, new technology, new production, etc., is certainly not a plus in selecting projects. (Incidentally, the factor, product newness, is quite independent from the two dimensions of overall resource compatibility and technical resource compatibility.) But production and technological newness has no great effect on product outcomes.

Two dimensions describing the market opportunity enter the screening model. The first of these pertains to the magnitude of the potential opportunity: being in a high-growth, large, and high-need market. The second is entering a market where the level of competition is minimal: few competitors, little price competition, few new products and static needs. This factor measures the ease of (or lack of resistance to) exploiting the market opportunity. Taken together, these two factors appear to capture the essential elements of the total opportunity.

Moderating variables, as expected, have a much weaker impact on product outcomes. Only product customness entered the regression solution, and in a very weak fashion.

CONCLUSION

Overall, the results of this derivation of a screening model are most encouraging. The selection problem has been reduced to more manageable proportions by identifying the 13 factors or dimensions that define the new product domain. These factors, besides being independent of each other, were easily identified and made intuitive sense. Moreover, the signs (directions of effect) of factors in the model concur with prior expectations. Finally, the implementation of the model is quite straightforward: the measurement of 48 characteristics for each project; the reduction of the variables to 13 factors using factor score coefficients; and the computation of a product score using the regression equation developed. The product score's distance from the zero point yields the probability of success or failure.[9]

The screening model developed promises to yield more effective new product project selection decisions. The problem of subjective ratings remains, and the screening decision will always be plagued by a high degree of uncertainty and sub-

[8] See also [9], [10].

[9] Positive is success; negative is failure; the computed t value, using a prediction interval of 2.73, yields the probabilities.

jectivity. But in spite of the subjective nature of the ratings, the model appears a reasonable predictor. The model itself is unique in that it is based on a large sample of actual projects, utilizes factor analysis and multiple regression, and yields excellent cross-split-half validation results. Perhaps most important, this step forward lends rigor and confidence to what has traditionally been a judgemental decision.

APPENDIX

SCREENING MODEL VARIABLES

Resource Compatibility

Our company's financial resources were more than adequate for this project.
Our company's R&D skills and people were more than adequate for this project.
Our company's engineering skills and people were more than adequate for this project.
Our company's marketing research skills and people were more than adequate for this project.
Our company's management skills were more than adequate for this project.
Our company's production resources or skills were more than adequate for this project.
Our company's salesforce and/or distribution resources and skills were more than adequate for this project.
Our company's advertising and promotion skills and resources were more than adequate for this project.

Project Characteristics

Our product was highly innovative–totally new to the market.
Our product was a very high technology one.
Our product was a "big ticket item"–it sold for a very high per-unit price.
Our product was mechanically and/or technically very complex.
The product *idea* came to us from the marketplace, as opposed to in-house lab or technical work (10 = marketplace; 0 = in-house).
The product specifications–exactly what the product should be–were very clear from the beginning of the project.
The technical aspects–exactly how the technical problems would be solved–were very clear from the beginning.
Our product was a custom product–designed for each customer–as opposed to a standard product (10 = custom; 0 = standard).
Our product was a defensive introduction to maintain our market share in this market as opposed to gaining share or new customers (10 = defensive; 0 = offensive).
Relative to our other product introductions in Canada, the expenses and investment incurred up to the first sale of the product were considerably greater (10 = considerably less)

Newness to Firm

The potential customers for this product were totally new to our company.
The product class itself was totally new to our company.
We had never made or sold products to satisfy this type of customer need or use before.
The nature of the production process was totally new to our company.
The technology required to develop the product (R&D) was totally new to our company.
The distribution system and/or type of salesforce for this product was totally new to our company.
The type of advertising and promotion required was totally new to our company.
The competitors we faced in the market of this product were totally new to our company.

Nature of Product

Compared to competitive products, our product offered a number of unique features or attributes to the customer.
Our product was clearly superior to competing products in terms of meeting customers' needs.
Our product permitted the customer to reduce his costs, when compared to what he was then using.
Our product permitted the customer to to a job or do something he could not presently do with what was available.
Our product was of higher quality–tighter specifications or stronger or lasted longer or more reliable, etc., than competing products.
Our product was priced considerably higher than competing products (10 = much higher; 0 = much lower).
We were the first into the market with this type of product.

Nature of Market

There were many potential customers for this product–a mass market–as opposed to one or a few customers (10 = mass market; 0 = one customer).
Potential customers had a great need for this class of product.
There was only a "potential demand" for this product class–no market existed at the time of introduction.
The dollar size of the market (either existing or potential) for this product was very large.
The market for this product was growing very quickly.
Competing products (or whatever the customer was then using) were very similar to each other–a high degree of product homogeneity.
The market was a highly competitive one.
The market was characterized by intense price competition.
There were many competitors in this market.
There was a strong dominant competitor–with a large market share–in the market.
There was a high degree of loyalty to existing (competitors') products in this market.
Potential customers were very satisfied with the products they were then using (competitors' products).
New product introductions by competitors were frequent in this market.
Users' needs change quickly in the market–a dynamic market situation.

Government legislation, rules, standards, etc., play an important role in the design and testing of products for this market.

REFERENCES

[1] A. Albala, "Stage approach for the evaluation and selection of R&D projects," *IEEE Trans. Eng. Manag.*, vol. EM-22, pp. 153–164, Nov. 1975.

[2] D. R. Augood, "A review of R&D evaluation methods," *IEEE Trans. Eng. Manag.*, vol. EM-20, pp. 102–107, Nov. 1973.

[3] N. R. Baker and W. H. Pound, "R&D project selection: Where we stand," *IEEE Trans. Eng. Manag.*, vol. EM-11, pp. 124–134, Dec. 1964.

[4] H. Bogaty, "Development of new consumer products—Ways to improve your chances of success," *Research Manag.*, vol. 17, pp. 26–30, July 1974.

[5] Booz, Allen, and Hamilton, *Management of New Products*, Booz, Allen, and Hamilton Inc., 1968.

[6] F. R. Bradbury, W. M. Gallagher, and C. W. Suckling, "Qualitative aspects of the evaluation and control of R&D projects," *R&D Manag.*, vol. 3, pp. 49–57, Feb. 1973.

[7] R. G. Brandenberg, "Project selection in industrial R&D: Problems and decision processes," in *Research Program Effectiveness*, M. C. Yovits, Ed. New York: Gordon and Breach, 1966, pp. 13–15.

[8] M. J. Cetron, J. Martino, and L. Roepcke, "The selection of R&D program content—Survey of quantitative methods," *IEEE Trans. Eng. Manag.*, vol. EM-14, pp. 4–13, Mar. 1967.

[9] R. G. Cooper, "Identifying industrial new product success: Project NewProd," *Ind. Market. Manag.*, vol. 8, no. 2, pp. 124–135, Apr. 1979.

[10] ——, "The dimensions of new industrial product success and failure," *J. Market.*, vol. 43, pp. 93–103, Summer 1979.

[11] B. V. Dean, "Evaluating, selecting and controlling R&D projects," research study no. 89, New York: American Management Association, 1968.

[12] B. V. Dean and M. J. Nishry, "Scoring and profitability models for evaluating and selecting engineering projects," *Operations Res.*, vol. 13, pp. 550–69, July–Aug. 1965.

[13] R. E. Gee, "A survey of current project selection practices," *Research Manag.*, pp. 38–45, Sept. 1971.

[14] R. H. Hamilton, "Screening business development opportunities," *Bus. Horizons*, pp. 13–24, Aug. 1974.

[15] A. F. Helin and W. E. Souder, "Experimental test of a Q-sort procedure for prioritizing R&D projects," *IEEE Trans. Eng. Manag.*, vol. EM-21, pp. 159–164, Nov. 1974.

[16] R. D. Hisrich and M. P. Peters, *Marketing a New Product: Its Planning, Development and Control*. Menlo Park, CA: Benjamin/Cummings, 1978.

[17] P. E. McGuire, *Evaluating New-Product Proposals*. New York: Conference Board, Inc., 1973.

[18] J. R. Moore and N. R. Baker, "Computational analysis of scoring models for R&D project selection," *Manag. Sci.*, vol. 16, no. 4, pp. B-212–232, Dec. 1969.

[19] J. T. O'Meara, Jr., "Selecting profitable products," *Harvard Bus. Rev.*, pp. 83–89, Jan.–Feb. 1961.

[20] J. E. Ramsey, *Research and Development: Project Selection Criteria*. UMI Research Press, 1978.

[21] E. Roberto and C. Pinson, "Compatibility analysis for the screening of new products," *Eur. J. Market.*, vol. 6, no. 3, pp. 182–189, 1972.

[22] R. Rothwell, "Factors for success in industrial innovations," in *Project SAPPHO—A Comparative Study of Success and Failure in Industrial Innovation*. Brighten, Sussex: S.P.R.U., 1972.

[23] A. H. Rubenstein, A. K. Chakrabarti, and R. D. O'Keefe, "Field studies of the technological innovation process," *Progress in Assessing Technical Innovations*, H. R. Clauser, Ed. Westport, CT: Technomic Pubi., 1974.

[24] A. D. Shocker, D. Gensch, and L. S. Simon, "Toward the improvement of new product search and screening," in *1969 Fall Conf. Proc. Amer. Market. Ass.*, P. R. McDonald, Ed., pp. 168–175, 1969.

[25] A. D. Shocker and V. Srinivasan, "A consumer-based methodology for the identification of new product ideas," *Manag. Sci.*, vol. 20, no. 6, pp. 921–937, Feb. 1974.

[26] L. S. Simon and M. Freimer, *Analytical Marketing*. New York: Harcourt, Brace & World, Inc., 1970.

[27] W. E. Souder, "A scoring methodology for assessing the suitability of management science models," *Manag. Sci.*, vol. 18, no. 10, pp. B-526–543, June 1972.

[28] ——, "Comparative analysis of R&D investment models," *AIIE Trans.*, vol. 4, March 1972.

[29] ——, "Effectiveness of nominal interacting group decision processes for interacting R&D and marketing," *Manag Sci.*, vol. 23, no. 6, pp. 595–605, Feb. 1977.