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MARKETING RESEARCH EXPENDITURES: A DESCRIPTIVE MODEL

by

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The views and opinions expressed in this report are those of the authors and are not necessarily endorsed by the Department of Industry, Trade and Commerce.

SCHOOL OF BUSINESS ADMINISTRATION
THE UNIVERSITY OF WESTERN ONTARIO

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SUMMARY

The decision on how much to spend on new product market research is a difficult decision and normative models have not seen wide-spread application in this area. This research focussed on an alternate route to the development of a prescriptive guide for marketing research expenditures -- the study of actual management decisions, and the development of a qualitative descriptive model based on past management decisions.

The descriptive model hypothesized for the research, which closely parallels a Bayesian model, was generally supported by the empirical data obtained from 118 case histories of successful industrial new product ventures. Managers' market research expenditure decisions were found to be fairly consistent, and were also qualitatively consistent with the Bayesian ideal. The main determinants of new product market research decisions were identified, and can be broadly categorized along three main dimensions, namely the amounts at stake, the uncertainties and probabilities of the situation, and the cost of market information. The resulting descriptive model -- in the form of a mathematical expression -- may provide useful prescriptive inputs when deciding on how much to spend on new product market research.

MARKETING RESEARCH EXPENDITURES: AN EMPIRICAL MODEL

INTRODUCTION

A number of methods have been proposed for determining what is an appropriate amount to spend on market research for a given marketing problem. These approaches, generally, may be classified as either objectives and task methods or valuation of information methods.( ) The objectives and task approach requires the manager first to set his information objectives and then to formulate a research plan to achieve the desired objectives. Such an approach fails to address the problem of deciding on an optimal expenditure level since it requires the assumption that objectives are worth the cost of the task required to achieve them. The valuation of information approach recognizes that information has both value and cost components and bases the expenditure level decision on assessments of anticipated research costs and benefits. The valuation of information approach tends to meet resistance in management practice because of the reluctance of managers to make the probability and value estimates the approach often requires and because the approach frequently requires an unrealistic simplification of the decision problem.

An alternate route to the derivation of a model for determining market research expenditures is to study the decisons made by operating managers. Empirical models describing past decisons of managers-- called Management Coefficients Models-- have been proposed as useful guides to future decisons. The assumption underlying such guides is

that managers' decisions are not so much biased as they are erratic . Thus, if managers' inconsistencies can be removed, their past decisons can serve as a normative guide. Regression models describing the past decisions of managers have been shown to yield better results than the actual performance of the managers they were based on.

This research develops from empirical data a descriptive model of marketing research expenditure decisons. The research focuses only on the quantitative component of the market research decision-- how much to spend--and does not deal with qualitative considerations, such as the type and quality of research to be done. The decisions were made by managers in industrial goods firms for the purpose of assessing markets for the development of new industrial products. The model relates amounts spent on marketing research to the characteristics of the new product situation, as perceived by managers.

THE HYPOTHESIZED MODEL

The general hypothesis of the research is that the amount of market assessment undertaken in a new product venture depends upon the particular new product situation. The problem then becomes to identify the relevant characteristics of the new product situation for measurement, and to suggest expected relationships between research expenditures and these characteristics. A descriptive model of the decision to undertake market research was therefore proposed.

The hypothesized descriptive model of this research was suggested by a Bayesian analysis of the choice situation.( ) Bayesian models identify three types of inputs which determine optimal marketing research expenditures, namely: ( )

a) the possible consequences of a decision outcome;

b) the prior probability distributions;

c) the cost versus accuracy of possible market studies.

The descriptive model hypothesized for this research parallels the Bayesian model and views the marketing research expenditure as the outcome of an implicit balancing of perceived cost versus perceived value of information (Figure 1). In a new product context, the perceived value of information depends on the amounts at stake in the product venture as well as the uncertainties and probabilities which surround the outcomes of the venture. All three constructs in the model -- perceived cost of information, amounts at stake, and probabilities and uncertainties -- in turn depend on the characteristics of the new product situation.

A number of variables describing the new product situation were identified which might affect managers' perceptions of the amounts at stake, probabilities and uncertainties and cost of market information. The particular variables selected for study have been previously suggested in the literature,( ) and are both realistic and familiar to managers.

Variables which might influence managers' perceptions of the amounts at stake include:

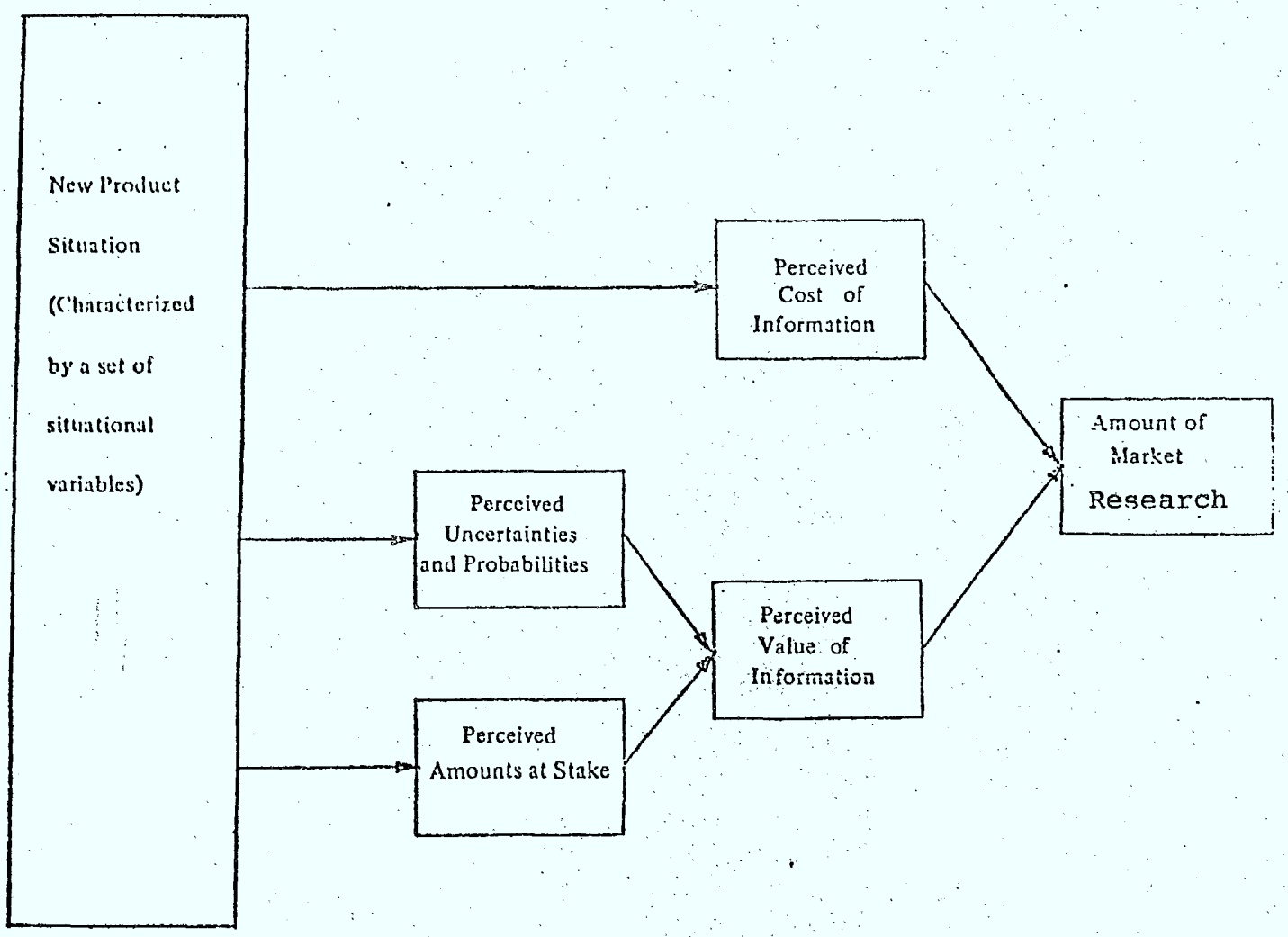

Figure 1. The hypothesized model of market research expenditures.

1) the possible losses if the project should fail;

2) the expected project payoffs.

Variables influencing managers' feelings of uncertainties and probabilities might include:

1) the newness of the product market;

2) the stability of the market;

3) the newness of the product;

4) the competitiveness in the product market;

5) the newness of the product to the firm;

6) the complexity of the product;

7) the newness of the purchase task;

8) the importance of the purchase;

9) the payback period.

Variables which could influence managers' perceptions of the cost of information include:

1) the number of customers;

2) the number of market segments;

3) the accessibility of customers;

4) the degree of development urgency.

These new product situational variables were therefore hypothesized to influence the amount of market research undertaken. Table 1 summarizes the hypothesized determinatnts of research expenditures, and notes the expected direction of effect.

The proposed descriptive model is not a complete model of the decision to undertake market research. Because it is based on a Bayesian approach, the model ignores a number of variables describing both managers and the organization which could influence research decisions.( ) Moreover, the model is a static one, and, therefore, fails to consider the

TABLE I

HYPOTHESIZED DETERMINANTS OF NEW PRODUCT MARKET RESEARCH EXPENDITURES (MR)

Variable symbol	Variable name	Variable Definition	Hypothesized Effect on (MR)
	Amounts at Stake		
F	Possible Cost of Failure	Possible losses if the project were a failure	Positive
	Possible Pay-offs including:	Possible gains if the project were a success:	
S	Anticipated Annual Sales	- expected annual sales	Positive
PR	Anticipated Annual Profits	- expected annual profits	Positive
DPR	Discounted Profits	- future profits (discounted)	Positive
RCF	Relative Cost of Failure	Possible losses relative to other new product ventures in the firm	Positive
	Uncertainties and Probabilities		
MN	Market Newness	How new the procuct is to the firm	Positive
SM	Market Stability	How stable customers needs are for the product	Negative
PN	Product Newness	How new the product is to the market	Positive
DC	Degree of Competition	How competitive the new product market is	Negative
TN	Technical Newness	How new the product is to the firm	Positive
PC	Product Complexity	How complex the product is	Positive
PTN	Purchase Task Newness	How new the purchase task is to the buyer	Positive
PI	Purchase Importance	How important the purchase is to the buyer including: PI-1: selling price of product PI-2: typical order size PI-3: time length of effect on buyer PI-4: effect on buyers profits	Positive
PP	Payback Period	The time required for the project to cover dispersements	Positive

Variable Symbol	Variable name	Variable Definition	Hypothesized Effect on MR
	Cost of Information		
NC	Number of Customers	Number of customers in the logical market	Positive
MS	Number of Market Segments	Number of market setments (industries) in the logical market	Negative
CA	Customer Accessibility	How accessible customers are for providing market information, including: CA-1: willingness to cooperate CA-2: geographic accessibility	Positive
TU	Time Urgency	The urgency of product development	Negative

dynamic nature of search and evaluation decisions. In spite of these limitations, the hypothesized model does provide a useful framework for the study of market research expenditures.

THE DATA

During the summers of 1971 and 1972, managers in 152 industrial product companies located in Ontario and Quebec were visited. The sample was selected from a population of firms known to engage in some new product development. ( ) The sample excluded certain industries such as industrial services, primary resources, and construction, where product development was thought to be less important. Moreover, the sample tended to be weighted toward larger firms to reflect their greater contribution to the total new product development effort in an industry. Of the original 152 firms visited, data on 118 firms were sufficiently complete for analysis in this research.

The data were collected in conjunction with a number of parallel studies into technological innovation in Canada. ( ) In each firm, the manager or managers most involved in the new product development process from a commercial viewpoint were interviewed. Several interviews were conducted over the two years in each firm and were based on detailed interview guides. Also, the managers were requested to complete short answer questionnaires which they subsequently mailed to the researchers.

In each firm, the manager was requested to select a typical and fairly recent new product venture which had

proved to be a success -- a project which he was also intimately familiar with. Following a detailed case history discussion of the venture, a number of questions were posed to characterize the new product situation. The mail-back questionnaire also sought more data to describe the product venture.

The amount of market research -- the main dependent variable of the research -- was operationally defined as the sum of manhours spent gathering information about the new product project. Market research was liberally defined to include not only formal marketing research studies but also such activities as gathering and assessing secondary data, field trips by salesmen and managers, prototype field testing, and test marketing.

The variables which describe the new product situation were defined as the characteristics as perceived by the managers near the beginning of the product development, and were measured in several ways. Quantitatives measures such as Anticipated Sales and Profits, and Possible Cost of Failure were obtained by posing direct questions during the interview. Qualitative measures such as Product Newness, Market Newness and Degree of Competition were obtained on the mailback questionnaire using five-point Likert scales.

The data contain a number of limitations. In the first place, the managers interviewed might not reflect the majority opinion of managers in the firm, while the product venture selected may not be representative of the firm's successful ventures. Moreover, the data rely on the memories

of managers and may be biased by post-hoc rationalization. Nevertheless, in all but a few cases, managers proved to be extremely cooperative, and appeared to respond to questions honestly and to the best of their abilities. The interviewers were all business school graduates or graduate students, were intimately involved in the preparation of the questionnaires and were extensively trained.

RESULTS

The hypothesized model of the research proposed that the amount of market research in new product ventures depends on variables which describe the new product situation. This model was generally supported by the results of the analysis: seven of the hypothesized relationships were found to be significant ($\alpha < .10$) when multiple regression analysis was used to test the hypotheses,( ) while the direction of effect of six of these relationships concurred with the hypotheses.

Multiple regression analysis related the criterion variable -- amount of market research, MR -- to the hypothesized predictor variables describing the new product situation. Likert measures were all assumed to be interval scale. The main determinants ($\alpha < .10$) of the amount of market research conducted in the 118 new product projects were:

S Anticipated Annual Sales (Positive)

F Possible Cost of Failure (Positive)

PN Product Newness tc the Market (Negative)

PI Importance of the Purchase (Positive)

PP Payback period (Positive)

NC Number of Customers (Positive)

MS Number of Market Segments (Negative)

These variables describe all three constructs in the hypothesized model, namely the amounts at stake, the probabilities and uncertainties of the situation, and the cost of market information.

Besides identifying seven significant determinants of research expenditures, the regression analysis revealed that the hypothesized model described actual decision behavior reasonably well. The multiple R^2 of the best fit equation was 0.400, while the equation was significant at the 0.001 level. Both logarithmic and linear regression models were tested. The logarithmic model explained a greater proportion of the variance on research expenditures (40% versus 32% for the linear model). In addition, several alternate measures of the Anticipated Payoffs were tested, namely,Anticipated Annual Sales, Annual Profits, and Profits discounted into the future at four discount rates. While all measures of Payoffs were highly intercorrelated ($r \geq .90$), the Anticipated Annual Sales yielded the highest multiple R^2 and proved to be the most significant and important ( ) of the Payoff functions when each was considered in separate multiple regression analyses. Table II outlines the results obtained from the regression analysis explaining the most variance in research expenditures. This best fit equation has the following form:

$$MR = 14.86(F)^{.185}(S)^{.364}(MS)^{-.565}(NC)^{.094}(PP)^{.164}(PI)^{.316}(PN)^{-.583} \quad (1)$$

The assumptions inherent in the use of multiple regression analysis were generally met in the case of the logarithmic model. The logarithmic distributions of variables

TABLE II

RESULTS OF BEST FIT REGRESSION EQUATION

Variable	Regression Coefficient	Beta	t	α
F	.18455	.21349	2.17	< .025
S	.36382	.38522	4.20	< .001
MS	-.56346	-.18033	2.16	< .025
PP	.16373	.12805	1.59	< .10
NC	.09443	.12144	1.57	< .10
PN	-.58318	-.15330	1.84	< .05
PI-3*	.31563	.11478	1.37	< .10
Constant = 2.6983			R^2 = .400 F = 10.415 $F_{.999}$ = 3.77	

Notes: Equation based on a logarithmic transformation of all variables; α based on one tail t-test.

*Purchase Importance was measured in four ways (see Table I).

approximated normal distributions, and there was no evidence of exact multicollinearity. Autocorrelation of predictor variables was not a concern given the nature of the variables, while residual analysis indicated that residual errors were independent of values of predictor variables.

The results obtained with related analytical techniques supported the findings of the regression analysis. Partial correlation analysis identified a similar set of significant predictor variables ($\alpha < .05$) namely: F, S, NC, MS, and PP. Another six predictor variables, PN, DC, PC, PI-3, CA-2, and TU were significant at the 0.20 level. Multiple Classification Analysis, a form of dummy variable regression, served to check the interval scale assumption used with Likert scales. ( ) MCA identified the same set of significant predictor variables and revealed no incidence of curvilinearity. MCA also confirmed that the logarithmic model provided a better description than the linear model. When the multiple R^2 of the MCA technique was adjusted for degrees of freedom, the resulting value was marginally less than that for the corresponding regression equation due to the limited sample size.

Multiple regression on principle components was utilized in order to reduce the number of predictor variables to a more manageable size. The predictor variables were factor analyzed using the method of principle components with iterations and Varimax rotation. Composite factor indices were constructed from the factor scores generated and the new product situational variables in standard form for each of the 118 cases. The resulting regression relationship between

the amount of research and the eight composite factor indices (principle components) explained only 33% of the variance in MR, while only two principle components were statistically significant ($\alpha < .10$). The single factor explaining most of the variance was heavily loaded on measures of the amounts at stake in projects. However, the low values of communalities in the factor analysis revealed that considerable information was lost when the predictor variables were reduced to eight principle components.

DISCUSSION

The hypothesized descriptive model of market research expenditure decisions in a new product context was generally supported by the actual decison behavior of managers. The resulting empirical model explained 40% of the variance in expenditure decisions, and demonstrated that managers' decision behavior was fairly consistent.

The main dimensions of the new product situation which appear to influence market research expenditures were identified. These were:

a) the amounts at stake;

b) the uncertainties and probabilities of the situation;

c) the cost of market information.

That variables which purported to measure the amounts at stake were the most important and most significant determinants of assessment expenditures was not surprising. Measures of these variables were quantitative and more concrete, and, therefore,

were likely more reliable. Moreover, because these variables werequantitative and obvious characteristics of a product venture, the managersprobably saw them as important considerations in their expenditure decisions. Finally,a Bayesian analysis suggests that the amounts at stake are indeed the most important inputs in determining optimal search expenditures.

What was surprising was that variables which purport to measure the uncertainties and probabilities of the situation played such a minor role in the model. While the reliability of Likert measures might be questioned, an examination of the correlation matrix of predictor variables revealed significant relationship between Likert measures and in the direction one might expect. Perhaps the manager had difficulty in translating his feelings of uncertainty and apprehension into predicable levels of increased market research. In the case of some of the uncertainty variables, namely Product Newness, Market Newness, Technical Newness and Purchase Task Newness, the increase in the perceived cost of information may have offset the increase in perceived value of information. This certainly appears true for Product Newness, where products new to the market actually had less market research undertaken

That variables which purport to describe the cost of information were so important in determining research expenditures was quite unexpected. In spite of the fact that research expenditures were so low relative to the total amounts at stake in product venture, ( ) many managers evidently perceived a high cost of doing market research. The evidence

suggests that managers may perceive an inflated cost of doing market studies, perhaps because they lack familiarity and expertise in the market research area. This speculative explanation tends to be supported further by the evidence that the usual expected constraints to market research -- a lack of time, or a lack of customer cooperation -- were analyzed and found to be not decisive in determining how much research was undertaken.

As might be expected, the best fit equation was multiplicative rather than additive,and linear in form. A Bayesian analysis reveals that a multiplicative expression would be more appropriate than a linear expression in determing optimal search expenditures. Moreover, the interactive nature of amounts at stake, probabilities, and cost of information to yield search cost appears intuitively plusible. The best Payoff function was Annual Sales rather than some measure of profitability, which suggests that managers may be resorting to a simpler notion of payoffs than normative financial analysis techniques propose.

Not only does the empirical evidence reveal a degree of consistency amongst managers' expenditure decision behavior, but it also suggests a strong qualitative consistency with the ideal. The hypothesized model for the research, which was empirically supported, was in fact based on a Bayesian ideal model. This qualitative consistency between actual and ideal decision-making does not mean that managers were necessarily making optimal decisions, but it does indicate that when the

venture situation called for more research, generally managers responded and undertook more research.

This descriptive model derived from past management decisions may, therefore, prove useful as a guide to future management decision making. In the first place, the model gives an indication of what the "average manager" (or management team) spent on market research when faced with various types of new product situations. This information itself is a useful input when deciding on how much to spend on new product market research. Secondly, other empirical studies have suggested that such regression models based on past decisions yield better decisions than actual behavior. The empirical model developed in this research was reduced to a simple mathematical expression, equation (1), which is also represented in tabular form in Table III. If a new product situation can be characterized by the seven model variables, then equation (1) and Table III may provide a reasonable guide to market research expenditures.

CONCLUSION

The decision on how much to spend on new product market research is a difficult decision and normative models have not seen wide-spread application in this area. This research focussed on an alternate route to the development of a prescriptive guide for marketing research expenditures -- the study of actual management decisions, and the development of a qualitative descriptive model based on past management decisions.

The descriptive model hypothesized for the research,

TABLE III

THE EFFECT OF THE NEW PRODUCT SITUATION ON MARKET RESEARCH

(BASED ON EQUATION 1)

Effect of Cost of Failure		Effect of Expected Payoffs	
Cost of Failure ($000)	Manhours of Market Research	Anticipated Annual Sales (average: 5 years) ($000)	Multiply MR by:
10	22.8	50	4.15
50	30.6	100	5.34
100	35.6	200	6.87
200	39.7	300	7.95
300	42.9	500	9.59
500	47.0	750	11.52
750	50.6	1000	12.32
1000	53.4	2000	15.85
1500	57.5	3000	18.40
2000	60.6	5000	22.2

Effect of Payback Period		Effect of Product Newness	
Payback Period	Multiply MR	Product Newness	Multiply MR by:
		The product is:	
0 - 1/2	1.000		
1/2 - 1	1.120	Virtually identical to products on the market	1.000
1 - 2	1.197	Fairly similar	0.666
2 - 5	1.254	Moderately similar	0.526
5 - 10	1.305	Only slightly similar	0.443
		Not at all similar to products on the market	0.389

Effect of Purchase Importance		Effect of Number of Customers	
Customer time commitment to product (years)	Multiply MR by:	Number of Customers	Multiply MR by:
≤ 1 year	1.000	1	1.000
1.1 - 2	1.245	10	1.242
2.1 - 5	1.414	50	1.447
5.1 - 10	1.548	100	1.546
> 10	1.662	1000	1.920

Effect of Number of Market Segments	
Market Segments	Multiplier on MR
Potential customers are:	
All in a single industry	1.000
mostly in a singly industry	0.678
in a few different industries	0.565
in several different industries	0.453
in many different industries	0.399

Example:

A major project, possible downside losses of $500,000; expected annual sales (5 years) of $2,000,000/year; payback period of 3 years; product is new to market, a very important purchase; many possible customers; all in a single industry.

MR = 53.4 x 15.85 x 1.254 x 0.389 x 1.662 x 1.920 x 1.000
(F) (S) (PP) (PN) (PI) (NC) (MS)

MR = 1315 manhours

that is, almost a 7 1/2 manmonth study.

which closely parallels a Bayesian model, was generally supported by the empirical data obtained from 118 case histories of successful industrial new product ventures. Managers' market research expenditure decisions were found to be fairly consistent, and were also qualitatively consistent with the Bayesian ideal. The main determinants of new product market research decisions were identified, and can be broadly categorized along three main dimensions, namely the amounts at stake, the uncertainties and probabilities of the situation, and the cost of market information. The resulting descriptive model -- in the form of a mathematical expression -- may provide useful prescriptive inputs when deciding on how much to spend on new product market research.

FOOTNOTES

1. Little, Cooper, More
2. Reviewed by: Myers and Samli; Day
3. AMA, Marketing Research Techniques Series #1 - 7
4. Bass
5. Day
6. Rex V. Brown
7. Bowman
8. Bowman; Gordon
9. Bayesian Models have been proposed as a useful guide to the derivation of theoretical descriptive models: Peterson and Beach; Green, Robinson and Fitzroy.
10. Raiffa and Schlaiffer; Bass
11. See for example: NICB "Assessing the Market"
12. Descriptive search theories have been proposed by: Cyert and March; Simon and Newell.
13. Source: Directory of R & D Establishments
14. The data collection phase for these studies has been described in more detail: Little, Cooper, More.
15. All analysis was undertaken using the Statistical Package for the Social Sciences (SPSS) at the University of Western Ontario, London, Ontario.
16. Tests of statistical significant based on one tail t-test.
17. Beta coefficients were used as an indicator of the importance of a predictor variable.
18. An outline of the MCA technique is provided by: Andrews, Morgan and Sonquist.

19. In half the projects studied, only 2.5 manhours of assessment were conducted for each $1000 of total possible downside losses, while only 2.0 manhours of assessment were undertaken for each $1000 of expected annual product profits.

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