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SOME FACTORS ASSOCIATED WITH THE EVALUATION OF IDEAS FOR PRODUCTION CHANGES IN SMALL COMPANIES

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SUMMARY

This paper reports research into some of the factors which influence the rate of technological change in industry. The gap between the availability of new knowledge and technology and the application of that knowledge and technology to the process of producing goods and services is generally considered to be substantial. The research reported herein is an attempt to explore the relevance of certain organizational and individual factors to the acceptance of ideas for changes in the firm's production process. This exploration was carried out by measuring the evaluation of actual ideas in the organizational setting and relating the number of ideas evaluated and the number accepted to the organizational and individual factors hypothesized to be relevant.

Data for the study was gathered by the author from 86 cooperating managers and engineers in 34 firms engaged in electronics manufacturing. Each manager and engineer, hereafter called an evaluator, was asked to keep a record of all ideas for changes in the firm's production process which he evaluated. The author collected these records once a week from each evaluator for six weeks. At the end of the six week period each evaluator filled out a questionnaire which served to measure certain organizational and individual variables of interest. Data was gathered on a total of 391 idea evaluations, and was analyzed by computer using a binary multiple regression model.

The first stage of the model, dealing with individual idea evaluators, was tested for two different dependent variables and with data on three subsets of idea evaluators. The two dependent variables of interest in this stage were the number of ideas evaluated and the number of ideas accepted by each evaluator. The three subsets of evaluators used were the set of all evaluators participating in the study, the set of all evaluators who were production managers in their companies, and the set of all evaluators who were presidents or vice presidents and general managers of their companies.

For the set of all idea evaluators, the following variables were found to be correlated, at a significance level of .90, with the number of ideas evaluated; the number of employees in the company, the amount of dissatisfaction with costs expressed by the evaluator, the number of professional, trade, and business publications read by the evaluator per month, and the number of trade shows attended per year by the evaluator. The first three correlations above were positive and the last was negative. The four variables together accounted for 26% of the variation in the number of ideas evaluated.

Again working with the group of all evaluators, the following variables were correlated at the .90 level with the number of ideas accepted; the number of employees in the company, the number of professional, trade, and business publications read by the evaluator per month, and the amount of dissatisfaction with sales levels expressed by the evaluator. The first two correlations above were positive and the last was negative. Together they accounted for 13% of the variation in the number of ideas accepted by each evaluator. It is apparent that the number of ideas evaluated is not influenced by the same variables as is the number of ideas accepted, for only two of the influential independent variables are common to both sets above.

Working with the subset of idea evaluators who were production managers of their companies, only dissatisfaction with costs was correlated at the .90

level with the number of ideas evaluated; and this variable accounted for 10% of the variation in the number of ideas evaluated. Similarly, only one variable was correlated at the .90 level with the number of ideas accepted among production managers. In this case, however, the variable was the amount of business travel accomplished in the past year by the evaluators, and it accounted for 17% of the variation in the number of ideas accepted by the production managers. As in the case with the set of all idea evaluators, it is apparent that the variables which are most influential in explaining the number of ideas evaluated are not the same as those which are most influential in explaining the number of ideas accepted.

The set of company presidents yielded three correlations with the number of ideas evaluated which were significant at the .90 level. These were dissatisfaction with costs, the amount of business travel performed, and the number of professional meetings attended. Together these three variables accounted for 45% of the variation in the number of ideas evaluated. Those variables which are most influential in explaining the number of ideas evaluated among presidents are not the same as those which are most influential in explaining the number of ideas evaluated among production managers. As will be shown below, the same is true of the variables which are most influential in explaining the number of ideas accepted.

Again working with the set of company presidents, three correlations with the number of ideas accepted were significant at the .90 level. They were the amount of business travel, the number of professional, trade, and business publications read, and the company's freedom to alter its products. The first correlation above was positive and the last two were negative. Together these three variables accounted for 22% of the variation in the number of ideas accepted.

Including correlations which carried significance levels lower than .90, the first stage models accounted for a larger portion of the variation in the dependent variables than is indicated above. For example, the last two model tests given for company presidents accounted respectively for 57% and 47% of the variation in the dependent variables.

Independent variables investigated which failed to show correlations significant at the .90 level included the age, educational level, and risk propensity of the idea evluator.

The second stage of the model dealt with the factors influencing the outcome of individual idea evaluations. The following attributes were correlated at the .90 level with the acceptance of an idea; the fact that the idea was perceived to have 1 chance in 10, or less, of failure, the fact that the idea was a potential solution to a problem perceived as "very urgent," the fact that obtaining the money required to implement the idea presented no problem, and the fact that obtaining the people necessary to implement the idea was a problem of moderate magnitude. The latter attribute was negatively correlated with idea acceptance. The evaluator's evaluation of the source of the idea, the potential dollar value of the idea to the company, and the amount of search associated with the problem to which the idea was a potential solution, were not significantly correlated with the acceptance of the idea.

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CHAPTER I: INTRODUCTION

The ever-whirling wheele
Of change, the which all mortall things doth sway

-- Edmond Spenser

The role of change in human life is the subject of much attention. Technological change, relatively slow in Spenser's time, now has accelerated to a pace which is variously described as a solution and a threat to human well-being. Its effect on people, however, is generally agreed to be great.

For purposes of simplification, technological change can be divided into the generation of new knowledge and the use of the knowledge to produce goods. In the former category belong research, some development work, and invention. These three functions have change as either a primary goal or as an implicit, potential goal. The Research and Development function has been studied in some depth by a variety of scientists and engineers using a variety of approaches. Significant among these is the combination engineering and behavioral science approach exemplified by the Northwestern University program of Research on Research (Rubenstein, 1964, p. 103). Invention, as well as Research and Development, has been investigated by economists seeking greater knowledge of the factors influencing economic growth (N.B.E.R., 1962).

Knowledge and prototype models generated by the research, development, and invention functions usually make their economic impact after they are transformed by a production process into goods and services. Some of the resulting goods and services are for ultimate consumers while others are usable by industry in its task of producing other goods and services. Thus, in addition to providing new output products, technological change affects industry by altering the array of goods and services available as inputs, to produce the products. The extent of the effect depends on the degree to which industry accepts and uses available knowledge, services, and materials to produce its product. This acceptance in turn affects the efficiency and competitive position of industry.

Assuming that technological change produces new knowledge, and materials, some of which are potentially beneficial to industry, the attitude of the management of industry toward new knowledge, methods and materials can have an important effect on the economic position of both individual companies and national economies. In reference to the latter, it has been charged that British industry has lagged that of certain other countries because it has not been willing to adapt and apply discoveries and knowledge to improve the production process (Carter and Williams, 1957, p. 6). This research is an investigation of the factors which influence the reaction of industrial managers in a sample of small electronics companies to opportunities for innovation, by which is meant ideas for change in their production processes. The focus is on ideas which suggest changes in a firm's production process, regardless, of whether the idea represents new technology or old. In other words, the author is here investigating the use of technology rather than its generation and early development.

Theoretical Background

Technical innovation in industry was extensively studied by Carter and Williams in Britain in the mid-1950's. Their study, while highly relevant to the present research, was accomplished without any theoretical framework. The study began as an exploratory investigation, and the wealth of information generated (Carter and Williams, 1957 and 1958) did not fall into a sufficiently clear pattern to permit the formation of a theory. Although they are economists by training, Carter and Williams recognized that non-economic factors played a large role in the varying amounts of innovation they observed in their sample companies.

One factor retarding innovation, according to Carter and Williams, was the lack of documentation of scientific work in a form usable by small companies. Another was the threat to the established order posed by the necessity of hiring a high-priced and high-status expert if the company were to enter an area of technology new to the company. Also significant factors in some companies were the absence of a desire for growth, a preoccupation with current operating problems, a lack of technically trained management, and a lack of competition in the market.

While they formed no model of industrial innovation, the authors composed a list of characteristics which they found to be associated with companies they rated as technically progressive. These characteristics are as follows:

1. High quality of incoming communication.
2. A willingness to share knowledge.
3. A deliberate survey of potential ideas.
4. A willingness to take new knowledge on license, and to enter joint ventures.
5. A readiness to look outside the firm.
6. Effective internal communication and coordination.
7. High status of science and technology in the firm.
8. A consciousness of costs and profits in the R & D department (if any).
9. Rapid replacement of machines.
10. A sound policy of recruitment for management.
11. An ability to attract talented people.
12. A willingness to arrange for the effective training of staff.
13. Use of management techniques.
14. Identifying the outcome of investment decisions.
15. Use of scientists and technologists on the Board of Directors.
16. A readiness to look ahead.
17. A high rate of expansion.
18. Good technical service to customers.
19. High quality in the chief executive.
20. Adequate provision for intermediate managers.
21. Good quality in intermediate management.
22. An ability to bring the best out of managers.
23. Ingenuity in getting around material and equipment shortages.
24. An effective selling policy.

(Carter and Williams, 1957, p. 178).

Carter and Williams also found five characteristics which they had expected to be associated with technical progressiveness but which were not, in general, so associated. These characteristics are:

1. Membership in an industry with a strong scientific or technological background.
2. Adequate buildings or site.
3. Scientific or technological training of the key personality in the firm.
4. Resistance to innovation on the shop floor.
5. Adequate finance.

(Ibid, p. 183)

While some of the above characteristics are almost platitudes, others will be useful in generating a model of industrial innovation. Carter and Williams conclude that there is such a thing as a "technically progressive firm." Such a firm is consistently progressive across different situations (innovations) and over at least a short period of time. The authors also offer some tentative evidence that the 24 characteristics above cause technical progressiveness, rather than merely being associated with it. (Carter and Williams, 1958, p. 92).

Edwin Mansfield, an American economist, has studied industrial innovation among the large companies of certain industries in the United States. The innovations studied were all significant and fairly costly. Mansfield started with a mathematical model based on the time lag between availability of an innovation and adoption of the innovation by the individual company. Comparing different companies' reaction to the same innovations, he predicted that the time lag would decrease as

1. The size of the firm increased
2. The profitability of the innovation increased
3. The rate of growth of the firm increased
4. The rate of profitability of the firm increased
5. The age of the president decreased.

(Mansfield, 1963, p. 291)

Mansfield's data supported propositions 1, 2 and 3 but not 4 and 5. In connection with number 2, Mansfield had great difficulty estimating the profitability of individual innovations, and the results must be viewed cautiously. Proposition 5, moreover, received support in an industrial study by Lapp (Lapp, 1966, p. 198).

As was the case with the Carter and Williams work, Mansfield found some tendency for firms which were quick to adopt one innovation to also adopt others. In other words, there appeared to be "more-innovative" firms and "less-innovative" firms, at least over a short (less than 10 years) time period. This conclusion is supported by Lapp's data on the railroad industry (Lapp, 1966, p. 138).

Mansfield concluded that non-economic variables are important in the innovative process, and suggested that the personality, attributes, interests, and training of top management are significant variables. As was the case with Carter and Williams, Mansfield appears to be saying that technological innovation, while on the surface an economic problem, turns out to have strong behavioral elements.

The two assertions related above (that there are innovative companies and that the personality, training, etc. of top management have an effect on innovative behavior) have also been made by other writers. Bright (Bright, 1964, p. 133) hypothesizes that resistance to change is lower where the members of an organization are "used to" change, and Myers observes that innovation flourishes in an atmosphere of anticipation of innovation (Myers, 1965, p. 94). These writers appear to be saying that current innovation is a

function of both past innovation and anticipated future innovation, implying that innovation tends to feed on itself.

Turning to the second assertion, Chandler, in a depth historical study of four large companies, found a tendency for the companies to react in different ways to the same stimulus, the difference being due to the personalities and training of the senior executives (Chandler, 1966, p. 374). A similar tendency is noted by Healy. Referring to the railroad industry from the vantage point of I.C.C. experience, he notes that "some officers have a keen interest in all the available improvements, and throughout the organization there is a feeling that capital expenditures get a sympathetic reception and that proposals for expenditure are to be actively developed and passed on up for decision. Other top officers seem more interested in squeezing everything possible out of existing plant...they have to be bludgeoned into making capital expenditure by competition, group pressure, or a preponderant example of prior advantageous use of facilities by others." (Healy, 1954, p. 151) Healy concludes that the attitudes of the top officers toward capital expenditures probably influence decision making more than do the stimuli of annual budgeting, planning, and equipment deterioration.

In an effort to find out which variables of the "personality, attributes, interests and training of top management" might explain the difference in innovation observed by Mansfield and others, we turn to the body of research on the diffusion of innovation.

There is a rich tradition of research on the diffusion or spread of an innovation in a society. The problem has been studied by economists and others in industrial settings, by anthropologists in diverse cultures, by medical sociologists in medical groups, by educators and educational sociologists in educational settings, by market research and mass communication specialists in the consumer public setting, and by rural sociologists in agricultural societes (Rogers, 1962, p. 23).

The industrial setting, unfortunately, has received less attention than most of the other settings described above. We will survey the industrial innovation literature first, then turn to other fields for more depth in some areas, and finally, formulate an industrial innovation model incorporating elements from several areas of research.

In addition to the industrial innovation work already described, Strassman investigated the role of risk and technological change in 19th Century American industry. Two of his conclusions were that:

1. A lack of men trained in more than one industry, and a lack of publications catering to businessmen of more than one industry, made it difficult for businessmen to keep up with other industries. This limited the horizons of business entrepreneurs, increasing the perceived risk of innovation and thereby retarding it (Strassman, 1959, p. 209;

2. After 1870, the more authority engineers had in an enterprise, the more progressive it was likely to be. Business managers without technical training were more averse to innovations than those having such training (Ibid, p. 223).

Thus, Strassman cites both formal training and experience as influences on innovations.

Enos, in a study of the oil refining industry, found wealth an important variable. He noted that prosperous refiners were the innovators, and impoverished ones the laggards. (Enos, 1958, p. 197). Since he also noted that

innovation usually paid off handsomely, it is hard to impute a causal sequence to these two variables in this study.

Comparing those companies in the cotton spinning industry which had adopted a certain innovation with those which had not adopted it, Sutherland noted that the adopters were more aggressive and more optimistic about the future. (The industry was declining at the time.) They stressed the intangible benefits of the innovation rather than a dollars and cents analysis of its cost reduction. Non-adopters were pessimistic, had a short-term outlook, and had plans to leave the industry if the market declined further. (Sutherland, 1959, p. 134). Perhaps the only surprising finding above is the tendency for adopters to stress intangible factors rather than dollars and cents evaluations. Carter and Williams found approximately the opposite-technically progressive firms used revenue and cost forecasts more often and more thoroughly than did non-progressive firms, when considering innovations. It is possible that in the Sutherland case an economic analysis had shown that the innovation might not pay off, and therefore the adoptors had to stress intangibles to rationalize their adoption.

Finally, in an analysis of innovation in English industry, Burns and Stalker note that continuity of contact between technologist and user is essential to technological change. (Burns and Stalker, 1961, p. 40). By this they mean that if there is to be a transfer of knowledge and methods from a scientist or engineer to a user, there must be continuous contact between the scientist or engineer and the user. This appears to agree with Carter and Williams' analysis.

The above findings are sketchy and largely disconnected. In an effort to find out more about the variables influencing industrial innovation, we will use, in the next section, a number of findings from the field of rural sociology. Here there exists a rich set of research findings related to the adoption, by farmers, of various innovative methods and products. The rural sociology studies are of interest not only because of the extensive investigation of innovation but also because the farmer, like the business decision maker, is presumably concerned with making a profit. This gives farm innovation studies an economic flavor not present in the same form in the medical and educational innovation studies.

It should be noted at this point that opinions differ on the similarity of farmers and businessmen as regards innovation decisions. Grilliches, an economist studying the adoption of hybrid corn, concluded that farmers acted "rationally" with respect to adoption, maximizing profit. Acceptance of the corn correlated well with profitability of adoption but not with wealth or socioeconomic status (Grilliches, 1957, p. 521). Grilliches' approach is macro-economic, involving data from large areas, so individual or local area variations are lost. In addition, hybrid corn is extremely profitable, which may have acted to swamp out variations in innovation. Taking the opposite side, Danhof argues the case that farming is not necessarily comparable to business in the context of innovation when he observes "Agriculture is noteworthy as one industry in which the refusal of a farmer to assume even a modicum of entrepreneurial activity does not, if he owns the resources he uses, force him out of business." (Danhof, 1949, p. 23). Thus, in taking variables from the findings of rural sociology diffusion sutdies, we must be aware that we are taking the risk that false analogies might weaken the industrial innovation model.

Models and Propositions

Several members of the Program of Research on the Management of Research and Development at Norhtwestern University have proposed models which are related in varying degrees to the question under discussion here. In a study of industrial companies responses to major developments in their primary market, McCarthy used a crisis-response model for conceptual purposes (McCarthy, 1965). In a study of idea flow through Research and Development into Production, Douds, and Rubenstein used a time sequence model of idea generation and development (Douds and Rubenstein, 1966). Finally, Kegan used an information flow model to represent the process whereby technology is transferred from a source to a destination (Kegan, 1966).

Before developing hypotheses for this study from the literature, we will propose a skeleton model on which to locate them. This is done because there appear to be two stages in the innovation process, and various of the propositions in the literature appear to relate to one or the other stage, or to both. March and Simon, in a theoretical discussion of innovation, discriminate between the organizational processes which originate proposals for activity and those which evaluate proposals (March and Simon, 1958, p. 199). The discrimination comes about because of the asymmetry between action and inaction and the importance of search activity to innovation. If the "origination of proposals" process feeds the "evaluation of proposals" process, clearly the number of proposals accepted can be influenced by varying either process and holding the other constant.

Dill is presumably referring to the "selection" stage of the skeleton model when he states that the training, experience, current expectations, and other factors of management may affect the organization's readiness to attend to and store types of input information, making the organization highly sensitive to some kinds of information and insensitive to others (Dill, 1962, p. 97). Similarly, March and Simon state that the rate and type of borrowing-type innovation are functions of exposure, and that selective filtering takes place in the transmission and elaboration of proposals (March and Simon, 1958, pp. 188-189).

We will now develop propositions from the literature and attempt to specify the variables suggested as (1) variables influencing the flow of perceived ideas to be evaluated, (2) variables influencing the acceptance of those ideas which are evaluated, and (3) variables influencing both stages.

It should be pointed out that the two stages of the model are not independent. Baker noted the effect of idea rejection on the idea production of Research and Development scientists, and social psychology theory postulates an effect called "response inhibition" whereby negative value associated with a response leads to inhibition of that response in future occurrances of the associated stimulus (Baker, 1965, p. 54), (Campbell, 1965). In the industrial innovation context, idea rejection tends to inhibit the production and transmission of ideas for evaluation, and hence the evaluation stage of the model influences the flow of ideas for evaluation coming through the selection stage. In addition, it appears that most of the variables influencing the selection stage also influence the evaluation stage.

A skeleton model embodying the above considerations is shown in Fig. 1.1. At the left and impinging on the selection process is the universe of all possible ideas for evaluation. This universe, is somewhat analogous to the "list of techno-economic opportunities" conceptualized by Rubenstein

in a paper delivered to the Institute of Management Sciences (Rubenstein, 1963, p. 6). From this universe the idea evaluator selects ideas for evaluation, having the option of searching for ideas which he has not previously perceived, selecting ideas which he has previously perceived but not evaluated, or selecting for re-evaluation ideas which he has previously evaluated. In Fig. 1.1 those ideas from the universe which have been perceived and selected for evaluation flow through the selection process to the evaluation stage. The flow of perceived ideas selected for evaluation is input to the evaluation process, and flows of ideas accepted and not accepted are the outputs from the evaluation process. As mentioned above, there are feedback effects, not shown in Fig. 1.1, which link the evaluation process back to the selection process.

An alternative conceptualization of the idea evaluation process is available, based on the assumption that a rough and quick evaluation is an inherent part of the perception of an idea. Under this assumption, there is no such thing as an idea which has been perceived but not evaluated, and an evaluation therefore necessarily preceeds the selection process. Under this conceptualization, two stages of evaluation are required, a "preliminary" evaluation incident to selection and a more formal evaluation which results in acceptance or non-acceptance of an idea in a particular context.

The focus of this research is such that it is not possible to differentiat between these two conceptualizations. While the second conceptualization discussed is plausible, it requires the assumption that some level of evaluation is inherent in the perceptual process. Lacking strong evidence for the validity of this assumption, the original conceptualization above was used for this research.

As Rubenstein pointed out in the reference cited above, it is difficult if not impossible to enumerate the population of the universe of potential ideas. In addition to this difficulty, the universe of potential ideas for any given organization depends on the types of technologies relevant to that organization's scale of operation, and probably other factors as well. This research will not attempt to deal with the problems of defining or estimating the size of the universe of potential ideas. Instead we will concentrate on a measurement of the flows of perceived ideas for evaluation and of ideas accepted and not accepted, along with the measurement of other variables which may help explain the variations in the flows mentioned.

In the following pages, those variables which influence the selection stage are discussed first, followed by those variables which influence only the evaluation stage. Although the propositions generated are expressed as two-variable relationships, they are parts of an interactive system and hence an implied "other things being equal" accompanies each proposition.

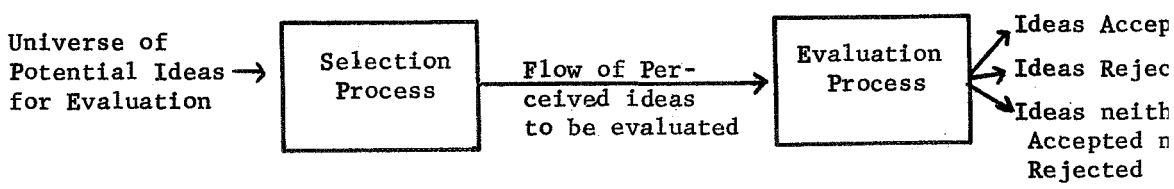


Fig. 1.1 A skeleton model of the flow of ideas through evaluation.

Variables Which Influence the Selection Process

Size of the Firm

It will be recalled that Mansfield found that larger firms showed a shorter time lag between the availability of an innovation and its adoption than did smaller firms. While Mansfield is actually dealing with idea evaluation, the reasons he gives for his proposition seem to apply to the idea selection stage as well. His arguments for the size effect on innovation are as follows:

1. Large firms can more easily bear the cost and risk of innovations than smaller firms, and large firms can commit resources to reduce the risk.
2. Large firms are more likely to contain the conditions appropriate to the installation of any given innovation than are smaller firms.
3. Large firms, having more equipment, will have more equipment that needs replacing at any given time than do smaller firms. Hence, they have more forced opportunities to consider innovation.

(Mansfield, 1963, p. 291)

Mansfield's measure of size was sales level. For reasons to be discussed later, this research will use number of employees as the measure of size. Some theoretical statements bearing on this measure are discussed below.

Carter and Williams imply a size effect when they comment on the importance of a company having the capacity to handle innovations. (Carter and Williams, 1957, p. 70). Here capacity refers to financial, managerial, and productive capacity, and presumably the number of employees in the firm is a component of productive capacity. As was the case with Mansfield's proposition, a firm's capacity for innovation would presumably influence both the flow of perceived ideas for evaluation and the evaluation decisions on those ideas.

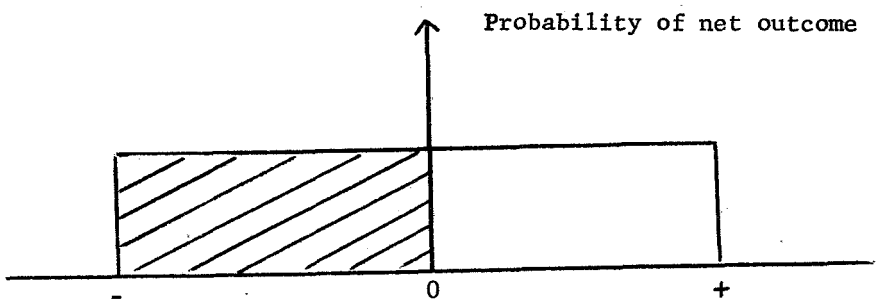
Closely related to the concept of capacity is the March and Simon observation that programmed tasks take precedence over unprogrammed tasks. (March and Simon, 1955, p. 185). On the same subject, Sayles hypothesizes that individual creativity and innovation are a function of the amount of time and energy an individual can extract from the daily routine and fire-fighting activities of his job. (Sayles, 1964). If individuals in small organizations spend more time and energy on routine and fire-fighting activities than do those in larger organizations (and it is not clear that they do), then individuals in large companies might tend to be more innovative than those in smaller companies.

We can then state proposition 1 as follows:

1. The more employees in a firm, the larger the flow of perceived ideas for evaluation and the more likely that any given idea will be accepted.

Risk Propensity of Idea Evaluators

The evaluation decision, which is a decision to accept or not accept an idea under evaluation, is a decision under
of a class of decisions which has been extensively treated in the decision theory literature. Edwards' survey of this literature illustrates the importance of the concept of risk to this area of investigation, although, as Edwards points out, "risk" itself is variously defined by researchers in the field (Edwards, 1954, p. 380). In the context of the present research, "risk" refers to the probability that an idea will yield a net negative valueto the idea evaluator. For example, if the distribution of possible net outcomes of accepting an idea is as shown by the curve below, the risk associated with accepting that idea is represented by the cross-hatched area under that part of the curve where the outcome is negative. Perhaps the most common negative outcomes in industrial innovations are those cases where an innovation costs more than its value or yields undesirable side effects which outweigh its positive value.



The literature surveyed by Edwards makes extensive reference to the risk which is perceived to be attached to the various alternatives available to the decision maker, but for the most part does not consider the attitude of the decision maker toward risk. Some of the research in the innovation area, however, indicates that the decision maker's attitude toward taking risks is relevant to innovation.

While they do not refer to risk by name, Carter and Williams note the importance of management attitudes toward future problems in the decision to use the results of research and development (Carter and Williams, 1957, p. 61). Again, without calling it risk, Hess and Miller noted that innovation among dairy farmers was significantly impeded by the refusal of many of the farmers to go into debt, this refusal being based on fear of adverse economic conditions (Hess and Miller, 1954, p. 16). The historical analyses of both Mansfield and Strassman refer to the "perceived risk of innovating," and a type of risk attitude was used in a farm study by Hoffer and Stangland. Their measure was a projective test which appears to tap attitudes toward risk, security, and tradition. The measure correlated with adoption of new practices in corn growing, leading the authors to conclude that farmers who were willing to take risks and who were progressive tended to adopt the practices (Hoffer and Stangland, 1958, pp. 115-120).

Wallach and Kogan have developed an instrument which they believe measures a person's attitude toward risk-taking. They refer to the measure as the "risk propensity" of an individual. Referring to the construct validity of the instrument, the authors report a series of findings "consistent with a risk taking interpretation." (Wallach, Kogan and Bem, 1962, p. 78). The internal consistency of the instrument has been tested on groups of various ages and sexes, resulting in split-half Spearman-Brown reliability coefficients of from .53 to .80. (Wallach and Kogan, 1961, p. 30). Finally, the test-retest reliability of the instrument was tested over a one week period under instructions which encouraged change rather than constancy. The correlations between successive scores by various groups ranged from .78 to .82. (Wallach, Kogan and Bem, 1962, p. 83). Thus the instrument appears to have satisfactory reliability, and there is some evidence of construct validity.

The instrument above, which is called the Choice-Dilemmas Procedure, has been used to predict gambling behavior in experimental settings, but has apparently never been used in a field setting (Kogan, 1966). An examination of the instrument, located in Appendix 1, reveals that it asks the respondent to advise a third person on 12 decisions involving several different types of risk (i.e. death, financial loss, unhappy marriage, etc.). Each decision balances a risk-free course of action against a course of action which carries a risk of failure but whose favorable outcome is more desirable than the riskless outcome. The respondent is asked to indicate the minimum probability of success that he would demand in order to advise a third person to choose the risky course of action. The structure of the instrument is thus similar to that used to determine utility levels of various lottery tickets in the Von Neumann-Morgenstern utility scheme (Baumol, 1961, p. 335). The author speculates that the risk aversion concept used in the Von-Neumann-Morgenstern work bears a relationship to the risk propensity concept under investigation here.

In view of the evidence above, it seems reasonable to postulate that if two idea evaluators are faced with the same set of ideas distributed over a risk dimension, evaluator A, with a higher risk propensity, is likely to accept more of the ideas than evaluator B, with the lower risk propensity, other things being equal. That is, A's risk threshold will include more of the ideas in the risk distribution than will that of B. Over a period of time, the feedback effect postulated by Baker and discussed on page I-12 will result in the idea evaluator with lower risk propensity perceiving fewer ideas to evaluate. Assuming that an individual's risk propensity is reasonably stable over time, hypothesis 2 is

> 2. The greater the risk taking propensity of an idea evaluator in an organization, the larger the flow of perceived ideas for evaluation and the more likely that any given idea will be accepted.

Age of Idea Evaluators

Age is one of the most frequently mentioned variables in the innovation and diffusion literature. As mentioned earlier, Mansfield found no significant correlation between age of the president and innovation time lag. Many of the diffusion research results, however, have found such correlations

(Rogers, 1962, p. 172). In particular, Lapp found a significant negative correlation between age of executives and "innovation score" in the railroad industry. (Lapp, 1966, p. 148). While the literature is not consistent, it appears that age is a variable worth studying. Although the mechanism of the age effect is not known, presumably it would affect both the flow of perceived ideas to be evaluated and the outcome of individual idea evaluations. Hypothesis 3 is then

3. The higher the age of the idea evaluator, the smaller the flow of perceived ideas for evaluation and the less likely that any given idea will be accepted.

Evaluator Satisfaction with Sales and Costs

The influence of dissatisfaction on the initiation of change has been noted by many authors. One of the characteristics of Carter and Williams' "parochial firms" is the belief, among management, that the firm doesn't need outside ideas (Carter and Williams, 1957, p. 108). The same authors, referring to the factors which inhibit the conversion of R and D ideas into products, cite the lack of a feeling of need for a new product on the part of production and sales executives (Ibid, p. 62). Bright points out that industrial resistance to innovation is greater where people are satisfied with the status quo. (Bright, 1964, p. 131). Dill echoes this in observing that organizations which seek people who have high aspiration levels and who are easily dissatisfied are better able to adapt than are organizations who seek other kinds of people (Dill, 1962, p. 104).

A similar effect is noted in agriculture. Lionberger observes that those farmers who were quickest to adopt new practices had higher aspiration levels than the community average (Lionberger, 1960, p. 16).

March and Simon approach the above effect from a theoretical point of view, arguing that the psychological concept of aspiration level holds for organizations as well as for individuals. (March and Simon, 1958, p. 182). Without going into the theory of how aspiration levels are determined, we can summarize the concept by stating that dissatisfaction results when achievement in any sphere of activity is below the aspiration level or goal for that sphere. Dissatisfaction in turn triggers a search for better ways of meeting the existing goals. The analogy of the above process in the industrial innovation setting might be dissatisfaction with cost or profit levels triggering a search for improved production methods. This search would presumably result in an increase in the flow of perceived ideas to be evaluated and might also enhance the probability that a given idea will be accepted. Hypothesis 4 is then

4. The greater the idea evaluator's dissatisfaction with sales and cost levels, the larger the flow of perceived ideas to be evaluated and the more likely that a given idea will be accepted.

Formal Education of the Idea Evaluators

Formal education or training is mentioned by several authorities as being associated with innovativeness. In a study of consumer innovations Bell

noted that innovators had a "very high" education level as compared to the average for his sample (Bell, 1962). In the agricultural setting, Marsh and Coleman (1955, p. 292) and Hildebrand and Partenheimer (1958, p. 447) found that the amount of a farmer's formal education correlated significantly with his innovativeness. Although he is not sure it stems from formal education, Rogers notes that early adopters have different mental abilities than later adopters, and speculates that the difference may be due to an ability to deal with abstractions, which the early adopters presumably possess (Rogers, 1962, p. 111, 177).

The industrial and theoretical literature also refers to the importance of certain types of training. Carter and Williams note that the receptivity of a firm to technological change depends on an understanding of and appreciation for science and technology, both of which in turn depend on the training and experience of the management (Carter and Williams, 1957, p. 66). Similarly, Dill hypothesizes that the training of the management is one factor which heightens the sensitivity of an organization to certain kinds of information and leaves it insensitive to others (Dill, 1962, p. 97). Lapp found a high correlation between mean amount of college education of railroad managers and the innovativeness score of their railroad (Lapp, 1966, p. 145). Finally, although he does not attribute this factor to education, Bright notes that management is sometimes unable or unwilling to tackle the tough economic and technical feasibility evaluation which accompanies some technological innovations (Bright, 1964, p. 437). Presumably this results in rejection of the proposed innovation. It is conceivable that an inability to tackle a technical feasibility study could result from a lack of the appropriate technical education.

The citations above indicate that the education effect influences both the flow of perceived ideas for evaluation and the probability that a given idea will be accepted. Hypothesis 5 is then

5. The greater the formal education of the idea evaluators, the larger the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

Exposure of the Idea Evaluators to Outside Contacts and Sources of Information

Using various terms, many professional writers refer to the effect, on a person's innovativeness, of contacts and sources of information outside the person's immediate social system. Carter and Williams noted that progressive firms were characterized by a readiness to look outside the firm, to use outside standards and management techniques, to have people travel, and to be conscious of the best standards. On the other hand, one of the characteristics of change-resistant firms was that managers had spent their lifetimes in the firm, and saw no need for outside ideas or help (Carter and Williams, 1957, p. 108, 177). A similar idea was advanced by Strassman, who concluded that a lack of men trained in more than one industry, and a lack of publications catering to businessmen of more than one industry, impeded industrial innovation in the United States of the 19th Century (Strassman, 1959, p. 209).

Chandler's depth study of four large corporations yielded the generalization that innovation was best carried out by younger executives who had not

been confined to one firm (Chandler, 1966, p. 396). And Bright observes that significant innovations are more often made by people outside of, but in contact with, a particular industry, than by people inside the industry (Bright, 1964, p. 97).

In the medical context, doctors who innovated in the use of a particular drug were found to be those who attended more out of town specialty meetings, received more journals, sought advice more often from colleagues, and shared offices more often than the average doctor (Coleman, Menzel, and Katz, 1964, p. 442-445). Katz generalized the findings of the above study by observing that early-adopting physicians were more in touch with relevant sources of influence, outside their community as well as inside it, than later-adopting physicians (Katz, 1963, p. 84).

The same effect seems to influence consumer innovation (acceptance of new products). Bourne found that the broader an individual's social orientation (outside the immediate locality), the more likely that he will accept new ideas (Bourne, 1957, p. 242).

Finally, agricultural innovation studies have numerous references to similar influences. Rogers reports that farm innovators have more contact with scientists and more favorable attitudes toward science, than do late adopters. In addition, early adopters use more information sources and travel more widely than late adopters. Rogers believes that innovators' reference groups are outside the local social system, and that they utilize information sources which are in closer contact with the origins of new ideas, than do non-innovators (Rogers, 1962, pp. 181-207). Danhof observes that an important element in innovation is broadening the sources of information (Danhof, 1949, p. 24).

Specific findings relating to agricultural innovation and exposure to outside sources of information include those of Marsh and Coleman, who found significant correlations between innovativeness and talking to agricultural agency representatives, participating in farm bureau activities, and reading farm bulletins (Marsh and Coleman, 1955, p. 292). Similarly, Gross and Taves found innovators, as compared to non-innovators,

1. Took more trips to the nearest metropolitan center
2. Read more state college bulletins
3. Participated more in community affairs
4. Subscribed to more magazines and newspapers
5. Read more books
6. Took more night school courses
7. Owned a radio more often.

(Gross and Taves, 1952, p. 324).

Other agricultural studies support some of the above findings (Hess and Miller, 1954, p. 6; Dean et al, 1958, p. 121). Finally Hildebrand and Partenheimer found that innovators were much more common among part-time farmers than among full-time farmers (Hildebrand and Partenheimer, 1958, p. 447).

Thus there is evidence from several different areas that exposure to outside contacts and sources of information affects innovation. Lionberger sums up the evidence and adds a causal implication when he says "Farmers exposed to many sources of information and having many contacts outside the immediate locality are more likely to be receptive to change than those who are restricted in their contacts. The evidence indicates that increasing receptivity frequently follows increased contact with people and ideas from beyond the community boundaries, particularly when those contacts are directly related to the changes being advocated." (Lionberger, 1960, p. 16). From the evidence presented, it would appear that exposure to outside contacts and sources of information affects both

the flow of perceived ideas to be evaluated and the probability that a given idea will be accepted. Hypothesis 6 is then

6. The greater the exposure of the idea evaluators to outside contacts and sources of information, the greater the flow of perceived ideas to be evaluated and the more likely that a given idea will be accepted.

Freedom to Alter the Product

This variable is not found in the literature but resulted from preliminary discussions by the author with prospective respondents in the project. Operations in the electronics manufacturing industry vary in the freedom which the manufacturer has to alter the design of the product. At one extreme is the manufacture of proprietary products where the manufacturer has almost complete freedom to design the product as he sees fit, and to alter it as desired. At the other extreme is the job shop operation where each product is made to the electrical and mechanical specifications of the customer and where any changes in product must be approved by the customer, which approval may require a considerable time lag. The potential respondents reported that a manufacturer in the latter situation will not seek ideas for changes in the product to the extent that a manufacturer with more freedom to alter the product might. In addition, the manufacturer with less fredom to alter the product would accept fewer of those ideas which came to him for evaluation than would the manufacturer with more freedom to alter the product. These observarions were combined into hypothesis 7 below

7. The greater the firm's freedom to alter the product, the greater the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

This concludes the discussion of variables which influence the selection stage and hence the flow of perceived ideas for evaluation. All of the variables mentioned so far appear to influence also the evaluation stage. The preceding hypotheses are summarized in Figure 1.2 and a partially completed model is shown in Figure 1.3.

The variables previously discussed are all individual or organizational variables, and it seems reasonable that characteristics of the ideas to be evaluated would also affect the evaluation stage. The next section concerns variables associated with the individual ideas to be evaluated. These variables can be expected to influence primarily the evaluation stage.

1. The more employees in a firm, the larger the flow of perceived ideas for evaluation and the more likely that any given idea will be accepted.

2. The greater the risk taking propensity of the idea evaluators, the larger the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

3. The higher the age of the idea evaluators, the smaller the flow of perceived ideas for evaluation and the less likely that a given idea will be accepted.

4. The greater the idea evaluator's dissatisfaction with sales and cost levels, the larger the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

5. The greater the formal education of the idea evaluators, the larger the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

6. The greater the exposure of the idea evaluators to outside contacts and sources of information, the larger the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

7. The greater the firm's freedom to alter the product, the larger the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

Figure 1.2. A summary of hypotheses influencing the flow of perceived ideas for evaluation.

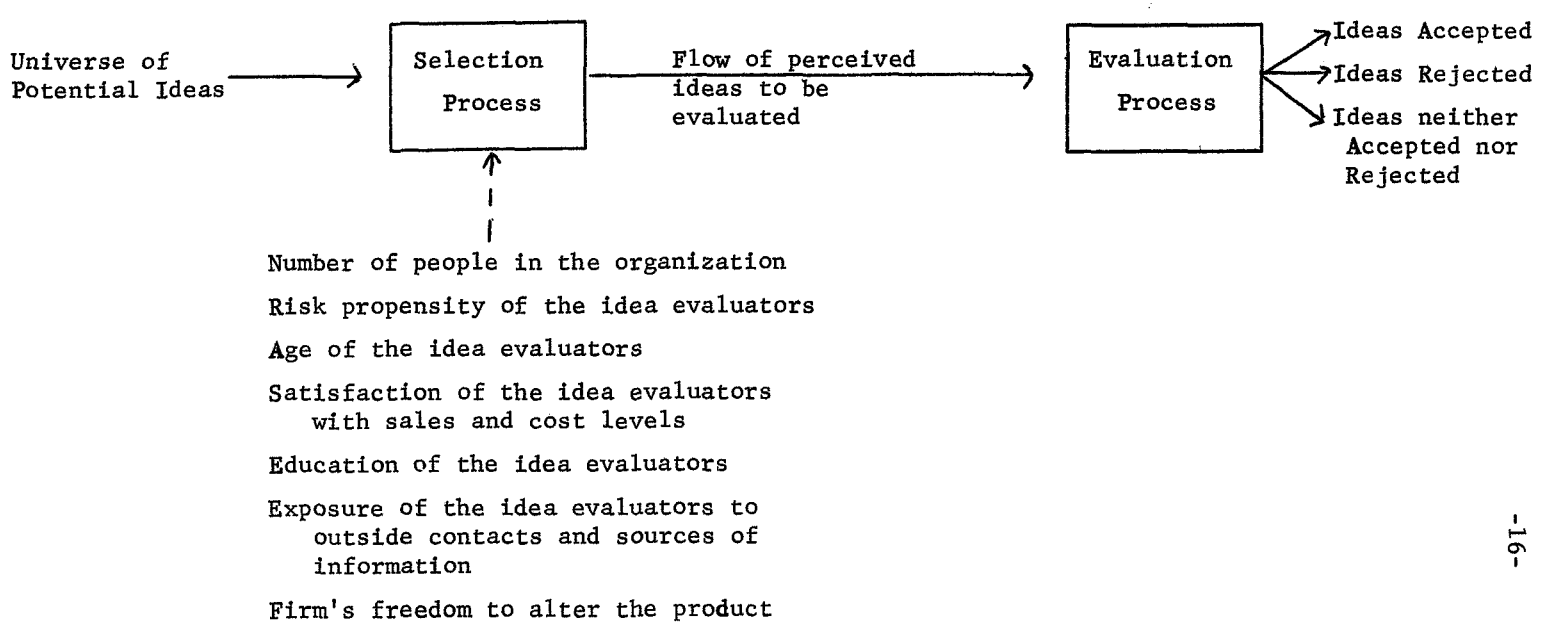


Figure 1.3 A partial model of the flow of ideas through evaluation.

Variables which Influence the Evaluation Process

Evaluation of the Source of an Idea

It is a theory of social psychology that the motivation to perform a certain act is greater the more frequently and/or consistently that act has been rewarded in the past (Campbell, 1965, p. 45). Translating that principle into the environment of this research would yield the statement that the more frequently and/or consistently the acceptance of an idea from a particular source has had beneficial results to the evaluator, the stronger is the motivation of the evaluator to accept new ideas from that source. In other words, an evaluator is more likely to accept ideas from a source which has in the past yielded "good" ideas than from a source which has not yielded good ideas. Proposition 8 is then

8. The more fruitful an idea source, as perceived by an idea evaluator, the more likely that a given idea from that source will be accepted.

Riskiness of an Idea

Initial discussions with the managers of 20 small companies indicated that several propositions about the evaluation of individual ideas were held, often implicitly, by them. One of the subjects discussed frequently in reference to the acceptance of a new idea was the question "will it work in our situation?" More specifically, for ideas related to design changes and new products, the questions were of the form "how will it sell?" or "will it be sufficiently reliable?" For production process changes the questions raised frequently included "how much will it disrupt production?" and "what will be the quality of the product?"

These questions and factors have a common thread in that they all refer to the possibility that acceptance of an idea for a change may have a negative outcome. In other words, a change might not sell as well as the original, it may create a maintenance or replacement problem, it could disrupt production or lower the quality of the product, or it might simply cost more than it saves. The latter possibility was particularly relevant to a number of companies in the sample, for they regularly received orders for a batch of product and subsequently received ideas for ways to improve the product's cost or performance. The decision to invest in improvements depends heavily on the probability that the initial order for the product will be followed by additional orders.

If we use the term "riskiness" to refer to the probability of a negative outcome or failure, it is clear that the questions raised above by the idea evaluators all have aspects of riskiness. Several company managers were explicit in their statements that if two ideas seemed to have the same payoff, and if everything else about them were equal except their probability of failure, they would prefer the idea with a lower probability of failure. These statements led to the formation of proposition 9, which is

9. The lower the probability that a given idea will fail, the more likely that the idea will be accepted.

Cost of Implementing an Idea

Several managers pointed out that since most industrial organizations have a relatively fixed amount of money available for implementing ideas, and since the money cost of implementing an idea represents alternative uses for the money which must be foregone, the cost of implementing an idea has the properties of a deterrent to acceptance of the idea. The extremely tight money market at this time may have accentuated the importance of this factor. It should be noted that the cost variable is here considered separately from the profit variable, which is disucssed in proposition 12. Proposition 10 is then

10. The higher the cost of implementing an idea, the less likely that the idea will be accepted.

Availability of Human Resources

Just as a lack of money could hinder the acceptance of an idea, a lack of people with the required skills could cause an idea to be rejected. This factor was mentioned frequently by managers, and was probably partly a reflection of the tight labor market in existence during the time the research was underway. "Available people" as used below includes those presently working for the company and those which could be hired.

11. The greater the availability of the people required to implement an idea, the more likely that the idea will be accepted.

Dollar Value of the Idea

Mansfield hypothesized that dollar value or profitability of an idea influences acceptance of the idea, high profitability serving to overcome uncertainty and inertia (Mansfield, 1961). This hypothesis is advanced in the present research, becoming proposition 12.

12. The higher the projected profit or savings associated with implementation of an idea, the more likely that the idea will be accepted.

Urgency of the Problem to which an Idea is a Potential Solution

Several managers stated, during initial interviews, that their attitude toward new ideas depended partly on the competing urgencies of the various problems before them, including the one for which they were evaluating ideas. Baker, in a study of ideas generated by a problem solving group in industry, found that 85% of the "best" ideas were submitted in response to a specific organizational need (Baker, 1965, p. 116). While Baker did not measure the urgency of various organizational needs, the managers statements above would seem to indicate that urgent problems receive attention and that ideas directed at solving these problems are likely to be accepted. Proposition 13

is then

13. The more urgent the problem to which an idea is a potential solution, the more likely that the idea will be accepted.

The Presence of Search Behavior

Search behavior on the part of a person or an organization is related to the urgency of the problem under consideration. March and Simon postulate that the amount of search decreases as satisfaction increases (March and Simon, 1958, p. 174). Conversely, the amount of search increases as satisfaction decreases. If urgency of a problem, as discussed previously, can be equated to dissatisfaction, then presumably search behavior would vary directly as urgency of the problem under consideration. It seems reasonable, however, to argue that search behavior results not only from dissatisfaction but also from the expectation that a solution to the problem can be discovered. In other words, a problem could be urgent but the idea evaluator might feel that there was only a remote chance of solving the problem. In such a case search behavior might be minimal. To investigate the possibility that search behavior might have an influence on idea acceptance independent of problem urgency, proposition 14 is advanced.

14. An idea which is a potential solution to a particular problem for which the idea evaluator has been actively searching for a solution is more likely to be accepted than an idea which is a potential solution to a general problem area where the evaluator is always looking for ideas. The latter type of idea is, in turn, more likely to be accepted than an unsought idea.

This completes discussion of the variables which are hypothesized to influence the flow of ideas to an evaluator and the number of these ideas which are accepted. The complete model is shown in Figure 1.4, and the propositions are summarized in Figure 1.5.

It would be naive to expect that the factors discussed in this chapter are the only variables which might influence the flow of ideas for evaluation and the number of ideas which are accepted. As mentioned earlier, the differences between the technologies which are relevant to various product lines can be expected to result in different sets of potential ideas. Additional factors which could influence the number of ideas perceived include the reading, speaking, and conceptual skills of the idea evaluators, the location of the plant, the degree to which the idea evaluators are socially integrated into the society, the intelligence and cultural values of the idea evaluators, and the previous experience of the idea evaluators. These factors are, for the most part, difficult to measure in the field setting to be described. Consequent they do not appear in the model. These omissions can be expected to influence the results of testing the model.

The next chapter will develop the means for acquiring the data necessary to test the model.

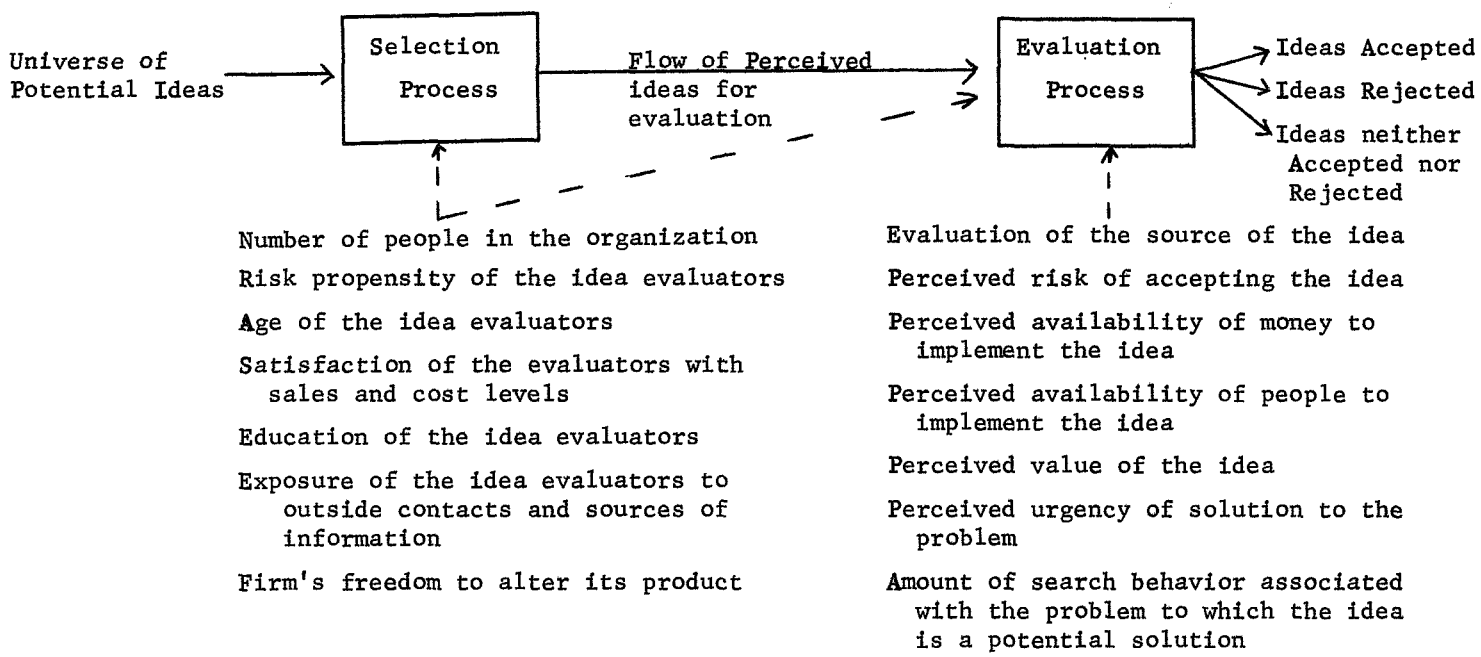


Figure 1.4 A model of the flow of industrial ideas through evaluation

Proposition 1

The more employees in a firm, the larger the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

Proposition 2

The greater the risk-taking propensity of the idea evaluators, the larger the flow of perceived ideas for evaluation and the more likely that any given idea will be accepted.

Proposition 3

The greater the age of the idea evaluators, the smaller the flow of perceived ideas for evaluation and the less likely that any given idea will be accepted.

Proposition 4

The greater the idea evaluator's dissatisfaction with sales and cost levels the larger the flow of perceived ideas to be evaluated and the more likely that any given idea will be accepted.

Proposition 5

The greater the formal education of the idea evaluators, the larger the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

Proposition 6

The greater the exposure of the idea evaluators to outside sources of information and contacts, the greater the flow of perceived ideas to be evaluated and the more likely that a given idea will be accepted.

Proposition 7

The greater the firm's freedom to alter the product, the greater the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

Proposition 8

The more fruitful an idea source, as perceived by an idea evaluator, the more likely that an idea from the source will be accepted by the evaluator.

Proposition 9

The more risky an idea, as perceived by an evaluator, the less likely that the idea will be accepted by the evaluator.

Proposition 10

The higher the perceived cost of an idea, the less likely that the idea will be accepted.

Proposition 11

The higher the perceived availability of human resources to implement an idea, the more likely that the idea will be accepted.

Proposition 12

The higher the projected profitability of an idea, the more likely that the idea will be accepted.

Proposition 13

The more urgent the problem to which an idea is a potential solution, the more likely that the idea will be accepted.

Proposition 14

An idea which is a potential solution to a particular problem for which the idea evaluator has been actively searching for a solution is more likely to be accepted than an idea which is a potential solution to a general problem area where the evaluator is always looking for ideas. The latter type of idea is, in turn, more likely to be accepted than an unsought idea.

Figure 1.5 Propositions on the flow of industrial ideas through evaluation.

CHAPTER II: DEVELOPMENT OF A MATHEMATICAL MODEL

The General Model

The propositions developed in the previous chapter have several characteristics. These include

1. They all postulate joint influences on two dependent variables. Each proposition taken by itself carries an implied "other things being equal," but the independent variables are postulated to act jointly in their influence on the dependent variables.
2. The propositions specify that the functions linking the independent and dependent variables are either increasing or decreasing functions, but they do not specify the form of the functions. A linear relationship seems to be postulated for proposition 1 by Mansfield (Mansfield, 1963, p. 291). On the other hand, the influence of age is believed by some to be curvilinear (Suits, 1957, p. 548). The possibility that curvilinear functions link some of the other independent variables with their dependent variables cannot be excluded.
3. Many of the variables mentioned cannot be expressed as cardinal numbers. Proposition 14 contains an attribute variable, and several propositions contain variables which can be measured only with ordinal numbers or by attributes.

These three characteristics suggest several requirements for any mathematical model developed to relate all 14 propositions. The first characteristic requires that the model be multivariate. The second characteristic suggests that the model not be confined to linear relationships, and the third requires that the model be able to handle attribute variables.

The multivariate regression model with dummy variables meets these requirements. The use of dummy variables is suited to curvilinear relationships and is appropriate for attribute variables (Suits, 1957, p. 548). The model also allows the user to postulate linear relationships with variables measurable in cardinal numbers, where these are appropriate.

The general form of the multiple regression equation with dummy variables is given below.

$$Y = a\,X + \sum_{i=1}^{t} \sum_{j=1}^{K_i} b_{ij} R_{ij} + c + u$$

where Y = the dependent variable

X = a continuous independent variable

$$R_{ij} = \begin{cases} 1 & \text{if the value of the } i^{th} \text{ variable falls within the } j^{th} \text{ interval of that variable} \\ 0 & \text{otherwise} \end{cases}$$

a = the regression coefficient for the continuous variable X

b_{ij} = the regression coefficient for the ith variable over the jth interval of that variable.

c = a constant

u = a random error term.

The Model for the First Stage

It will be recalled that the model postulated in the preceding chapter contained two stages. The first stage hypothesized that 8 individual and organizational variables influence the flow of perceived ideas for evaluation. Expressing this flow as the number of ideas evaluated in a given time period, the first stage of the model can be represented by the regression equation below.

$$Y = aX + \sum_{j=1}^{K_1} b_{1j}R_{1j} + \sum_{j=1}^{K_2} b_{2j}R_{2j} + \sum_{j=1}^{K_3} b_{3j}R_{3j}$$

$$+ \sum_{j=1}^{K_4} b_{4j}R_{4j} + \sum_{j=1}^{K_5} b_{5j}R_{5j} + \sum_{j=1}^{K_6} b_{6j}R_{6j} + c + u$$

where

Y = the number of ideas for evaluation perceived by a given idea evaluator in a given time period

X = the number of employees in the organization to which the idea evaluator belongs

a = the regression coefficient associated with the above variable

$R_{1j} = \begin{cases} 1 & \text{if the idea evaluator's risk propensity is within the } j^{th} \text{ interval on the risk propensity scale} \\ 0 & \text{otherwise} \end{cases}$

b_{1j} = the regression coefficient of risk propensity over the jth interval

$R_{2j} = \begin{cases} 1 & \text{if the idea evaluator's age is within the } j^{th} \text{ interval on the age scale} \\ 0 & \text{otherwise} \end{cases}$

b_{2j} = the regression coefficient of age over the jth interval

$R_{3j} = \begin{cases} 1 & \text{if the idea evaluator's satisfaction with cost and sales levels is in the } j^{th} \text{ interval on the satisfaction scale} \\ 0 & \text{otherwise} \end{cases}$

b_{3j} = the regression coefficient of satisfaction with cost and sales levels over the jth interval

$R_{4j} = \begin{cases} 1 & \text{if the idea evaluator's formal education is in the } j^{th} \text{ interval on the formal education scale} \\ 0 & \text{otherwise} \end{cases}$

b_{4j} = the regression coefficient of formal education over the jth interval

$R_{5j} = \begin{cases} 1 & \text{if the idea evaluator's exposure to outside contacts and sources of information is in the } j^{th} \text{ interval on the exposure scale} \\ 0 & \text{otherwise} \end{cases}$

b_{5j} = the regression coefficient of exposure over the jth interval

$R_{6j} = \begin{cases} 1 & \text{if the evaluator's company's freedom to alter the product is in the } j^{th} \text{ interval on the freedom to alter the product scale} \\ 0 & \text{otherwise} \end{cases}$

b_{6j} = the regression coefficient of freedom to alter the product over the jth interval

c = the regression constant

u = a random error term.

Although the term "interval" has been used above, in each case the terms "attribute" or "category" could be substituted. Under either usage, the

regression coefficient is interpreted as the contribution to the dependent variable associated with the observation that an independent variable is in a given interval or has a given attribute.

As an example of the above, suppose that the variable "freedom to alter the product" is measured in three intervals or categories, such as "low", medium" and "high". Let "low" be category 1 (j=1), "medium" be category 2 (j=2) and "high" be category 3 (j=3). Then an individual idea evaluator whose company has "medium" freedom to alter the product would receive the following entries in the "freedom to alter the product" section of the individual's regression equation:

$$R_{61} = 0$$
$$R_{62} = 1$$
$$R_{63} = 0$$

The other variables represented by dummy variables would be treated in an analogous manner.

After the regression equation has been "solved," using data for all idea evaluators, each b_{ij} will be given a value which represents the best fit of the hypothesized relationship. For reasons which will be explained below, the number of non-zero coefficients is always at least one less than the number of categories. Continuing the consideration of the "freedom to alter the product" variable, suppose the relevant coefficients which emerge from the best fit procedure are, say,

$$b_{62} = .17$$
$$b_{63} = .25$$

The above results are interpreted as follows: the fact that an idea evaluator's company has "medium freedom to alter the product" is associated with an increase of .17 in the number of idea evaluations per unit time. The fact that the company has "high freedom to alter the product" has a similar effect, with an increase of .25.

The use of "increase" above requires further explanation. Each variable is divided into K_i intervals and each interval is assigned an R_{ij} if one if a particular measurement of that variable falls into that interval and zero otherwise. Since any particular individual measurement on the ith variable falls into one and only one interval of that variable,

$$\sum_{j=1}^{K_i} R_{ij} = 1 \qquad \text{for every } i.$$

This condition means that a complete set of R_{ij} for an individual measurement is redundant, for given K_i-1 values of R_{ij} and the condition above, it is always possible to deduce the $K_i{}^{th}$ R_{ij}. This in turn means that a matrix composed of measurements on all intervals of each variable will be non-invertible due to the fact that for every variable there is a column which is a linear combination of the other K_i-1 columns which constitute the intervals of that variable. Thus, the regression equation as given earlier is inderterminate. It can be restored to determinacy by setting the coefficient for one interval of each variable equal to zero (Suits, 1957, p. 548).

As an example of the above, suppose the variable "freedom to alter the product" is divided into three intervals or attributes: "high," "medium," and "low" freedom. For a given idea evaluator whose company has "medium" freedom to

alter the product, the binary scoring described above for the variable is as follows:

Freedom to alter the product		
Low	Medium	High
0	1	0

For every variable, one and only one interval or attribute receives a "1" score. All the other intervals or attributes receive scores of "0", since the measurement scheme is so constructed that a company cannot have, say, both "medium" and "high" freedom to alter the product.

These conditions mean that if any one interval or attribute measurement in the above example is covered up or concealed, we could always guess what it must be. For example, if all we were told about the particular company below were these scores,

Freedom to alter the product		
Low	Medium	High
	1	0

we would know immediately that the correct score for "low" must be a "0". Similarly if we were told the scores below,

Freedom to alter the product		
Low	Medium	High
0		0

we would know immediately that the correct score for the "medium" attribute had to be a "1".

The above situation means that we could do without the score on any one interval or attribute of the above variables, as long as we know (1) how many attributes or intervals constitute the variable, and (2) the scores on the remaining intervals or attributes. This is true for every variable regardless of the number of intervals or attributes into which it is divided, and it means that a complete set of scores for each variable contains redundant information.

The redundant information is harmless to an individual contemplating the data, but it renders the data un-analyzable by the technique of multiple regression. In order to remove the redundancy and allow the use of multiple regression analysis, the scores for one attribute or interval of each variable are dropped from the data before analysis. As shown above in the example, this deletion of data does not reduce the amount of information in the remaining data.

Setting certain coefficients equal to zero as above means that the b_{ij} coefficients measure shifts in the regression as deviations from the intercept of the eliminated category. In the case presented above, where the "low" category coefficient (b_{43}) was arbitrarily set equal to zero, the values of b_{62} and b_{63} measure shifts in the number of ideas evaluated per unit time from the number that would have been predicted for an idea evaluator in a company with low freedom to alter the product. In other words, b_{62} represents the increase in number of ideas evaluated per unit time associated with the fact that an idea evaluator's company has "medium," as compared to "low," freedom to alter the product. b_{63} represents the increase in number of ideas evaluated per unit time associated with the fact that an idea evaluator's company has "high," as compared with "low," freedom to alter the product. Variables other than "freedom to alter the product" are treated and interpreted similarly.

The above mathematical model and interpretation is concerned with the first stage of the theoretical model, comprising the first eight propositions.

We now turn to the second stage of the model and the remaining propositions.

Model for the Second Stage

It will be recalled that the second stage of the theoretical model presented in Chapter I referred to the evaluation of ideas. The eight variables hypothesized to influence the first stage are also believed to influence the second stage. In addition, seven other idea-specific variables are hypothesized to influence the acceptance or non-acceptance of each individual idea. Thus a total of 14 variables are believed to influence the acceptance or non-acceptance of each individual idea. While it is true that an idea can have dispositions other than acceptance or non-acceptance, such as being under study or temporarily dormant, it is not feasible to relate these dispositions to each other quantitatively. Thus while the actual disposition of an idea is of considerable interest and will be investigated, it is necessary to consider only two dispositions in the mathematical model. By doing this it becomes possible to use a binary multiple regression model with two possible idea dispositions, acceptance and non-acceptance. The unit of analysis in such a model is the individual idea. The model is

$$Z = \sum_{i=1}^{T} \sum_{j=1}^{K_j} d_{ij} S_{ij} + g + u$$

where

$$Z = \begin{cases} 1 \text{ if the idea is accepted} \\ 0 \text{ if not} \end{cases}$$

d_{ij} is analogous to b_{ij} in the previous model

s_{ij} is analogous to R_{ij} in the previous model

g is analogous to c in the previous model

u = a random error term.

The model above is similar to the first stage model except that the dependent variable is now binary instead of continuous, and x, the continuous independent variable present in the first stage model, is not present in the above model. Thus the above model is binary throughout.

Because of the similarity of application of this idea-oriented model to the first stage evaluator-oriented model, the individual variables will not be delineated here. They are the same eight variables expressed in the first stage model, plus the seven idea-specific variables listed below.

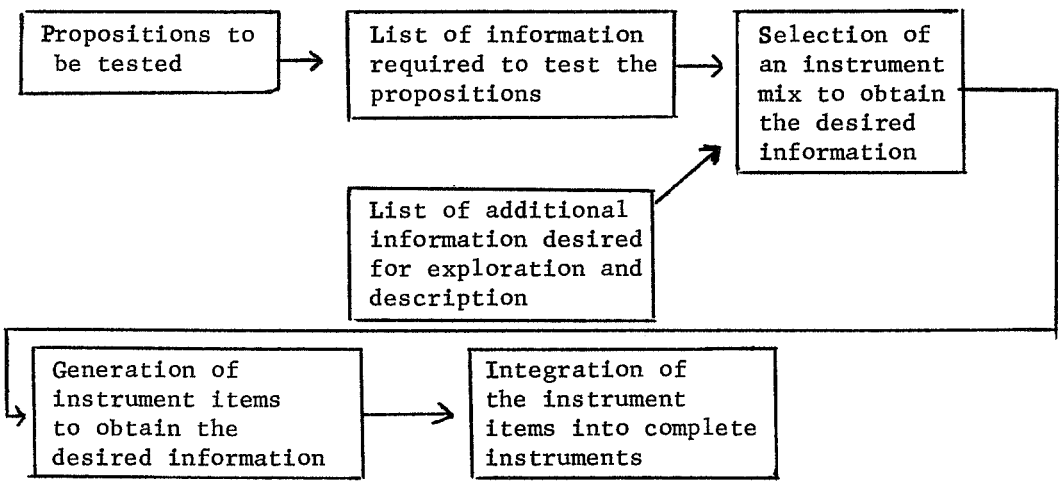
Evaluation of the source of the idea
Perceived risk of accepting the idea
Perceived availability of money to implement the idea
Perceived availability of people to implement the idea
Perceived value of the idea
Perceived urgency of the problem to which the idea is a potential solution
Amount of search which was associated with the problem to which the idea is a potential solution

The d_{ij} coefficients generated by the regression procedure are interpreted as the conditional probability that an idea is accepted, given that the ith variable is in the jth category or interval of the variable. The Z value predicted by the regression procedure is interpreted as the conditional probability that an idea is accepted, given a set of values of the independent variables and attributes. (Johnston, 1963, p. 224).

CHAPTER III: METHODOLOGY

Introduction

The purpose of the research reported here is twofold: to explore the nature of the flow of production-related ideas into industrial companies and to test hypotheses about this process. The purpose of this chapter is to develop a means of gathering the data required to test propositions enumerated previously and to explore the process of idea flow and evaluation in industry. The development of data gathering instruments occurred in the stages shown below.



The propositions to be tested have already been listed. Information requirements are developed in the next section, and subsequent sections deal with instrument mix selection, generation of instrument items, and design of instruments.

To avoid differences due to membership in different industries, it was decided this research would be conducted in a number of companies in the same industry. The initial intention was to survey at least 20 companies, concentrating on those with fewer than 500 employees. These decisions influenced the selection and construction of data-gathering instruments.

Information required to test the propositions

In this section each proposition previously enumerated is listed, followed by the variable referred to and the information required to measure that variable. The dependent variables are listed at the end of the list of propositions.

Item No.	Proposition referred to	Variable	Information Requirement
1.	1	Number of employees	Number of employees in each company studied
2.	2	Risk propensity	Risk propensity of each idea evaluator
3.	3	Age	Age of each evaluator
4.	4	Dissatisfaction	Level of dissatisfaction with sales and costs, for each idea evaluator
5.	5	Formal education	Level of each idea evaluator's formal education
6.	6	Exposure to outside contacts and sources of information	Amount of exposure of each idea evaluator to outside contacts and sources of information
7.	7	Freedom to alter the product	Extent to which each company can alter its product
8.	8	Fruitfulness of idea source	Evaluation of the fruitfulness of each idea source by each idea evaluated
9.	9	Riskiness of idea	Each idea evaluator's estimate of the riskiness of each idea evaluator
10.	10	Cost of idea	Each idea evaluator's estimate of the cost of implementing each idea evaluated
11.	11	Availability of human resources	Each idea evaluator's estimate of the availability of human resources to implement each idea
12.	12	Potential profitability of idea	Each idea evaluator's estimate of the potential profitability of each idea
13.	13	Urgency of problem	Each idea evaluator's estimate of the urgency of the problem to which each idea is a potential solution.
14.	14	Extent of search associated with an idea	The extent to which the idea evaluator had been searching for that particular type of idea when each idea was evaluated.

15.	All	Number of ideas evaluated	The number and identity of ideas evaluated by each idea evaluator
16.	All	Number and identity of ideas evaluated which are accepted	The number and identity of ideas accepted by each idea evaluator

Information desired to explore the process of the flow and evaluation of production-related ideas in industrial companies

In addition to the information required to test the propositions, additional information was desired to explore the process of the flow and evaluation of production-related ideas in industrial companies. The information requirements associated with this exploration objective were generated by the author as a result of reading and discussion with graduate students and faculty members associated with the Northwestern University Idea Flow Studies (see, for example, Program of Research on the Management of Research and Development, Document Numbers 65/12, 65/30, 65/36).

The Idea Flow studies at Northwestern University focus on Research and Development ideas and define an idea as "an actual or potential proposal for undertaking new technical work which will require the commitment of significant organizational resources, such as time, money, manpower, energy" (Rubenstein, 1963). For the purpose of this study, an idea was defined as "a suggestion or proposal which would, if accepted, significantly alter the company's product, product line, or production process." Thus this research did not focus on the same type of ideas as did the idea flow studies. Some of the concepts and findings of the idea flow studies were felt to be relevant to this research, however, and were incorporated into the research as information requirements. These information requirements, less structured than the previous ones listed, are indicated in Figure 3.1 below. In each case the term "idea" refers to the production-related ideas, as defined above. Item numbers continue the numbering developed in the previous section.

Item No.	Information Requirements
17.	Whether the companies studied are single plant or multi-plant. If the latter, the size of the parent company.
18.	The technical sophistication of the participating plants and their parent companies.
19.	The approximate amount of value added to its product by each plant.
20.	The source of any limitations on the company's freedom to alter its product.
21.	The identity of the evaluator of each idea in terms of his position in the company.
22.	The time lag between hearing of an idea and taking action on it.

23. The types of ideas under consideration in terms of whether the ideas are for a material substitution in a product, a change in design of a product, a change in production method, or a new product.

24. The sources of the ideas under consideration

25. The disposition of each idea.

Figure 3.1 Exploratory information requirements

Selection of an instrument mix to obtain the desired information

The information requirements stated in the two previous sections fall naturally into three categories. The first category consists of general and background information pertaining to each organization studied. The second category contains information pertaining to each individual idea evaluator, and the third category is that of information on each idea evaluated. The three categories and the information requirement item numbers falling within each are shown below.

Category	Information requirement item numbers
Company-level information	1, 7, 17-20
Individual-level information	2-6
Idea-level information	8-16, 21-25

The company-level information requirements for companies of the size studied were not available in public sources, with one exception. The number of employees was listed in the Illinois Manufacturers Directory for all companies studied. This information, however, was over six months old and was found to be inaccurate when compared with company presidents' figures gathered during the pilot study. It was therefore necessary to gather all company-level information by querying the managers, and interview-questionnaire was selected as the instrument for obtaining this information.

Of the six items of individual-level information, only age and formal education are likely to be recorded anywhere. These two items are usually recorded in company personnel records. Attempts to gain access to such records, however, were refused on the grounds that the information was confidential. It was therefore necessary to obtain all individual-level information items by querying the individuals directly, and written questionnaire was selected for this task.

Idea-level information posed a larger problem than the two categories already discussed, since ideas presumably occur at irregular intervals both while the evaluators are at work and when they are not. In addition, the occurance of an idea evaluation does not necessarily lead to any tangible evidence and therefore must be obtained by self report of the evaluator, either as it occurs or from memory. The possibility of forgetting the existence of an idea evaluation suggested that the time lag between idea evaluation and the measurement of idea-level information items should be minimized. For earlier

field experience with this factor see Program of Research on the Management of Research and Development, Northwestern University, Document numbers 65/25 and 66/28.

Two types of reporting devices were designed to meet the objective of minimizing the time between the occurrence of an idea evaluation and the acquisition of information about the evaluation. They were the self-initiated report and the high frequency researcher-initiated query. In the former, the respondent is asked to initiate a report whenever he makes an idea evaluation. A variation of this would have the respondent report, at frequent regular intervals, on his idea evaluation activities. The high frequency researcher-initiated query would consist of frequent communications from the researcher to the respondent, asking for any idea evaluation activity since the last communication.

A two-stage pilot study was used to resolve the selection of an idea evaluation reporting device and to evaluate other data gathering methods. The second step will be discussed later.

The first stage consisted of interviews with the managers of 19 companies. These interviews were designed to test the general approach of the study, guage the managers' willingness to divulge the information required for the study, and select a means for reporting idea evaluations. The overall approach of the study occasioned general support from the potential respondents. The information requirements met significant resistance only in the area of sales levels; a number of managers stated that they could not divulge this information. There was also some resistance to divulging idea level information on the grounds of company security, but this was apparently overcome by an explanation of the research security system and by the researcher's assurance that the respondents could use a coding system to refer to their specific ideas.

With respect to reporting idea evaluations, the managers' opinions were somewhat one-sided. No one expressed a preference for frequent, regular reporting. Two-thirds of the people interviewed preferred written reporting as ideas were evaluated. The majority of this two-thirds gave the impression they could not participate in the study if it required frequent telephone calls, either incoming or outgoing. The reasons cited most frequently for this feeling were the disruption to work occasioned by telephone calls and the managers' frequent inaccessibility by telephone. Most potential respondents indicated that one telephone call a week was acceptable, but more would be disruptive.

This set of potential respondent attitudes caused attention to be focused on a written, self-reporting, respondent-initiated system for gathering idea evaluation information. In order to capture some of the desirable prompting value of the rejected researcher-initiated query, it was decided to use the acceptable limit of one telephone call per week to remind the respondents of the study. Accordingly, the researcher called each respondent once a week and suggested that he (the researcher) would like to visit the respondent's plant and pick up the accumulated written idea reports. This call and impending visit apparently prompted respondents to search their memory for idea evaluations which had been made but not reported, for the distribution below shows a large number of idea evaluations dated the same day as the researcher's visit. The weekly visit also provided an opportunity for discussion of the written idea reports, thereby mitigating the impersonality of the written reports, and insuring that the questions were being interpreted as intended.

Time lag between date of idea report and date of researcher's visit, days	Number of idea reports
0 (same day)	119
1	38
2	14
3	42
4	14
5	22
6	22
7	18
8 or more	84
TOTAL	373

Fig. 3.2 Distribution of time lag between date of idea report and date of researcher visit.

The distribution above indicates that there was a midweek "peak" of idea reports 3 days before the researcher visit. It also shows a large number of idea reports dated more than one week before the research visit. Some of them occurred in companies with many respondents, where not all the respondents were able to return their idea reports by the day of the researcher visit. The others were the result of late recall of earlier idea evaluations.

The time lag between the date an evaluator reported first hearing of an idea and the date he reported an evaluation of the idea is presented in Fig. 33. The time lags are longer than those of Fig. 3.1, as is to be expected. Although a significant fraction of ideas (23%) was evaluated the same day they were received by the evaluator, another significant fraction (22%) was evaluated more than a month after reception by the evaluator. Pound, commenting on his study of the evaluation of Research and Development ideas, stated "idea evaluation is not necessarily a fast process" (Pound, 1966, p.ii). Apparently the same can be said for idea evaluations of the type studied here.

Time Lag	Number of Ideas	Percent of Total
0 (same day)	87	23.0%
1 day	22	5.8%
2 days	20	5.3%
3 days	13	3.4%
4 days	12	3.2%
5 days	17	4.5%
6 days	15	4.0%
7 days	15	4.0%
1 week-1 month	91	24.2%
1 month-1 year	80	21.2%
3 years or more	5	1.3%
	377	100.0%

Fig. 3.3 Time lag between the date an evaluator first heard of an idea and the date he reported evaluating it.

The first stage of the pilot study also resulted in several suggestions that the amount of freedom a company had to alter its product influenced the amount of attention the managers paid to ideas for alteration of the product or process. These suggestions led to the incorporation of a variable called "freedom to alter the product" into the study.

In summary, the instrument mix selected to obtain the information requirements stated earlier is as follows:

Category of Information Requirements	Items in Cateogry	Instrument Type
Company-level information	1, 7, 17-20	Interview-written questionnaire
Individual-level information	2-6	Written questionnaire
Idea-level information	8-16, 21-25	Written, self-initiated report with regular prompting

Generation of instrument items to obtain the desired information

Having developed information requirements and selected an instrument mix for obtaining them, the next step was to develop items for the instruments to obtain the required information. The following pages develop each information requirement from proposition or information desired through the specific words to be used on the instruments selected and the categorization of the variable.

The source of each information requirement is listed first; either one or more propositions, or an exploratory information requirement. Next is listed the variable referred to by the requirement. Following the variable, an indicator which can be used to measure the variable is given. Then the specific item as it appears on an instrument is given, followed by the categorization or scaling of the measured variable. Finally, some of the information requirements are discussed in a discussion section.

Proposition 1

The more employees in a firm, the larger the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

Independent Variable

Number of employees in the organization.

Indicator

Answer to direct question.

Item on Questionnaire

How many people are employed at this plant? _____

Operational Measure and Scaling or Categorization

The number of employees will be used directly. No scaling or categorization is needed.

Discussion

Mansfield's work on innovation and organization size refers to the size of the organization in terms of sales (Mansfield, 1963, p. 290). Other work in the same area is not specific as to measure of size, or seems to refer to number of employees. A pilot study showed that not all companies of interest to this research were willing to divulge sales information. This was particularly true of divisions of multiplant corporations. Number of employees was therefore chosen as the measure of size.

Proposition 2

The greater the risk-taking propensity of the idea evaluators, the larger the flow of perceived ideas for evaluation and the more likely that any given idea will be accepted.

Independent Variable

Risk-taking propensity of the idea evaluators.

Indicator

Score on the Wallach and Kogan "Choice-Dilemmas" procedure.

Items on Questionnaire

The Choice-Dilemmas Procedure is too lengthy for inclusion here in its entirety. It is reproduced in Appendix 1 and an example is given below.

Operational Measure and Scaling or Categorization

Possible scores on the Choice-Dilemmas Procedure range from 1.00 to 10.0, with the higher numbers indicating a lower risk propensity. Individual scores on the Procedure will be categorized into nine categories as follows:

Score	1.00-1.99	Risk Category 1 - highest risk propensity
Score	2.00-2.99	Risk Category 2 - next highest risk propensity
.	.	.
.	.	.
.	.	.
Score	9.00-10.00	Risk Category 9 - lowest risk propensity

Discussion

The Wallach and Kogan Choice-Dilemmas procedure is a projective test with 12 choice situations presented to the respondent. In each situation the respondent chooses the odds that he would require in order to recommend the more risky of the two possible choices. As an example, one of the choice situations is reproduced below.

Mr. A, an electrical engineer, who is married and has one child, has been working for a large electronics corporation since graduating from college five years ago. He is assured of a lifetime job with a modest, though adequate, salary, and liberal pension benefits upon retirement. On the other hand, it

is very unlikely that his salary will increase much before he retires. While attending a convention, Mr. A is offered a job with a small, newly founded company which has a highly uncertain future. The new job would pay more to start and would offer the possibility of a share in the ownership if the company survived the competition of the larger firms.

Imagine that you are advising Mr. A. Listed below are several probabilities or odds of the new company's proving financially sound.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. A to take the new job.

___The chances are 1 in 10 that the company will prove financially sound.
___The chances are 3 in 10 that the company will prove financially sound.
___The chances are 5 in 10 that the company will prove financially sound.
___The chances are 7 in 10 that the company will prove financially sound.
___The chances are 9 in 10 that the company will prove financially sound.
___Place a check here if you think Mr. A should not take the new job no matter what the probabilities.

Proposition 3

The greater the age of the idea evaluators, the smaller the flow of perceived ideas for evaluation and the less likely that any given idea will be accepted.

Independent Variable

Age of the idea evaluators.

Indicator

Answer to direct question.

Item on Questionnaire

Date of birth _____.

Operational Measure and Scaling or Categorization

Age of idea evaluators will be broken down into 6 categories as follows:

Response	Category
Age 20-29	Age category 1 (youngest)
.	.
.	.
.	.
Age 70-79	Age category 6 (oldest)

Proposition 4

The greater the idea evaluator's dissatisfaction with sales and cost levels, the larger the flow of perceived ideas to be evaluated and the more likely that any given idea will be accepted.

Independent Variable

Amount of dissatisfaction of the idea evaluators with sales and cost levels.

Indicator

Answers to direct questions.

Items on Questionnaire

1. How does the current level of sales compare with your current personal sales goals?
   ( ) Sales exceed goals
   ( ) Sales are meeting goals
   ( ) Sales are slightly below goals
   ( ) Sales are moderately below goals
   ( ) Sales are well below goals
   ( ) I do not have a sales goal but I feel sales are
      ( ) highly satisfactory
      ( ) satisfactory
      ( ) slightly unsatisfactory
      ( ) moderately unsatisfactory
      ( ) very unsatisfactory

2. How do current costs compare with your current personal cost goals?
   ( ) Costs are lower than goals
   ( ) Costs are meeting goals
   ( ) Costs are slightly higher than goals
   ( ) Costs are moderately higher than goals
   ( ) Costs are well above goals
   ( ) I don't have a cost goal but I feel costs are
      ( ) highly satisfactory
      ( ) satisfactory
      ( ) slightly unsatisfactory
      ( ) moderately unsatisfactory
      ( ) very unsatisfactory

Operational Measure and Scaling or Categorization

To score responses to the above questions, it is assumed that the first five answers are equivalent respectively to the last five. In other words, the response "costs are lower than goals," is considered to be equivalent in terms of cost satisfaction, to response "I don't have a cost goal but I feel costs are highly satisfactory," and similarly for the other four possible responses. Sales responses are treated similarly. This assumption condenses the 20 possible responses to the above two questions to 10 responses, 5 categories of satisfaction each for costs and sales. These five responses are assigned as follows:

Response	Category
"Costs are lower than goals" or equivalent	Cost satisfaction Category 1 (lowest cost dissatisfaction)
.	.
.	.
.	.
"Costs are well above goals" or equivalent	Cost satisfaction Category 5 (highest cost dissatisfaction)

and similarly for sales satisfaction.

Proposition 5

The greater the formal education of the idea evaluator, the larger the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

Independent Variable

Amount of formal education.

Indicator

Answer to direct question

Item on Questionnaire

Formal education (please check the highest completed and indicate the major field)

Level	Major
( ) High School	_____
( ) Technician training	_____
( ) Junior college	_____
( ) One or more years work toward Bachelors degree	_____
( ) Bachelors degree	_____
( ) Masters degree	_____
( ) Doctors degree	_____
( ) Other (please specify)	_____

Operational Measure and Scaling or Categorization

The responses above are condensed into three categories as follows:

Response	Category
High School or Technician Training	Education Category 1 (no college training)
Junior College or 1 or more years toward Bachelors degree	Education Category 2 (Some college training but no degree)
Bachelors degree, Masters degree, or Doctors degree	Education Category 3 (Bachelors degree or higher)

Proposition 6

The greater the exposure of the idea evaluators to outside contacts and sources of information, the greater the flow of perceived ideas to be evaluated and the more likely that a given idea will be accepted.

Independent Variable

Exposure of the idea evaluators to outside contacts and sources of information.

Indicators

Five exposure scores (developed below), based on answers to the following questions.

Items on Questionnaire

1. During the past 12 months, about how many days have you spent traveling on business outside the Chicago area? _____

2. During the past 12 months, about how many trade shows have you attended? _____

3. During the past 12 months, about how many professional meetings or conventions have you attended? _____

4. About how many of the following types of publications do you read or scan each month? _____Professinnal Journals
_____Trade Journals or Magazines
_____Business and Management Magazines (such as Fortune, Business Week, etc.)
_____Other Magazines

5. How many technical or college, university, night school or correspondence courses have you completed within the last 12 months? _____

Operational Measure and Scaling or Categorization

The 5 questions above refer to five possible types of exposure to outside contacts and sources of information. The responses to the questions are not combinable into one score and hence must be treated as independent components of exposure. The components are scored as follows:

For each of the five types of exposure, a median number (of days traveled, shows attended, etc.) is calculated, based on responses to the particular question. Each respondent is then given a score of 1 if his response to the first question above is higher than the median response of all respondents to that question, and a 0 otherwise. The process is repeated for the other four questions. The result is five separate binary exposure scores, each one being treated as an independent variable. The scoring is then as follows:

Response	Category
Days traveling is less than or equal to the median	Travel Category 1
Days traveling is more than the median	Travel Category 2
Trade shows attended is less than or equal to the median	Shows Category 1
.	.
.	.
.	.
etc.	etc.

Proposition 7

The greater the firm's freedom to alter the product, the greater the flow of perceived ideas for evaluation and the more likely that a given idea will be accepted.

Independent Variable

Amount of freedom to alter the product possessed by the organization.

Indicator

Response to the question below.

Items on Questionnaire

1. Into which category does the majority of your products (by volume) fall?
   _____a. We can alter both the mechanical and electronic specifications subject to the market.
   _____b. We can alter the mechanical specifications within limits, but work to relatively fixed electronic specifications (or vice versa).
   _____c. We work to fixed mechanical and electronic specifications.
2. If the answer to the question above is b. or c., please indicate whether the specifications referred to are fixed by
   _____Customer
   _____Industry or association standards
   _____Limitations inherent in the production process
   _____Other (please specify) _____

Operational Measure and Scaling or Categorization

Question 1 above is categorized as follows:

Response	Category
a.	High freedom to alter the product
b.	Medium freedom to alter the product
c.	Low freedom to alter the product

Question 2 is not categorized since it is exploratory only.

Discussion

Question 2 above is exploratory in nature and has no direct theoretical connection with the variable "freedom to alter the product." It is presented here because of its close relationship to the preceeding question.

Proposition 8

The more fruitful an idea source, as perceived by an idea evaluator, the more likely that an idea from that source will be accepted by the evaluator.

Independent Variable

Perceived fruitfulness of an idea source

Indicator

Answer to the question below.

Item on Questionnaire

Considering both the number and value of previous ideas from this particular source (particular person, magazine, etc.), how fruitful has this source been?

( ) Not fruitful ( ) Somewhat fruitful
( ) Moderately fruitful ( ) Highly fruitful
( ) No previous experience with this particular source

Operational Measure and Scaling or Categorization

The responses above will be categorized as follows:

Response	Category
Not fruitful	Fruitfulness Category 1 (lowest)
Somewhat fruitful	Fruitfulness Category 2
Moderately fruitful	Fruitfulness Category 3
Highly fruitful	Fruitfulness Category 4 (highest)
No previous experience. . .	Fruitfulness Category 5 (null fruitfulness

Proposition 9

The more risky an idea, as perceived by an idea evaluator, the less likely that the idea will be accepted by the evaluator.

Independent Variable

Perceived riskiness of the idea.

Indicator

Response to the question below

Item on Questionnaire

How risky is this idea, i.e., how high is the probability that it will either fail to accomplish its intended purpose or will have undesirable side effects?

( ) About 1 chance in 10, or less, of failure
( ) About 3 chances in 10 of failure
( ) About 5 chances in 10 of failure
( ) About 7 chances in 10 of failure
( ) About 9 chances in 10 of failure

Operational Measure and Scaling or Categorization

The responses above are categorized as follows:

Response	Category
About 1 chance in 10, or less, of failure	Risk Category 1 (lowest)
.	.
.	.
.	.
About 9 chances in 10 of failure	Risk Category 5 (highest)

Proposition 10

The higher the perceived cost of an idea, the less likely that the idea will be accepted.

Independent Variable

Perceived cost of the idea.

Indicator

Response to the question below

Item on Questionnaire

Considering the cost of this idea, but not any of its other advantages or disadvantages, how difficult would it be to obtain the amount of money necessary to implement the idea?

( ) No problem getting this amount of money.
( ) Slight problem getting this amount of money.
( ) Some problem getting this amount of money.
( ) Considerable problem getting this amount of money.
( ) Very difficult problem getting this amount of money.

Operational Measure and Scaling or Categorization

The above responses are categorized as follows:

Response	Category
No problem getting this amount of money	Cost Category 1 (lowest)
.	.
.	.
.	.
Very difficult getting this amount of money	Cost Category 5 (highest)

Discussion

This variable is not concerned with whether the idea will pay for itself but with the extent to which the cash outlay associated with implementing the idea is constrained by the company's financial position. Since it is impossible to objectively estimate this constraint without a detailed knowledge of the company's finances, we are asking the respondent to make the estimate and report the result subjectively.

Proposition 11

The greater the perceived availability of the human resources required to implement an idea, the more likely that the idea will be accepted.

Independent Variable

Perceived availability of the human resources required to implement the idea.

Indicator

Response to the question below.

Item on Questionnaire

To what extent are the people necessary to implement this idea available?

( ) No problem getting the people
( ) Slight difficulty in getting the people
( ) Some difficulty in getting the people
( ) Considerable difficulty in getting the people
( ) Almost impossible to get the people

Operational Measure and Scaling or Categorization

The above responses are categorized as follows:

Response	Category
No problem getting the people	Human resources Category 1 (lowest)
.	.
.	.
.	.
Almost impossible to get the people	Human resources Category 5 (highest)

Proposition 12

The greater the potential profitability of implementing an idea, the more likely that the idea will be accepted.

Independent Variable

Potential (estimated) profitability of implementing an idea.

Indicator

Response to the question below.

Item on Questionnaire

If successful, what will be the approximate total value of this idea to the company?

( ) A saving or profit of less than $1,000
( ) A saving or profit of $1,000-$10,000
( ) A saving or profit of $10,000-$100,000
( ) A saving or profit of over $100,000
( ) Other _____

Operational Measure and Scaling or Categorization

The responses above are categorized as follows:

Response	Category
A saving or profit of less than $1,000	Value Category 1 (lowest)
.	.
.	.
.	.
A saving or profit of over $100,000	Value Category 4 (highest)
Other	As indicated

Discussion

Ideally, the dollar levels of savings and profits should be normalized

by financial data, to account for the possibility that the subjective value of, say, $1,000 may be different for different evaluators and different companies. The lack of any financial data on the participating companies precluded this. It seems reasonable to assume, however, that in the size range of companies considered, a profit or saving of $1,000 has approximately the same value to the various participating managers.

Proposition 13

The greater the perceived urgency of the problem to which an idea is a potential solution, the more likely that the idea will be accepted.

Independent Variable

Perceived urgency of the problem to which an idea is a potential solution.

Indicator

Response to the question below.

Item on Questionnaire

How urgent is the problem to which this idea is a potential solution?

( ) very urgent
( ) moderately urgent
( ) not urgent

Operational Measure and Scaling or Categorization

The responses above are categorized as follows:

Response	Category
Very urgent	Urgency Category 1 (highest)
.	.
Not urgent	Urgency Category 3 (lowest)

Proposition 14

An idea which is a potential solution to a particular problem for which the idea evaluator has been actively searching for a solution is more likely to be accepted than an idea which is a potential solution to a general problem area where the evaluator is always looking for ideas. The latter type of idea is, in turn, more likely to be accepted than an unsought idea.

Independent Variable

Extent of search associated with an idea.

Indicator

Response to the question below

Item on Questionnaire

Is this idea ( ) a potential solution to a particular problem for which you have been actively searching for a solution?
( ) a potential solution to a general problem area where

you are always looking for ideas?
( ) an unexpected or unsought idea?

Operational Measure and Scaling or Categorization

The responses above are categorized as follows:

Response	Category
a potential solution to a particular problem for which you have been actively searching for a solution	Search Category 1 (highest)
. . .	. . .
an unexpected or unsought idea	Search Category 3 (lowest)

Information Requirement

The number and identity of ideas evaluated by each idea evaluator.

Indicator

The number and identity of idea reports submitted by each evaluator.

Instrument Item

The idea reports themselves

Operational Measure and Scaling or Categorization

None. This and the following information requirements are exploratory.

Information Requirement

The number and identity of ideas which are accepted by each idea evaluator.

Indicator

The number and identity of idea reports which are checked "accepted in principle" or "accepted and change ordered."

Item on Idea Report

What is the present disposition of this idea?
( ) Rejected ( ) Under study ( ) Dormant
( ) Accepted in principle ( ) Accepted and change ordered
( ) Other _____

Information Requirement

Whether the respondent companies are single plant or multi-plant. If the latter, the size of the parent company.

Indicator

Response to the question below. The response was checked with interview data.

Item on Questionnaire

If a multi-plant company, approximately how many people are employed by the whole company? _____

Information Requirement

The technical sophistication of the participating plants and their parent companies.

Indicator

Fraction of total number of employees which hold B.S. or higher degrees in a technical field.

Items on Questionnaire

How many employees of this plant hold B.S. or higher degrees in a technical field? _____

If a multi-plant company, approximately how many employees of the whole company hold B. S. or higher degrees in a technical field? _____

Information Requirement

The approximate amount of value added to its product by each plant.

Indicator

The complement of the answer to the question below.

Item on Questionnaire

What percentage of this plant's total costs are represented by costs of materials purchased? _____

Information Requirement

The source of any limitations on the company's freedom to alter its product.

Indicator

This indicator is covered under Proposition 7 in view of its close connection with the question on freedom to alter the product.

Information Requirement

The identity of the evaluator of each idea in terms of his position in the company.

Indicator

Response to the question below.

Item on Idea Report

Your position in company:

( ) President (Vice President and General Manager if subsidiary)
( ) Manufacturing or Production Vice President
( ) Chief Engineer
( ) Manufacturing or Production Supervisor
( ) Manager of Quality Control
( ) Other _____

Information Requirement

The time lag between hearing of an idea and taking action on it.

Indicator

Elapsed time between the responses to the two items below.

Items on Idea Report

Date you heard of the idea _____
Date today _____

Discussion

Respondents were requested to fill out an idea report the same day the idea was evaluated. If unable to do this, they were instructed that "date today" refers to the date the idea evaluation occurred. Thus the date entered after "date today" is the date of the idea evaluation.

Information Requirement

The types of ideas under consideration, in terms of whether the ideas are for a material substitution in a product, a change in design of a product, a change in production method, or a new product.

Indicator

Response to the question below.

Item on Idea Report

Type of idea ( ) Change of input material
( ) Change in production method
( ) Change in design of a product
( ) New product
( ) Other

Information Requirement

The sources of the ideas under consideration

Indicator

Response to the question below.

Item on Idea Report

Source of idea: ( ) Self ( ) Employee ( ) Business Associate
( ) Newspaper or magazine ( ) Trade Journal

( ) Trade show ( ) Customer ( ) Supplier
( ) Other _____

Information Requirement

The disposition of each idea.

Indicator

Response to the question below.

Item on Idea Report

What is the present disposition of this idea?

( ) Rejected ( ) Under study ( ) Dormant
( ) Accepted in principle ( ) Accepted and change ordered
( ) Other _____

Integration of the Instrument Items

Having generated instrument items to meet the information requirements, the final step in the design of an instrument set was to integrate the items into instruments. As indicated previously, three instruments were required; an interview-questionnaire guide, a written questionnaire and a written idea report. The instrument items from the previous section are grouped and arranged into these three instruments in Appendix 1, which shows the instruments in final form.

The "organization" and "individual" questionnaires, because they are administered in a conventional way, are of standard design. The idea report, being respondent-initiated, had to be conspicuous and handy to use. In particular, it was desired that (1) the idea report not look like standard business papers or letters, which might allow it to become "lost in the pile" on a desk, and (2) the idea report be of such size and shape that it could be carried in a shirt pocket. IBM cards met the requirements. The items necessary for the idea report, when typed and photo-reduced to 1/2 size, fit on the card. Although colored cards would have been much more conspicuous, they did not provide enough contrast to permit easy reading of the reduced printing. The idea report was therefore printed on white IBM cards, which were punched with the company's I.D. number for later identification and sorting.

Following the design of instruments, the second stage of the pilot study was conducted. This stage, designed to test the instruments and the data gathering methods, involved studying 4 companies over a 5 week period. The companies filled out idea reports which were picked up weekly. Each pick-up visit included questions by the researcher regarding the suitability of the idea report. As a result of this test, one question on the idea report was altered and an additional question was added. The format of the report was well received, as was the weekly call and pick-up. On the basis of this pilot study, the full study proceeded as described in the next chapter.

This completes the discussion of the development of instruments to acquire the necessary information. The next chapter deals with the administration of the instruments in industrial companies.

CHAPTER IV: COLLECTION OF DATA

Introduction

The previous chapter describes the information requirements of this research, and describes the development of instruments for gathering the required information. This chapter will describe the process by which information was gathered. The first section discusses selection of the sample of companies to be used as respondents, or sources of information. The second section describes the administration of the instruments to the respondents.

For reasons of company security, the basic data could not be included in this paper. Such data is available, in anonymous form, to qualified researchers.

Selection of Respondents

To help reduce problems of comparability of the data from different companies, it was decided to choose respondents from one industry and within fairly narrow size limitations. Data availability caused the initial size band constraint to be eased somewhat, but the respondent companies are largely "small" companies, with a few of moderate size. The electronics industry was selected because of the author's experience in electronics and the availability of a sufficient number of companies in the Chicago area.

The initial sample universe was the set of companies listed in the "Electronic Components and Equipment" section of the 1966 Illinois Manufacturers Directory. This initial universe was cut down by eliminating all companies more than 1½ hours driving time from Northwestern University and all companies with fewer than 10 or more than 1000 employees. The reduced list, which numbered 77 companies, was checked for accuracy of address and president's name and was then broken down into 5 geographical groups. One group at a time was contacted by letters which introduced the project and advised the receiver that he would receive a call from the author. Initial calls were made 1-3 days after the potential respondents received the introductory letter. During the initial phone call, the author requested an appointment with the president of the company to discuss the project.

During this initial interview, which usually lasted about 30 minutes, the author explained the purpose of the project and the procedure to be followed. The meeting was frequently attended by the production managers, chief engineers, and quality control managers of the company. Each item on the idea report was explained, and the company officials were asked for comments and questions. Following this, if the company agreed to participate in the project, the idea reports were distributed to the respondents.

The above procedure was followed for the main data gathering effort and also for the second stage pilot study which preceded it. The second stage pilot study was run for six weeks with four companies participating, one of which dropped out before the six week period was ended. The idea report, which had been substantially modified as a result of the first stage pilot test, was further modified by changing the categories in the question on the dollar value of the idea, and by adding a question on the urgency of the problem to which the idea is a potential solution.

The first stage pilot interviews also revealed that not all companies were willing to release sales data. This latter fact led to a slight modification of the experimental design as explained under the development of proposition 1.

Administration of Instruments

The list of respondents evolved from the initial sample list through several types of attrition. First, due to outdated information accompanying the Manufacturers Directory list, several of the companies contacted were defunct, were too small, or were not engaged in manufacturing. Second, several companies declined to participate in the project. The reason given by these companies was always the same they were so busy meeting current orders that they did not wish to take on even a small additional time obligation. Allowing for the possibility that this reason was a convenient excuse in some cases, it is nevertheless probable that the sample of participating companies was biased by the elimination of these "busiest" companies. Finally, a number of companies agreed to participate in the project but subsequently dropped out, reporting that they were unable to keep up with the idea reports or unable to fill out the final questionnaires. Again, the reason given for this was always lack of time. The number of companies falling into each of the above categories is summarized in Fig. 4.1.

All respondents were asked to keep track of all ideas they evaluated which would, if implemented, change the company's product, product line, or production process. They were asked to do this for a period of six weeks, using idea reports to record the idea evaluations. In order to secure more information, seven companies were asked to continue the process for a total of 12 weeks. These 7 were, for the most part, companies which appeared to the author to be reporting every idea evaluated, and which began reporting ideas at the beginning of the data gathering process. The complete process required 14 weeks, exclusive of the pilot study which preceded it and which required 6 weeks. Thus 20 weeks elapsed between the first telephone contact with a potential respondent and the last data gathering visit.

Each participating company was contacted by telephone once a week. The president, or other person designated by him, was asked if there were any idea reports to be picked up. If the answer was yes, an appointment was arranged and the author picked up the idea reports personally. If the answer was no, the author tried to ascertain whether the lack of reports was due to a lack of idea evaluations or to insufficient time to fill out idea reports. If the latter, the author attempted to get the respondent to include the week's evaluations during the following week. This situation rarely occurred, respondents usually giving "no idea evaluations" as the reason for no idea reports. It should be noted that business during the data gathering period was at a high level, and on several occasions respondents reported that they were so busy "getting the products out the back door" that they were not spending any time evaluating ideas for new products or new production methods.

This high level of business activity and the consequent perceived reduction in the level of idea evaluation activity may have acted to reduce the generality of the results obtained. Several respondents commented that business was "not normal" during their period, due to strong demands for products, pressure for delivery, high interest rates, and scarcity of labor and materials. In addition to this long-term abnormality, the consumer portion of the electronic

Initial list			77
Companies eliminated initially because they were too small, too large, or too distant			-8
			69
Additional companies eliminated by the author			
Defunct	3		
Not engaged in manufacturing	4		
Too small	2		
	9		-9
			60
Companies which declined to begin the project			
Declined the initial interview		10	
Declined following the initial interview		4	
		14	-14
			46
Companies which began the project but dropped out before completion			-12
Companies comprising the data sample			34

Fig. 4.1 The set of respondents compared to the initial list of companies and the reasons for the reduction in the size of the list.

industry is slightly seasonal, with fall being a high-production season in anticipation of Christmas. Both of these factors may have reduced the level of idea evaluation activity below "normal" and thus will temper the confidence with which the results of the study can be generalized.

The weekly call had considerable prompting effect, according to several of the respondents. Making phone calls more frequently than once a week was considered, but the first stage of the pilot study indicated that this was unacceptable to many respondents. Consequently, the weekly call was used in all cases.

As each set of idea reports was picked up by the author, it was checked for completeness and clarity of information. The author was usually able to question the respondent about any items which were unclear. This discussion also gave the respondents an opportunity to comment on the idea report itself and to expand on the information given in the reports.

At the end of the six week data gathering period (12 weeks for seven companies), all respondents were given an "idea evaluator" questionnaire. In addition, the president of each company (or someone designated by him) was given an "organizational" questionnaire. Both types of questionnaire were accompanied by stamped, addressed return envelopes. The respondents were asked to complete the questionnaires and mail them back at their convenience. This process usually required 1-2 weeks, and follow-up calls were required in

about one-third of the companies.

Five respondents representing four companies which participated in the six-week data gathering process failed to return the "idea evaluator" and "organizational" questionnaires, even after repeated phone calls. Three of these four companies had reported no idea evaluations during the six-week period. The fourth company moved shortly after the data gathering period ended, and the managers reported that they were too busy with problems raised by the move to complete the questionnaires. The final yield included data on 86 idea evaluators from 34 companies.

The respondents were distributed among the responding companies as indicated in Fig. 4.2 below.

Number of respondents per company	Number of companies
1	15
2	5
3	5
4	5
5	2
7	1
9	1
	34

Fig. 4.2 Distribution of respondents among participating companies.

The 86 idea evaluators turned in 392 idea reports. The number of idea reports per evaluator varied from zero to 14½, on a six week basis. The average number of idea evaluation reports was 4.56 per evaluator, with a median of three reports. The distribution is given in Fig. 4.3.

As indicated in Chapter III, almost one-third of all the idea reports indicated that the idea evaluation took place the same day the researcher visited the plant to pick up idea reports. This fact suggests that the behavior of the idea evaluators was influenced by the researcher's behavior, for apparently either (1) a disproportionate amount of idea evaluation activity coincided with the day of the researcher visit, or (2) the impending visit prompted the respondents to report idea evaluations which had actually occurred during the past week. The latter possibility seems more probable than the former, and in fact several respondents indicated that the impending visit of the researcher prompted them to search their memory for idea evaluations which had been made in the past week but not reported at the time. To the extent that this occurred, it is possible that some idea evaluations were forgotten and not reported. This possibility is a consequence of the weekly nature of the researcher's prompting influence, and could have been reduced by more frequent prompting. As indicated previously, this alternative was not acceptable to the respondents.

Number of idea evaluations reported	Number of evaluations
0	10
½	5
1	8
1½	2
2	18
2½	1
3	6
3½	1
4	11
4½	2
5	5
6	4
7	3
7½	1
8	2
9	4
11	2
12	1
13	1
14½	1
	88

Fig. 4.3 Distribution of number of idea evaluations reported per evaluator in a six-week period. The fractions arose from halving the number of ideas for those evaluators who participated for 12 weeks.

There is also the possibility that the respondents overstated the amount of idea evaluation activity by turning in invalid idea reports. The researcher tried to check for this by picking a total of approximately 40 idea reports at random and asking for more detailed information on them. This information was always readily supplied and since no "fakes" were discovered the researcher concluded that the idea reports were largely genuine.

Previous chapters have developed a theoretical background, expressed the theoretical propositions as a model, developed an instrument mix to test the model, and described the application of the instruments to measure the variables of interest. The succeeding chapter deals with the results and implications of the information gathered.

CHAPTER V: RESULTS AND IMPLICATIONS

Introduction

In earlier chapters we discussed the development of a model and a set of instruments for obtaining data necessary to test the model and to explore the phenomenon of idea evaluation. The preceding chapter dealt with the procedures used to obtain the desired information. We will now use the data both for model testing and for exploratory research.

It will be recalled that the model has two stages, and that the first stage consists of seven two-part propositions. Testing the model therefore requires three tests, and for purposes of discussion the model is considered to consist of three parts as follows:

Stage Ia. Propositions referring to the number of ideas evaluated.
Stage Ib. Propositions referring to the number of ideas accepted.
Stage II. Propositions referring to the outcome of individual idea evaluations.

Stage Ia is tested first using all idea evaluators who participated in the study. This test is carried out with the variables categorized as indicated in Chapter Three, and then with each independent variable except "company size" categorized into only two categories, "high" and "low."

Following the above test, the stage Ia model is used for exploratory research by testing it on two subsets of the idea evaluators; production managers and presidents. The same sequence of tests and exploratory research is then conducted on the stage Ib model.

The stage Ia and Ib tests and discussions are followed by a test of the stage II model. More exploratory research is then reported which yields additional information about the phenomenon under investigation.

The Stage Ia Model

The stage Ia model consists of the following propositions:

1. The more employees in a firm, the larger the flow of perceived ideas for evaluation.

2. The greater the risk propensity of an idea evaluator, the larger the flow of perceived ideas for evaluation.

3. The higher the age of the idea evaluator, the smaller the flow of perceived ideas for evaluation.

4. The greater the idea evaluator's dissatisfaction with sales and cost levels, the larger the flow of perceived ideas for evaluation.

5. The greater the formal education of the idea evaluator, the larger the flow of perceived ideas for evaluation.

6. The greater the exposure of the idea evaluator to outside contacts and sources of information, the larger the flow of perceived ideas for evaluation.

7. The greater the freedom of the organization to alter the product, the larger the flow of perceived ideas for evaluation.

In all of the above propositions the flow of perceived ideas for evaluation is considered to be the number of idea evaluations reported by each individual idea evaluator during the data period.

The stage Ia model was tested using the BMD-29 program developed by U.C.L.A. The first test was performed with the variables categorized as indicated in Chapter Three. Following this test, the model was tested with the variables dichotomized. This program performs a multiple regression analysis, limiting the variables included to those whose proportional reduction of variation is more than a selected limit. The results reported below were obtained with this limit set at 1%, which means that only those independent variables which explain more than 1% of the variation of the dependent variable are listed.

The printout of the stage Ia model test results obtained using all evaluators is given in Appendix 2 and summarized in Fig. 5.1 below. Following two tests using all evaluators, the significance of evaluator work role is examined in two further tests using subsets of evaluators.

Results of the Stage Ia Test Using all Idea Evaluators and with the Variables Categorized as Indicated in Chapter III

Fig. 5.1 shows that company size (number of employees) accounts for more of the variation in number of ideas evaluated (11.4%) than does any other independent variable. The association is in the predicted direction, with idea evaluators in larger companies evaluating more ideas than those in smaller companies. This result is significant at the 99.5% level.

The fact that an idea evaluator reads more professional, trade and business publications than the median idea evaluator accounts for 5.16% of the variation in the number of ideas evaluated. The association is in the predicted direction (a larger number of publications read is associated with more ideas evaluated) and is significant. The fact that an idea evaluator attends more trade shows than the median evaluator in the sample accounts for 3.27% of the variation in number of ideas evaluated, but the association is in the opposite direction to that predicted. Attending more trade shows than the median is negatively associated with number of ideas evaluated, whereas a positive association was predicted.

The evaluator attribute "moderate dissatisfaction with costs" accounts for 4.12% of the variation in number of ideas evaluated. As explained in Chapter III, the correlation coefficients in this and the following variables are relative to an omitted attribute. In the case of cost dissatisfaction the omitted attribute is "low dissatisfaction with costs". The partial correlation coefficient for "moderate dissatisfaction with costs" is interpreted as follows: the fact that an idea evaluator is moderately dissatisfied with costs, as compared to one whose dissatisfaction with costs is low, is correlated .264 with the variation in number of ideas evaluated. Similarly, the fact that an idea evaluator is highly dissatisfied with costs as compared to one whose dissatisfaction with costs is low, is correlated .146 with the variation in number of ideas evaluated. These two results, significant at the 99% and 90% levels respectively, indicate that "moderate dissatisfaction with costs" is associated with a greater increase in number of ideas evaluated over the "low dissatisfaction" condition than is "high dissatisfaction with costs." Thus while the association of each of the attributes "moderate

Variable or Attribute	Partial Correlation Coefficient	Percent of Variation Explained	Confidence Level
Company size	.409	11.4	99.5
Number of professional, trade and business publications read is in excess of group median	.272	5.15	99
Moderate dissatisfaction with costs	.264	4.12	99
Attendance at trade shows is in excess of group median	-.174	3.27	90
Moderate freedom to alter the product	.158	2.04	90
2nd lowest risk propensity	.180	1.34	90
High dissatisfaction with costs	.146	1.30	90
4th lowest risk propensity	.137	1.23	85
Education level includes some college work but less than a B.S. degree	-.127	1.14	85
	TOTAL	31.0	

Fig. 5.1. Results of stage Ia model test using all idea evaluators and with the variables categorized as indicated in Chapter III. Numbers have been rounded off to 3 decimal places.

dissatisfaction" and "high dissatisfaction" is in the predicted direction, the relative magnitude of the two correlations is in a direction opposite to that predicted.

The attribute "moderate freedom to alter the product" is correlated .158 with the variation in number of ideas evaluated, compared to the attribute "low freedom to alter the product." This result, significant at the 90% level, is in the predicted direction and accounts for 2.04% of the variation in the dependent variable.

Membership in the 2nd lowest category of risk propensity is correlated .180 with the variation in number of ideas evaluated, compared to membership in the lowest category of risk propensity. Membership in the 4th lowest category has a correlation of .137. These two results, which account respectively for 1.34 and 1.23% of the variation in the dependent variable, are both in the direction predicted, although there is no significant correlation in the higher categories of risk propensity.

Finally, the fact that an evaluator has had some college work but lacks a B.S. degree is correlated -.127 with the variation in number of ideas evaluated, compared to evaluators who have had less education. This result, while contrary to the prediction, does not carry a high confidence level.

The nine variables discussed above together account for 31.0% of the variation in the dependent variable.

Discussion of Stage Ia Model Results using all Idea Evaluators and With the Variables Categorized as Indicated in Chapter III

The relatively high correlation coefficient and significance level of the size variable indicates that company size is closely associated with the number of ideas evaluated by an idea evaluator. This result supports Mansfield's overall size argument. Mansfield gave three reasons for expecting size to influence idea acceptance. They were:

1. Large firms can more easily bear the cost and risk of innovations than smaller firms, and large firms can commit resources to reduce the risk.

2. Large firms are more likely to contain the conditions appropriate to the installation of any given innovation than are smaller firms.

3. Large firms, having more equipment, will have more equipment that needs replacing at any given time than do smaller firms. Hence they have more forced opportunities to consider innovation.

(Mansfield, 1963, p. 291).

While the above finding strengthens belief in Mansfield's hypothesis, it does not assist in the decision as to which, if any, of the three reasons are in fact operating.

The highly significant, positive correlation between the number of professional, trade, and business publications read per month and the number of ideas evaluated is as predicted, and would not require additional discussion were it not for the negative correlation between the number of trade shows attended and the number of ideas evaluated. It will be recalled that both the reading of business, trade, and professional publications and attendance at trade shows were assumed to be indicators of exposure to outside

contacts and sources of information. On the basis of this assumption, it was predicted that reading of publications and attendance at trade shows would both be correlated with the number of ideas evaluated. Diagrammatically, the situation is as follows:

Proposition	Assumption	Results of Prediction
The greater the exposure of the idea evaluators to outside contacts and sources of information, the greater the flow of ideas for evaluation	Attendance at trade shows is a form of exposure to outside contacts and sources of information	Refuted. Significant negative correlation.
	Reading professional, trade and business publications is a form of exposure to outside contacts and sources of information	Supported. Significant positive correlation.

These are several possible interpretations of this state of affairs. One is that the initial proposition does not hold and the observed correlations are due to other causes. Another is that multicollinearity has entered the estimation process in the form of a high correlation between attendance at trade shows and reading of publications. The simple correlation between these two attributes is .28. A standard test for the presence of multicollinearity in a regression model is to compare the ratio of the regression coefficient to the sampling error with 2.0. If the ratio exceeds 2.0, we can state with 95% confidence that multicollinearity did not affect the estimate in question (Klein, 1965, p. 101). This ratio is 2.9 for attendance at trade shows and 2.5 for reading publications, leading the author to conclude that multicollinearity probably did not affect the estimated coefficient of either of these attributes.

A third possible explanation for the conflicting appearance of the results is that reading pertinent publications is a form of exposure which is associated with increased idea evaluation activity, whereas attending trade shows is a form of exposure which is associated with decreased idea evaluation activity. Recalling that the idea evaluations under measurement are largely of production related ideas, the author speculates that those idea evaluators who attend more than the median of trade shows are sales oriented and evaluate fewer production related ideas than do other, more production-oriented idea evaluators. Production-oriented idea evaluators may tend to read professional and trade publications for ideas, rather than attending trade shows, and may evaluate more production-related ideas because of their orientation. More research is required to settle this ambiguity, but it is possible that the original proposition is too simple and does not reflect reality. More light is shed on this question by the second stage test.

Moderate freedom to alter the product is significantly correlated with number of ideas evaluated, but high freedom is not so correlated. The original proposition was "the higher the freedom to alter the product, the larger the flow of ideas for evaluation." Thus the result above constitutes only partial support for the proposition.

The fact that an evaluator is moderately dissatisfied with costs is positively correlated with the number of idea evaluations, as is the fact that

the evaluator is highly dissatisfied with costs. Moderate dissatisfaction, however, is more highly correlated with number of idea evaluations than is high dissatisfaction, and low dissatisfaction is not correlated. This set of results constitutes only partial support for the original proposition, which was "the higher the dissatisfaction with sales and costs, the larger the flow of ideas for evaluation." According to the results, although both moderate and high dissatisfaction with costs are correlated with the number of idea evaluations, moderate dissatisfaction is more highly correlated. This outcome may be caused by multicollinearity, for while the ratio of regression coefficient to standard error is 2.4 for moderate dissatisfaction it is only 1.3 for high dissatisfaction. Thus it is not clear whether high dissatisfaction with costs is more conducive to idea evaluation activity than moderate dissatisfaction. It appears, however, that both of the above conditions are more conducive to idea evaluation activity than is low dissatisfaction with costs. That part of the original proposition dealing with dissatisfaction with sales levels is not supported at any level of dissatisfaction.

The author speculates that the results with respect to dissatisfaction with cost levels may be explained by reference to aspiration level theory. As expounded by March and Simon, the theory states that a difference between aspiration level and achievement level will trigger activity once it exceeds a certain threshold magnitude. If the difference is large and persistent, however, it may cause dysfunctional activity (March and Simon, 1958, p. 189). In other words, the theory postulates that a small gap between achievement and aspiration level leads to no action, a moderate gap leads to a search for ways to improve achievement, and a large gap leads either to apathy or to inappropriate activity. It is possible that the attribute "low dissatisfaction with cost levels" represents a gap between aspiration level and achievement level which is below the threshold gap, whereas the attribute "high dissatisfaction with cost levels" represents a gap which is large enough to cause dysfunctional activity. If such dysfunctional activity is associated with low idea evaluation activity, then it would be expected that high and low dissatisfaction with cost levels might be correlated to a lesser extent with idea evaluation than would moderate dissatisfaction. Considerably more research would be required before the above explanation could be seriously advanced. For the present it must remain as speuclation.

The positive correlation between membership in the 2nd lowest and 4th lowest categories of risk propensity and the number of ideas evaluated is in the direction predicted by the proposition, which stated, "The higher the risk propensity of the idea evaluator, the larger the flow of ideas for evaluation." The other five categories of risk propensity, however, show no significant correlation with the number of idea evaluations. Thus the support for this proposition is quite meagre.

The negative correlation between the attribute "educational level includes some college work but less than a B.S. degree" and number of ideas evaluated is counter to the proposition, which stated, "The higher the educational level of the idea evaluator, the larger the flow of ideas for evaluation." The lack of significant correlation in the third education category (B.S. degree or higher) suggests that the proposition is refuted. It will be recalled that the "B.S. degree or higher" category includes 6 idea evaluators with masters degrees. The number of ideas evaluated by these six is not significantly different than the number evaluated by all evaluators, however.

The fact that the attributes dealing with age do not appear in the model

results indicates that these attributes account for less than 1% of the variation in the dependent variable. The proposition that "The higher the age of the idea evaluators, the smaller the flow of ideas for evaluation," is therefore not supported. This finding may be due to the fact that idea evaluators of many different organizational levels were lumped together in this part of the model test. Research which controlled for organizational roles and levels is discussed later in this chapter.

To summarize the results of testing the model, the propositions and the results of testing are given in Fig. 5.2.

The Stage Ia Model Test Using All Evaluators and Dichotomous Variables

The test just described, using categorizations of the variables developed prior to the data collection, indicated that the model and original categorization scheme were capable of explaining a modest 31% of the total variation in the number of ideas evaluated. The categorization scheme used for the previous test broke each basic variable down into as many as seven intervals or categories. To investigate the possibility that the results reported earlier were an artifact of the number of categories used in the categorization scheme, the model was retested with every independent variable except company size dichotomized. Each of the independent variables dichotomized was split on the median measurement, with all scores above the median being classified as "high" and all scores on or below the median classified as "low." The results of this test are indicated in Fig. 5.3.

Discussion of Results of Stage Ia Test Using all Evaluators and Dichotomous Variables

Company size is correlated .401 with the number of ideas evaluated, and accounts for 13.5% of the variation in number of ideas evaluated. Dissatisfaction with cost levels is similarly correlated .205 and accounts for 4.92% of the variation in number of ideas evaluated.

The number of professional, business, and trade publications read is correlated .272 with the number of ideas evaluated, while the number of trade shows attended is correlated -.200. These two variables account respectively for 4.31% and 3.08% of the variation in number of ideas evaluated.

All of the above results carry a confidence level of 90% or higher, and the regression as a whole carries a confidence level in excess of 99%.

The above results are consistent with those obtained with the variables categorized under the original scheme. The above four variables are the top four, in terms of variation explained, in the original test. The other five variables or attributes from the original test results do not appear in this test, indicating that they each explain less than 1% of the variation in number of ideas evaluated. One of these 5 was "high dissatisfaction with costs," which is merged, along with "moderate dissatisfaction with costs," into the variable "dissatisfaction with costs" in the above results. The remaining four were attributes dealing with risk propensity, freedom to alter the product, and educational level. The fact that the high-low dichotomization of these variables causes them to disappear from the results suggests that they do not have a substantial overall effect on idea evaluation. It would appear that the correlations found for these attributes in the original test were local effects. The fact that none of the four carried high confidence levels is consistent with this interpretation.

Proposition	Result of Test
1. The more employees in a firm, the larger the flow of perceived ideas for evaluation.	Supported.
2. The greater the risk taking propensity of the idea evaluators, the larger the flow of perceived ideas for evaluation.	Partially supported.
3. The greater the age of the idea evaluator, the smaller the flow of perceived ideas for evaluation.	Not supported.
4. The greater the idea evaluators' dissatisfaction with sales and cost levels, the larger the flow of perceived ideas for evaluation.	Not supported for dissatisfaction with sales levels. Some support for dissatisfaction with cost levels.
5. The greater the formal education of the idea evaluator, the larger the flow of perceived ideas for evaluation.	Not supported.
6. The greater the exposure of the idea evaluators to outside contacts and sources of information, the larger the flow of perceived ideas for evaluation.	Supported for one measure of exposure, not supported for three others.
7. The greater the freedom of the organization to alter its product, the larger the flow of perceived ideas for evalution.	Partially supported.

Fig. 5.2. Summary of results of stage Ia model test using all the idea evaluators and with the variables categorized as indicated in Chapter III.

Variable or Attribute	Partial Correlation Coefficient	Percent of Variation Explained	Confidence Level
Company size	.408	13.5%	99.5
Dissatisfaction with costs	.205	4.92%	90
Number of professional, business, and trade publications read	.272	4.31%	98
Number of trade shows attended	-.200	3.08%	90
	TOTAL	25.8%	

Fig. 5.3. Results of Stage Ia model test using all idea evaluators and dichotomous variables.

The results of testing the stage Ia model with data from all idea evaluators and dichotomous variables are summarized in Fig. 5.4.

Although the confidence levels in both the individual correlations and the overall regression above are high, the total percentage of variation explained by the independent variables is disappointing. In an attempt to explore the possibility, suggested by Dr. M. Radnor of Northwestern University, that a difference in the work roles of the evaluators might be obscuring basic relationships, two subsets of idea evaluators were identified. The results of testing the model with these subsets are described in the next two sections.

The Stage Ia Model Test Using Production Managers

Discussion with the respondents during and following the research indicated that the role of production manager was common among the idea evaluators. The larger companies in the sample usually had someone whose job title was production manager, while in smaller companies this function is performed by the president. In an effort to test the model with a set of idea evaluators having similar job functions, a subset of production managers was selected. This subset consists of 15 production managers and 13 presidents of companies which do not have a production manager. The subset will be called "production managers" to distinguish it from the "presidents" subset which will be discussed later.

The size of the production manager subset dictated the use of dichotomous independent variables, since the number of variables in the original categorization scheme (30) exceeded the sample size of 28. The results of testing the stage Ia model with production managers are given in Fig. 5.5.

Proposition	Result of Test
1. The more employees in a firm, the larger the flow of perceived ideas for evaluation.	Supported
2. The greater the risk taking propensity of the idea evaluators, the larger the flow of perceived ideas for evaluation.	Not supported.
3. The greater the age of the idea evaluator, the smaller the flow of perceived ideas for evaluation.	Not supported.
4. The greater the idea evaluators' dissatisfaction with sales and cost levels, the larger the flow of perceived ideas for evaluation.	Supported
5. The greater the formal education of the idea evaluator, the larger the flow of perceived ideas for evaluation.	Not supported.
6. The greater the exposure of the idea evaluators to outside contacts and sources of information, the larger the flow of perceived ideas for evaluation.	Supported for one measure of exposure, not supported for three others.
7. The greater the freedom of the organization to alter its product, the larger the flow of perceived ideas for evaluation.	Not supported.

Fig. 5.4. Summary of results of stage Ia model test using all evaluators and dichotomous variables.

Variable	Partial Correlation Coefficient	Percent of Variation Explained	Confidence Level
Dissatisfaction with costs	.491	10.0%	98
Educational level	.229	10.4%	70
Dissatisfaction with sales	-.327	6.50%	85
Number of professional meetings attended	.160	3.69%	n.s.
Number of trade shows attended	-.246	3.41%	n.s.
Number of professional, trade, and business publications read	.153	1.55%	n.s.
		TOTAL 35.5%	

Fig. 5.5. Results of Stage Ia model test using production managers.

Discussion of Results of the Stage Ia Model Test Using Production Managers

Fig. 5.5 shows that, for the production managers, dissatisfaction with costs carries the highest correlation coefficient with the number of ideas evaluated (.491) and accounts for 10% of the variation in the number of ideas evaluated. This result supports the prediction that the higher the dissatisfaction with costs, the more ideas will be evaluated. This result was also obtained in the two earlier tests, indicating that dissatisfaction with costs is associated with idea evaluation activity among production managers as well as among all idea evaluators.

The .229 correlation of educational level with the number of ideas evaluated, and the fact that this variable accounts for 10.4% of the variation in number of ideas evaluated, support the proposition but are somewhat surprising in view of the failure of previous tests to support this proposition. It appears that higher educational level is associated with more idea evaluation activity among production managers but not among all idea evaluators. This finding and the one below will be discussed further in the summary of stage Ia results.

Dissatisfaction with sales levels is correlated -.327 with the number of ideas evaluated and accounts for 6.5% of the variation in number of ideas evaluated. This finding is counter to the proposition and is also the first appearance of the sales dissatisfaction variable in the results considered so far. Apparently high sales dissatisfaction is associated with low idea evaluation activity, among production managers.

Attendance at professional meetings is correlated .160 with the number of ideas evaluated, and accounts for 3.64% of the variation in number of ideas evaluated. Although this finding constitutes support for a proposition which was not supported in the two tests previously discussed, the non-significant

confidence level indicates that not much confidence can be inputed to the support.

Attendance at trade shows is correlated -.246 with the number of ideas evaluated, and accounts for 3.41% of the variation in number of ideas evaluated. This result, while being counterto the proposition,is consistent with previously reported results and indicates that high attendance at trade shows is associated with low idea evaluation activity, among production managers and among all idea evaluators.

Finally, reading professional, trade, and business publications is correlated .153 with the number of ideas evaluated, and accounts for 1.55% of the variation in number of ideas evaluated. While this finding supports the proposition and is consistent with the results for all idea evaluators, its non-significant confidence level indicates that not much confidence can be attached to the support.

The results of testing the stage Ia model with the production managers subset are summarized in Fig. 5.6. It will be noticed that company size, which was the dominant variable in both tests reported previously, does not appear in the test using the production manager subset. Company size has no association with idea evaluation among production managers.

Apparently the production manager subset is more homogeneous than the set of all idea evaluators, for the model accounts for 35.5% of the variation in number of ideas evaluated. This compares to 25.8% for the analogous dichotomous test on all idea evaluators. In an attempt to explore further this approach of comparing idea evaluators with similar organizational functions, a subset of presidents was investigated and is discussed in the following section.

The Stage Ia Model Test Using Presidents

The belief that the functions of the president across the different companies in the sample set might contain similarities which would be relevant to idea evaluation activity led to the formation of a subset of idea evaluators who were presidents of companies. This subset, which numbered 24 evaluators, was tested with the Stage Ia model. As indicated previously, 13 of these evaluators were also in the production manager subset. As was the case with production managers, the small sample size forced the use of dichotomous independent variables.

The results of this test are reported in Fig. 5.7.

Discussion of Results of Stage Ia Model Test Using Company Presidents

For the group of idea evaluators who are company presidents, dissatisfaction with costs is correlated .553 with the number of ideas evaluated and accounts for 23.2% of the variation in number of ideas evaluated. This result supports the proposition on cost dissatisfaction and is consistent with the findings from other tests on this variable.

The amount of business travel is correlated .509 with idea evaluation and accounts for 13.0% of the variation in number of ideas evaluated. This finding supports the proposition but did not appear in the tests reported earlier. Apparently business travel is associated with idea evaluations among company presidents but not among production managers or idea evaluators as

Proposition	Result of Test
1. The more employees in a firm, the larger the flow of perceived ideas for evaluation.	Not supported.
2. The greater the risk taking propensity of the idea evaluators, the larger the flow of perceived ideas for evaluation.	Not supported.
3. The greater the age of the idea evaluator, the smaller the flow of perceived ideas for evaluation.	Not supported.
4. The greater the idea evaluators' dissatisfaction with sales and cost levels, the larger the flow of perceived ideas for evaluation.	Supported for dissatisfaction with costs. Not supported for dissatisfaction with sales.
5. The greater the formal education of the idea evaluator, the larger the flow of perceived ideas for evaluation.	Supported
6. The greater the exposure of the idea evaluators to outside contacts and sources of information, the larger the flow of perceived ideas for evaluation.	Supported for two measures of exposure, not supported for other two
7. The greater the freedom of the organization to alter its product, the larger the flow of perceived ideas for evaluation.	Not supported.

Fig. 5.6. Summary of results of stage Ia model test using production managers.

Variable	Partial Correlation Coefficient	Percent of Variation Explained	Confidence Level
Dissatisfaction with costs	.553	23.2%	98
Amount of business travel	.509	13.0%	95
Number of professional meetings attended	.532	8.52%	98
Number of professional, trade, and business publications read	-.312	3.17%	80
Risk propensity	.263	3.19%	n.s.
	TOTAL	57.2%	

Fig. 5.7. Results of stage Ia model test using company presidents.

a group.

The number of professional meetings attended is correlated .532 with idea evaluation and accounts for 8.52% of the variation in number of ideas evaluated. This result also supports the proposition and is consistent with the result obtained among production managers.

The number of trade shows attended is negatively correlated (-.238) with the number of ideas evaluated and accounts for 6.19% of the variation in number of ideas evaluated. This finding, which is consistent with all three tests previously reported, is counter to the proposition. Apparently attendance at trade shows is not conducive to idea evaluation activity among presidents, production managers or all idea evaluators.

The number of professional, trade, and business publications read is correlated -.312 with the number of ideas evaluated and accounts for 3.17% of the variation in number of ideas evaluated. This finding is counter to the proposition and also inconsistent with the findings for other groups of idea evaluators. Apparently reading professional, trade, and business publications is associated with low numbers of idea evaluations among presidents, but with high numbers of idea evaluations among production managers and among all idea evaluators. This finding will be discussed further in the next section.

Risk propensity is correlated .263 with the number of ideas evaluated by the presidents, and accounts for 3.19% of the variation in number of ideas evaluated. This result supports the proposition, although the confidence level is not significant. Apparently high risk propensity is associated with high levels of idea evaluation among presidents but not among production managers or among all idea evaluators.

The results above account for a total of 57.2% of the variation in the number of ideas evaluated. This result indicates that the model's predictive power is much greater for this subset than for the set of all idea evaluators, suggesting that job function is a relevant factor in the idea evaluation

process.

The results of testing the stage Ia model with the company presidents group are summarized in Fig. 5.8.

Summary of the Results of Stage Ia Model Test

The results of the three separate stage Ia tests, performed on the overlapping subsets of all evaluators, production managers, and presidents, are listed in Fig. 5.9.

The proposition on company size was supported among all evaluators but not among production managers or presidents. Since there was a significant correlation in the set of all idea evaluators but not in the subsets of production managers or presidents, it seemed likely that, for the subset of evaluators who are neither production managers nor presidents, there should also be a significant correlation between company size and number of ideas evaluated. A correlation analysis of these two variables showed that this was indeed the case; the partial correlation coefficient of company size with number of ideas evaluated for this group was .560, compared to .408 for the set of all idea evaluators. Thus the original proposition is supported for evaluators who are neither production managers nor presidents, but not for those two groups of evaluators.

The group of evaluators who are neither presidents nor production managers is composed largely of engineers and quality control managers. Such positions fall within the category of what are generally called staff jobs. Thus it would appear that staff men in the large companies of this sample tend to evaluate significantly more ideas than those in the small companies.

The proposition on risk taking propensity was supported among the presidents but not among production managers or all evaluators. The non-significant confidence level associated with the correlation between risk propensity and number of ideas evaluated among presidents, coupled with the absence of such correlation among production managers and all idea evaluators, suggests that the effect of risk propensity upon idea evaluation activity is more complex than was originally thought. Dr. A. P. Hurter of Northwestern University has pointed out that just as the riskiest securities portfolio, among portfolios with a given market value, is the one with only one security in it, so the riskiest set of ideas of a given value is a small set.

It may be that some of the idea evaluators in this study preferred to take risks by concentrating on a small set of ideas rather than a large set. Such a tendency is, of course, counter to that postulated by the proposition, which reads "the greater the risk taking propensity of the idea evaluators, the larger the flow of ideas for evaluation." To check the existence of such a tendency, the average perceived riskiness of the ideas evaluated by each evaluator was investigated in relation to the number of ideas evaluated by each evaluator. Tests using both simple correlation and nonparametric statistics failed to disclose a significant relationship between these variables, however. The inconclusive results of all these tests suggest that more research is warranted in the area of risk propensity and idea evaluation.

The proposition on age of the idea evaluators has received no support even where organizational level has been controlled. Apparently, for this sample of idea evaluators, age does not affect the number of ideas evaluated.

Proposition	Result of Test
1. The more employees in a firm, the larger the flow of perceived ideas for evaluation.	Not supported.
2. The greater the risk taking propensity of the idea evaluators, the larger the flow of perceived ideas for evaluation.	Supported.
3. The greater the age of the idea evaluator, the smaller the flow of perceived ideas for evaluation.	Not supported.
4. The greater the idea evaluators' dissatisfaction with sales and cost levels, the larger the flow of perceived ideas for evaluation.	Supported for dissatisfaction with cost levels but not for sales levels.
5. The greater the formal education of the idea evaluator, the larger the flow of perceived ideas for evaluation.	Not supported.
6. The greater the exposure of the idea evaluators to outside contacts and sources of information, the larger the flow of perceived ideas for evaluation.	Supported for two measures of exposure, not supported for two others.
7. The greater the freedom of the organization to alter its product, the larger the flow of perceived ideas for evaluation.	Not supported.

Fig. 5.8. Summary of results of stage Ia model test using company presidents.

Proposition		All Evaluators	Production Managers	Presidents
1. The more employees in a firm, the larger the flow of perceived ideas for evaluation.		+	0	0
2. The greater the risk taking propensity of the idea evaluators, the larger the flow of perceived ideas for evaluation.		0	0	+
3. The greater the age of the idea evaluator, the smaller the flow of perceived ideas for evaluation.		0	0	0
4. The greater the idea evaluators' dissatisfaction with (a) cost, and (b) sales levels, the larger the flow of perceived ideas for evaluation.	(a)	+	+	+
	(b)	0	-	0
5. The greater the formal education of the idea evaluator, the larger the flow of perceived ideas for evaluation.		0	+	0
6. The greater the exposure of the idea evaluators to outside contacts and sources of information, as measured by (a) business travel, (b) attendance at trade shows, (c) attendance at professional meetings, and (d) reading professional, trade, and business publications, the larger the flow of perceived ideas for evaluation.	(a)	0	0	+
	(b)	-	-	-
	(c)	0	+	+
	(d)	+	+	-
7. The greater the freedom of the organization to alter its product, the larger the flow of perceived ideas for evaluation.		0	0	0

+ = positive support
0 = no support
- = negative support; relationship in opposite direction to that predicted.

Fig. 5.9. Summary of stage Ia model test using three subsets of evaluators.

The proposition on dissatisfaction with costs and sales must be treated as two propositions. Dissatisfaction with costs was significantly correlated with the number of ideas evaluated in all three groups of evaluators and in each case this variable has explained a relatively large percent of the variation in number of ideas evaluated. Dissatisfaction with sales levels, however, was negatively correlated with number of ideas evaluated among production managers, and was not correlated among presidents or among all idea evaluators. The theory on aspiration levels and search behavior offers no explanation for a negative correlation between dissatisfaction and number of ideas evaluated. The author concludes that the proposition "the greater the dissatisfaction with costs, the larger the flow of perceived ideas for evaluation" is supported, while the proposition "the greater the dissatisfaction with sales, the larger the flow of perceived ideas for evaluation" is not supported.

The proposition on level of formal education is supported among production managers but not among presidents or all evaluators. Apparently, idea evaluators performing the functions of production manager evaluate more ideas the higher their educational level, while for idea evaluators in other functions there is no association between educational level and number of ideas evaluated. Evidence for the proposition is thus inconclusive, and the author suggests that further research in this area investigate the interrelationship of educational level and job function as both affect the evaluation of ideas.

The proposition on exposure to outside contacts and source of information will be discussed in the context of the various indices of exposure used in the study. The sub-proposition "the greater the amount of business travel by the evaluator, the larger the flow of perceived ideas for evaluation" is supported among presidents but not among production managers or all evaluators. On the other hand, the sub-proposition "the more professional, trade and business publications read by the evaluator, the larger the flow of perceived ideas for evaluation" is supported among all evaluators, and among production managers but not among presidents. Viewing these two findings in juxtaposition, it appears that reading professional, trade and business publications is associated with high levels of idea evaluation among all evaluators and among production managers, whereas business travel is associated with high levels of idea evaluation among company presidents.

The sub-proposition "the more the evaluator's attendance at trade shows, the larger the flow of perceived ideas for evaluation" is refuted by all three subsets of evaluators, yielding a negative correlation coefficient in each case. It appears that attendance at trade shows has a negative correlation coefficient in each case.

Following the discussion of the stage II model test, it will be shown that trade shows were the source of only 1.1% of the ideas evaluated during this research. These findings suggest that attendance at trade shows may be a less effective source of ideas than is the evaluators' normal work routine.

The last sub-proposition in this group is "the greater the evaluator's attendance at professional meetings, the larger the flow of perceived ideas for evaluation." This sub-proposition is supported for company presidents and production managers but not for the group of all evaluators. Apparently those production managers and presidents who attend more professional meetings than the median evaluate more ideas than do those who attend fewer professional meetings, but the same is not true of the group of all evaluators.

The above findings relative to the general variable "exposure to outside contacts and sources of information" suggest that the variable is relevant to

idea evaluation and that the mechanisms of the variable are worthy of further study.

The proposition "the greater the freedom of the organization to alter the product, the larger the flow of ideas" was not supported among any of the three subsets of idea evaluators. This proposition must be regarded as not supported.

The foregoing stage Ia analysis has dealt with propositions whose dependent variable is the number of ideas evaluated by each evaluator.

The groups of presidents and production managers have shown some interesting differences in the factors which influence this dependent variable. While the difference in the effect of risk propensity cannot be taken too seriously, due to the non-significant confidence level associated with the correlation, the differential effect of dissatisfaction with sales is of interest. Among presidents, dissatisfaction with sales is not correlated with the number of ideas evaluated, whereas among production managers it is negatively correlated. This means that those production managers who are most dissatisfied with sales levels tend to evaluate fewer ideas than those who are less dissatisfied with sales levels, while this tendency is not found among presidents. Since neither of these results was predicted by the relevant theory, they are difficult to interpret. It would seem that the level of sales would be of greater concern to the president of a company than to the production manager. Further research into the behavioral results of dissatisfaction with sales might clarify this set of findings.

Another difference between production managers and presidents appears in the association of educational level with idea evaluation. While the confidence level is only .70, educational level is correlated with the number of ideas evaluated among production managers but not among presidents. If it were true that the types of ideas evaluated by production managers were more complex in a technical sense than those evaluated by presidents, the finding could be explained on the grounds that in order to evaluate pertinent ideas, production managers "need" education more than do presidents. Lacking the above information, we can only speculate on the reason for the difference.

The highly significant correlation between business travel and the number of ideas evaluated by presidents has no counterpart among production managers. Lacking precise information on the origin of ideas, we cannot conclude that business travel is a source of ideas for presidents but not for production managers. We can say that those presidents who travel on business most evaluate more ideas than those who travel less, but the same is not true for production managers. More research into the origins of ideas would be required to explain both the above result and the one below.

The positive correlation between reading professional, trade, and business publications and the number of ideas evaluated by production managers does not carry a significant confidence level, but the negative correlation between the same variables for presidents carries a confidence level of .80. As in the case above, lacking sufficient information on the sources of ideas, we can only speculate that reading professional, trade, and business publications may be a more fruitful source of ideas for production managers than for presidents.

The above material is discussed further in the conclusions section.

We will now consider the stage Ib model and a set of propositions with the same independent variables as the stage Ia model above, but whose dependent variable is the number of ideas accepted by each evaluator.

The Stage Ib Model

The stage Ib model is simply the second part of each of the seven propositions, the first parts of which make up the stage Ia model. In other words, the stage Ib model can be obtained by dropping the words "perceived ideas for evaluation" from each proposition in the stage Ia model and substituting the words "ideas accepted." The stage Ib model therefore consists of the following seven propositions:

1. The more employees in a firm, the larger the flow of ideas accepted.

2. The greater the risk propensity of an idea evaluator, the larger the flow of ideas accepted.

3. The higher the age of the idea evaluator, the smaller the flow of ideas accepted.

4. The greater the idea evaluator's dissatisfaction with sales and cost levels, the larger the flow of ideas accepted.

5. The greater the formal education of the idea evaluator, the larger the flow of ideas accepted.

6. The greater the exposure of the idea evaluator to outside contacts and sources of information, the larger the flow of ideas accepted.

7. The greater the freedom of the organization to alter its product the larger the flow of ideas accepted.

The stage Ib model was tested in the same manner as the stage Ia model, using the BMD-29 program with the limit set at 1% of the variation in the dependent variable. Only the dependent variable itself is different in these tests.

For purposes of this test, an idea is considered to be "accepted" if the evaluator classified is as "accepted and change ordered" on the idea report form. While the category "accepted in principle" also appears on the idea report form, it does not carry the committment connotation of the above category, and is therefore not included in the stage Ib test. One model run was made, using all evaluators and with the variables categorized as indicated in Chapter III, using as a dependent variable the sum of the number of ideas "accepted in principle" and the number "accepted and change ordered." The results were not significantly different from those to be described in the next section.

As with the stage Ia tests, the stage Ib model is first tested using all evaluators and with the variables categorized as indicated in Chapter III. The results of this test are given in Fig. 5.10, and computer printouts are reproduced in Appendix 2.

Discussion of Stage Ib Model Results Using all Evaluators and With the Variables Categorized as Indicated in Chapter III

The fact that an organization possesses moderate freedom to alter its product accounts for a higher proportion of the variation in number of ideas accepted (5.5%) and carries a higher confidence level (99) than does any other attribute. This finding supports the proposition on freedom to alter the

Variable or Attribute	Partial Correlation Coefficient	Percent of Variation Explained	Confidence Level
1. Moderate freedom to alter the product	.351	5.50%	99
2. Number of employees	.288	5.29%	98
3. Moderate dissatisfaction with cost levels	.265	4.43%	98
4. Medium level of risk propensity	-.233	2.8%	95
5. Moderate dissatisfaction with sales levels	.228	2.79%	95
6. Educational level includes some college work but less than a B.S. degree	-.082	2.42%	n.s.
7. Number of professional, trade, and business publications read is in excess of group median	.194	2.07%	90
8. Number of days spent travelling on business in past year is in excess of group median	-.159	1.78%	70
9. Educational level B.S. degree or higher	.125	1.12%	70
10. 2nd lowest level of risk propensity	.118	1.01%	n.s.
	TOTAL	29.2%	

Fig. 5.10. Results of stage Ib test using all evaluators and with the variables categorized as indicated in Chapter III. Numbers are rounded to three decimal places.

product, but the fact that the attribute "high freedom to alter the product" does not appear in the results weakens this support. This combination of findings suggests that while moderate freedom to alter the product is associated relatively strongly with the number of idea acceptances, high freedom to alter the product is not so associated. This in turn suggests that the effect of freedom to alter the product upon the number of idea acceptances is not linear, but is in the shape of an inverted U. Such a tentative conclusion is at odds with the reasons for advancing the proposition, but it should be pointed out again that this proposition was based on the verbalized experiences of a number of company managers and not on the theoretical literature. More research is needed to clarify this question.

The association of number of employees with number of ideas accepted accounts for 5.29% of the variation in number of ideas accepted and supports Mansfield's hypothesis and the author's proposition.

The .265 correlation of "moderate dissatisfaction with cost levels" with number of ideas accepted accounts for 4.43% of the variation in number of ideas accepted and supports the proposition. As was the case when the dependent variable was the number of ideas evaluated, however, "low" and "high" dissatisfaction with cost levels failed to appear in the results. This situation was examined at some length in the section on discussion of stage Ia model results and will not be further discussed here. Membership in the medium level of evaluator risk propensity is correlated -.233 with the number of ideas accepted and accounts for 2.8% of the variation in number of ideas accepted. This negative correlation, which carries a confidence level of 95, indicates that idea evaluators whose risk propensity is medium tend to accept fewer ideas than those with lower risk propensities. This finding is counter to the proposition, which hypothesized that the higher the risk propensity of an idea evaluator, the larger the flow of ideas accepted by that evaluator. The only other category of risk propensity appearing in the results supports the proposition but carries a non-significant confidence level. Membership in the second lowest category of risk propensity is correlated .118 with the number of ideas accepted and accounts for 1.01% of the variation in number of ideas accepted. This finding is in the right direction to support the proposition but does not carry a sufficiently high confidence level to constitute support. Thus the proposition on risk propensity must be considered not supported.

The attribute "moderate dissatisfaction with sales levels" accounts for 2.79% of the variation in number of ideas accepted. This result, which carries a confidence level of 95, supports the proposition. As has been the case with other appearances of the dissatisfaction variable, neither the low nor the high dissatisfaction attributes appear in the results. This development was examined in the section on discussion of stage Ia model results and the same speculation applies to this result.

The negative correlation between membership in the educational level category which includes some college work but less than a B.S. degree, and the number of ideas accepted, is in the opposite direction to that predicted, for it indicates that idea evaluators with some college work tend to accept fewer ideas than idea evaluators with no college. While this finding accounts for 2.42% of the variation in number of ideas accepted, the fact that it carries a non-significant confidence level indicates that it is not a reliable indicator of negative support for the proposition, but rather constitutes no support. The other educational level attribute in the test, educational level

B.S. degree or higher, is correlated .125 with the number of ideas accepted and supports the proposition. Although the percent of the variation in number of ideas accepted which is explained by this attribute (1.12%) is lower than for the category considered above, the confidence level is higher. In the author's opinion, these two results together constitute weak and partial support for the proposition.

The last two findings both relate to the basic variable "exposure to outside contacts and sources of information." The attribute "number of professional, trade and business publications read is in excess of group median" is positively associated (.194) with the number of ideas accepted, whereas the attribute "number of days spent travelling on business is in excess of group median" is negatively associated (-.159) with number of ideas accepted. The attributes account respectively for 2.07% and 1.78% of the variation in number of ideas accepted. A similar situation occurred in stage Ia except that the variable negatively correlated was attendance at trade shows. In the discussion on cross-correlations it will be shown that the simple correlation coefficient between the attributes "attendance at trade shows is in excess of group median" and "number of days spent travelling on business is in excess of group median" is .43. This relatively high correlation may explain the fact that the above attributes are negatively correlated with idea evaluation and idea acceptance, respectively.

Thus the proposition is supported by the finding on "publications read" but is refuted by the finding on "business travel." The other attributes dealing with exposure to outside contacts and sources of information do not appear in the results and hence each account for less than 1% of the variation in number of ideas accepted. The proposition on exposure is therefore supported by one attribute and not supported by the other four. Apparently reading trade, professional, and business publications is positively associated with the number of ideas accepted while other attributes which were also assumed to be indices of exposure to outside contacts and sources of information are not so associated. Viewing the results as a whole, the proposition must be considered not supported. More research would help with the problem of reformulating the proposition to take account of the findings.

The results of the stage Ib test using all evaluators and with the variables categorized as indicated in Chapter III are summarized in Fig. 5.11. In the following section the test of the stage Ib model is repeated with all the independent variables except company size dichotomized.

The Stage Ib Model Test Using All Evaluators and Dichotomous Variables

The test just described, using categorizations of the variables developed prior to the data collection, indicated that the model and original categorization scheme were capable of explaining a modest 29% of the total variation in the number of ideas accepted. As in the test of the stage Ia model, this model was retested with every independent variable except company size dichotomized. Each of the independent variables dichotomized was split on the median measurement, with all scores above the median being classified as "high" and all scores on or below the median classified as "low." The results of this test are indicated in Fig. 5.12.

Proposition	Result of Test
1. The more employees in a firm, the larger the flow of ideas accepted.	Supported
2. The greater the risk propensity of an idea evaluator, the larger the flow of ideas accepted.	Not supported.
3. The higher the age of the idea evaluator, the smaller the flow of ideas accepted.	Not supported.
4. The greater the idea evaluator's dissatisfaction with sales and cost levels, the larger the flow of ideas accepted.	Both supported for moderate levels of dissatisfaction but not for high levels.
5. The greater the formal education of the idea evaluator, the larger the flow of ideas accepted.	Partially supported.
6. The greater the exposure of the idea evaluator to outside contacts and sources of information, the larger the flow of ideas accepted.	Supported for one index of exposure, but not supported for four others.
7. The greater the freedom of the organization to alter its product, the larger the flow of ideas accepted.	Partially supported.

Fig. 5.11. Summary of results of stage Ib model test using all evaluators and with the variables categorized as indicated in Chapter III.

Variable or Attribute	Partial Correlation Coefficient	Percent of Variation Explained	Confidence Level
Company size	.249	8.07%	95
Number of professional, business, and trade publications read	.189	2.56%	90
Dissatisfaction with sales	-.193	2.22%	90
Risk Propensity	-.130	1.72%	70
Freedom to alter the product	-.123	1.27%	70
Dissatisfaction with costs	.132	1.01%	70
	TOTAL	16.8%	

Fig. 5.12. Results of stage Ib model test using all idea evaluators and dichotomous variables.

Discussion of Results of Stage Ib Test Using all Evaluators and Dichotomous Variables

Company size is correlated .249 with the number of ideas accepted, and accounts for 8.07% of the variation in number of ideas accepted. This result supports the proposition on company size and is consistent with the results of the previous stage Ib test.

The number of professional, business, and trade publications read is correlated .189 with the number of ideas accepted, and accounts for 2.56% of the variation in number of ideas accpeted. This result supports the proposition on exposure to outside contacts and sources of information, but it is the only index of such exposure to appear in this test. Thus this proposition is supported by one index of exposure to outside contacts and sources of information but not by the other three.

Dissatisfaction with sales levels is correlated -.193 with the number of ideas accepted and accounts for 2.22% of the variation in number of ideas accepted. This result, which indicates that evaluators who are highly dissatisfied with sales tend to accept fewer ideas than do evaluators who are less dissatisfied with sales, is in the direction opposite to that predicted by the proposition and is not consistent with the results of the stage Ib test described previously. On the other hand, dissatisfaction with costs is positively correlated (.132) with the number of ideas accepted and accounts for 1.01% of the variation in number of ideas accepted. This result supports the proposition with respect to dissatisfaction with cost levels, and is consistent with the results of the previous stage Ib test. Thus the results of testing the dissatisfaction proposition are split, with positive support for the predicted association between dissatisfaction with costs and number of ideas accepted, and negative support for the predicted association between dissatisfaction with sales and number of ideas accepted.

Evaluator risk propensity is correlated -.130 with the number of ideas accepted and accounts for 1.72% of the variation in number of ideas accepted.

This finding is in the opposite direction to that predicted by the risk propensity proposition and, although the confidence level is low, constitutes negative support for the proposition.

Freedom to alter the product is correlated -.123 with the number of ideas accepted and accounts for 1.27% of the variation in the number of ideas accepted. As was the case with risk propensity, this finding constitutes negative support for the proposition, although the confidence level is low. In addition, this result is inconsistent with the previous stage Ib test results.

The stage Ib model using all evaluators and dichotomous variables accounts for 16.8% of the variation in the number of ideas accepted. A summary of the results of testing this model appears in Fig. 5.13.

The fact that the stage Ib model using all evaluators and dichotomous variables accounts for only 16.8% of the variation in number of ideas accepted suggests that some exploratory research into the phenomenon is warranted. In the following sections the same model is tested with two subsets of the set of all idea evaluators, production managers and company presidents.

The Stage Ib Model Test using Production Managers

As was explained in the discussion of the stage Ia model, an effort to test the model with a set of idea evaluators having similar job functions led to the selection of a subset of production managers. This subset consists of 15 production managers and 13 presidents of companies which do not have a production manager. The subset is called "production managers" to distinguish it from the "presidents" subset which will be discussed later.

The results of testing the stage Ia model with production managers and dichotomous variables are given in Fig. 5.14.

Discussion of Results of the Stage Ib Model Test Using Production Managers

Fig. 5.14 shows that, for the production managers, the amount of business travel carries the highest correlation coefficient with the number of ideas accepted (.348) and accounts for 16.5% of the variation in the number of ideas accepted. This result supports the prediction that the more the business travel, the more ideas will be accepted. The other indicators of exposure to outside contacts and sources of information do not appear in the results, however, indicating that they account for less than 1% of the variation in number of ideas accepted by the production managers.

Dissatisfaction with sales is negatively correlated (-.201) with the number of ideas accepted, and accounts for 6.14% of the variation in number of ideas accepted. Although the associated confidence level is not significant, the result indicates that those production managers in the sample who are highly dissatisfied with sales levels accept fewer ideas than those who are less dissatisfied with sales levels. This finding is in the opposite direction to that predicted by the proposition.

Evaluator age is correlated .160 with the number of ideas accepted and accounts for 2.47% of the variation in number of ideas accepted. This result indicates that older production managers in the sample tend to accept more ideas than the younger production managers. Like the previous result,

Proposition	Result of Test
1. The more employees in a firm, the larger the flow of ideas accepted.	Supported.
2. The greater the risk taking propensity of the idea evaluators, the larger the flow of ideas accepted.	Not supported.
3. The greater the age of the idea evaluator, the smaller the flow of ideas accepted.	Not supported.
4. The greater the idea evaluator's dissatisfaction with sales and cost levels, the larger the flow of ideas accepted.	Supported for dissatisfaction with costs. Not supported for dissatisfaction with sales.
5. The greater the formal education of the idea evaluator, the larger the flow of ideas accepted.	Not supported.
6. The greater the exposure of the idea evaluators to outside contacts and sources of information, the larger the flow of ideas accepted.	Supported for one measure of exposure, not supported for three others.
7. The greater the freedom of the organization to alter its product, the larger the flow of ideas accepted.	Not supported.

Fig. 5.13. Summary of results of stage Ib model test using all evaluators and dichotomous variables.

Variable	Partial Correlation Coefficient	Percent of Variation Explained	Confidence Level
Amount of business travel	.348	16.5%	90
Dissatisfaction with sales	-.201	6.14%	n.s.
Age	.160	2.47%	n.s.
Risk Propensity	.136	1.39%	n.s.
	TOTAL	26.5%	

Fig. 5.14. Results of stage Ib model test using production managers.

this result is in the opposite direction to that predicted, but carries a non-significant confidence level. Thus the proposition on evaluator age is not supported by the subset of production managers.

Finally, risk propensity is correlated .136 with the number of ideas accepted and accounts for 1.39% of the variation in number of ideas accepted by production managers. While this finding supports the proposition on risk propensity, its confidence level is not significant.

The above variables account for a total of 26.5% of the variation in number of ideas accepted by the subset of production managers. The results of testing the stage Ib model with the subset of production managers are summarized in Fig. 5.15. In the next section the same model is tested using the subset of company presidents.

The Stage Ib Model Test Using Presidents

The belief that the functions of the president across the different companies in the sample set might contain similarities which would be relevant to idea acceptance activity led to the formation of a subset of idea evaluators who were presidents of companies. This subset, which numbered 24 evaluators, was tested with the stage Ib model. As was the case with production managers, the small sample size forced the use of dichotomous independent variables.

The results of this test are reported in Fig. 5.16.

Discussion of Results of Stage Ib Model Test Using Company Presidents

For the group of idea evaluators who are company presidents, the amount of business travel is correlated .610 with the number of ideas accepted, and accounts for 12.5% of the variation in number of ideas accepted. This finding supports the proposition and is consistent with the result for the production managers. Apparently business travel is associated with idea acceptance among company presidents and among production managers.

Proposition	Result of Test
1. The more employees in a firm, the larger the flow of ideas accepted.	Not supported.
2. The greater the risk taking propensity of the idea evaluators, the larger the flow of ideas accepted.	Weakly supported.
3. The greater the age of the idea evaluator, the smaller the flow of ideas accepted.	Not supported.
4. The greater the idea evaluator's dissatisfaction with sales and cost levels, the larger the flow of ideas accepted.	Not supported.
5. The greater the formal education of the idea evaluator, the larger the flow of ideas accepted.	Not supported.
6. The greater the exposure of the idea evaluators to outside contacts and sources of information, the larger the flow of ideas accepted.	Supported for one measure, not supported for three others.
7. The greater the freedom of the organization to alter its product, the larger the flow of ideas accepted.	Not supported.

Fig. 5.15. Summary of results of stage Ib model test using production managers.

Variable	Partial Correlation Coefficient	Percent of Variation Explained	Confidence Level
Amount of business travel	.610	12.5%	99
Number of professional meetings attended	.267	7.60%	n.s.
Freedom to alter the product	-.442	6.10%	90
Evaluator age	.390	5.02%	85
Dissatisfaction with costs	.277	4.55%	70
Number of professional, trade, and business publications read	-.417	4.10%	90
Number of trade shows attended	.160	3.53%	n.s.
Risk propensity	-.184	1.86%	n.s.
Educational level	.239	1.68%	n.s.
	TOTAL	46.9%	

Fig. 5.16. Results of stage Ib model test using company presidents.

The number of professional meetings attended is correlated .267 with the number of ideas accepted and accounts for 7.60% of the variation in number of ideas accepted. This result also supports the proposition but carries a non-significant confidence level.

Freedom to alter the product is correlated -.442 with the number of ideas accepted and accounts for 6.1% of the variation in number of ideas accepted. This relatively strong and significant result indicates that the company presidents in the sample who are associated with companies having a large amount of freedom to alter the product tend to accept fewer ideas than do those presidents who are associated with companies having less freedom to alter the product. This result is the opposite of that predicted by the relevant proposition.

The evaluator's age is correlated .390 with the number of ideas accepted and accounts for 5.02% of the variation in number of ideas accepted. This result is also opposite of the predicted association, indicating that older company presidents tend to accept more ideas than younger presidents. The same tendency was found among production managers.

Dissatisfaction with costs is correlated .277 with the number of ideas accepted and accounts for 4.55% of the variation in number of ideas accepted. Although the confidence level of this result is low, it supports the proposition, indicating that those company presidents in the sample who are most dissatisfied with costs tend to accept more ideas than those presidents who are less dissatisfied with costs.

The number of professional, trade, and business publications read by the presidents is correlated -.417 with the number of ideas accepted and accounts for 4.1% of the variation in number of ideas accepted. This indicates that those presidents in the sample who read the most professional, trade, and business publications tend to accept fewer ideas than those who read fewer of the aforementioned publications. This result is the opposite to that predicted by the proposition.

Although the confidence level is not significant, the number of trade shows attended by the presidents is correlated .160 with the number of ideas accepted, and accounts for 3.53% of the variation in the number of ideas accepted. While this result supports the relevant proposition, the tests ran on production managers and all evaluators did not provide such support.

The risk propensity of the presidents is negatively correlated (-.184) with the number of ideas accepted and accounts for 1.86% of the variation in number of ideas accepted. While this finding is the opposite to that predicted by the proposition, the confidence level is not significant.

The results above account for a total of 46.9% of the variation in number of ideas accepted. This improvement over the 16.8% accounted for by the same model using all idea evaluators suggests that the job function of the evaluator is a significant factor in explaining the number of ideas accepted by the evaluator.

The results of testing the stage Ib model with company presidents are summarized in Fig. 5.17.

Summary of Results of Stage Ib Model Test

The results of the three separate stage Ib tests, performed on the overlapping subsets of all evaluators, production managers, and presidents, are listed in Fig. 5.18.

The proposition on company size was supported among all evaluators but not among production managers or presidents. Since there was a significant correlation in the set of all idea evaluators but not in the subsets of production managers or presidents, it seemed likely that, for the subset of evaluators who are neither production managers nor presidents, there should also be a significant correlation between company size and number of ideas accepted. A correlation analysis of these two variables showed that this was indeed the case; the partial correlation coefficient of company size with number of ideas accepted for this group was .525, compared to .249 for the set of all idea evaluators. Thus the original proposition is supported for evaluators as a whole and for evaluators who are neither production managers nor presidents, but not for presidents or production managers.

The proposition on risk taking propensity was supported among the production managers but negatively supported among all evaluators and among presidents. The non-significant confidence levels associated with all three correlations between risk propensity and number of ideas accepted, however, indicate that very little reliance can be placed in either the magnitude or the direction of the partial correlation coefficients. This in turn means that the test of the risk propensity proposition must be considered inconclusive.

The proposition on age of the idea evaluators received no support among all idea evaluators and negative support where organizational level was controlled. Apparently, for the sample of all idea evaluators, age does not affect the number of ideas evaluated, whereas among production managers and

Proposition	Result of Test
1. The more employees in a firm, the larger the flow of ideas accepted.	Not supported.
2. The greater the risk taking propensity of the idea evaluators, the larger the flow of ideas accepted.	Not supported.
3. The greater the age of the idea evaluator, the smaller the flow of ideas accepted.	Not supported.
4. The greater the idea evaluators' dissatisfaction with a) sales and b) cost levels, the larger the flow of ideas accepted.	a) Not supported. b) Supported.
5. The greater the formal education of the idea evaluator, the larger the flow of ideas accepted.	Not supported.
6. The greater the exposure of the idea evaluators to outside contacts and sources of information, as measured by a) business travel, b) attendance at trade shows, c) attendance at professional meetings, and d) reading professional, trade and business publications, the larger the flow of ideas accepted.	a) Supported. b) Supported. c) Supported. d) Not supported.
7. The greater the freedom of the organization to alter its product, the larger the flow of ideas accepted.	Not supported.

Fig. 5.17. Summary of stage Ib model test results using company presidents.

Proposition		All Evaluators	Production Managers	Presidents
1. The more employees in a firm, the larger the flow of ideas accepted.		+	0	0
2. The greater the risk taking propensity of the idea evaluators, the larger the flow of ideas accepted.		-	+	-
3. The greater the age of the idea evaluator, the smaller the flow of ideas accepted.		0	-	-
4. The greater the idea evaluators' dissatisfaction with (a) cost, and (b) sales levels, the larger the flow of ideas accepted.	(a)	+	0	+
	(b)	-	-	0
5. The greater the formal education of the idea evaluator, the larger the flow of ideas accepted.		0	0	+
6. The greater the exposure of the idea evaluators to outside contacts and sources of information, as measured by (a) business travel, (b) attendance at trade shows, (c) attendance at professional meetings, and (d) reading professional, trade, and business publications, the larger the flow of ideas accepted.	(a)	0	+	+
	(b)	0	0	+
	(c)	0	0	+
	(d)	+	0	-
7. The greater the freedom of the organization to alter its product, the larger the flow of ideas accepted.		-	0	-

+ = positive support
0 = no support
- = negative support; relationship in opposite direction to that predicted.

Fig. 5.18. Summary of stage Ib model test using three subsets of evaluators.

presidents, older men accept more ideas than younger men. Thus there is no support for the proposition stated but some support for the proposition "the older the idea evaluator, the larger the flow of ideas accepted."

The proposition on dissatisfaction with costs and sales must be treated as two propositions. Dissatisfaction with costs was significantly correlated with the number of ideas accepted among all evaluators and among presidents, but not among production managers. Dissatisfaction with sales levels, however, was negatively correlated with number of ideas accepted among production managers, and among all evaluators, and was not correlated among presidents. The theory on aspiration levels and search behavior offers no explanation for a negative correlation between dissatisfaction and number of ideas accepted. The author concludes that the proposition "the greater the dissatisfaction with costs, the larger the flow of ideas accepted" is supported, while the proposition "the greater the dissatisfaction with sales, the larger the flow of ideas accepted," is not supported.

The proposition on level of formal education is supported among presidents but not among production managers, or all evaluators. Apparently, idea evaluators performing the function of president tend to accept more ideas the higher their educational level, while for idea evaluators in other functions there is no association between educational level and number of ideas evaluated. In view of the non-significant confidence level associated with the result for presidents, however, the proposition cannot be considered supported in this study. The author suggests that further research in this area investigate the interrelationship of educational level and job function as both affect the acceptance of ideas.

The proposition on exposure to outside contacts and sources of information will be discussed in the context of the various indices of exposure used in the study. The sub-proposition "the greater the amount of business travel by the evaluator, the larger the flow of ideas accepted" is supported among presidents and production managers but not among all evaluators. On the other hand the sub-proposition "the more professional, trade and business publications read by the evaluator, the larger the flow of ideas accepted" is supported among all evaluators but not among production managers or presidents. Viewing these two findings in juxtaposition, it appears that reading professional, trade, and business publications is associated with high levels of idea acceptance among all evaluators, whereas business travel is associated with high levels of idea acceptance among production managers and company presidents.

The sub-proposition "the more the evaluator's attendance at trade shows, the larger ghe flow of ideas accepted" is supported among presidents but not among production managers or all evaluators. In view of the non-signficiant confidence level associated with the result among presidents, the sub-proposition must be considered not supported. As mentioned previously, trade shows were the source of only 1.1% of the ideas evaluated during this study. These findings suggest that for this sample of evaluators, attendance at trade shows is not significantly associated with the acceptance of ideas.

The last sub-proposition in this group is "the greater the evaluator's attendance at professional meetings, the larger the flow of ideas accepted." This sub-proposition is supported for company presidents but not for production managers or the group of all evaluators. The non-significant confidence level associated with the result for presidents suggests that the sub-proposition be considered not supported.

The above findings relative to the general variable "exposure to out-

side contacts and sources of information" suggest that the variable is worthy of further study.

The proposition "the greater the freedom of the organization to alter the product, the larger the flow of ideas accepted" received negative support among all evaluators and among company presidents, and no support among production managers. This proposition must be regarded as not supported, and there is evidence that an inverse association exists.

As was the case with the stage Ia model test, the results of the stage Ib test point up interesting differences between production managers and presidents in the correlates of idea acceptance. For example, those presidents who are most dissatisfied with costs tend to accept more ideas than presidents who are less dissatisfied with costs, but this tendency is not present among production managers.

There is also a significant negative correlation between the number of professional, trade, and business publications read by presidents and the number of ideas accepted by them, whereas no such relationship exists for production managers. In other words, presidents who read more of the above types of publications tend to accept fewer ideas than presidents who read fewer of such publications. It is not clear why the reading of professional, trade, and business publications should be strongly associated with the number of ideas accepted by presidents but not by production managers.

Presidents of companies having high freedom to alter the product tend to accept fewer ideas than presidents of companies having less freedom to alter the product, but no such relationship holds for production managers. As in the cases above, this differential association cannot be readily explained. These results suggest that the differences in functions and perceptions between the groups of presidents and production managers may influence the idea acceptance activity of each group. This suggestion is discussed further in the conclusions section.

The differential associations of idea acceptance with risk propensity, dissatisfaction with sales, educational level, and attendance at trade shows and professional meetings are all based on correlations having non-significant confidence levels and are therefore not reliable findings.

A Comparison of the Factors Associated with Idea Evaluation and with Idea Acceptance

When the theoretical model for this research was formulated, it was hypothesized that the number of ideas evaluated and the number of ideas accepted by an evaluator were both influenced by the same seven variables. Having isolated groups of evaluators (production managers and presidents) whose idea evaluation and acceptance activity is predicted by the model to a greater degree than is the case with the set of all idea evaluators, we can now examine the extent to which the various independent variables have the same association with the two dependent variables. We will do this for each group of evaluators separately, comparing the association of a given independent variable with the number of ideas evaluated, with the association of the same independent variable with the number of ideas accepted.

Since we are in this section comparing correlations with each other instead of with zero, the confidence levels of both correlations to be compared are relevant. It follows that we should demand a higher confidence level of each correlation to be compared than if we were merely searching for correlations.

For this reason, Fig. 5.19 shows only those correlations of either sign that carry a confidence level of .90 or higher.

Idea Evaluation and Acceptance Among Production Managers

An examination of Fig. 5.19 shows that among production managers two independent variables had a significantly different association with the number of ideas evaluated than they did with the number of ideas accepted. Dissatisfaction with costs is significantly associated with the number of ideas evaluated but not with the number accepted. Correlation does not imply causation, but if causation is in fact present and flowing from the independent variable to the dependent variable, we could deduce from the above results that dissatisfaction with costs tends to increase the number of ideas evaluated by production managers but not the number accepted. In other words, dissatisfaction with costs is an effective spur to idea evaluation but has no significant effect on idea acceptance. This result could mean that the production manager who is dissatisfied with costs examines more alternatives for every idea accepted than does the production manager who is less dissatisfied with costs. All of this is speculation since we have no evidence of a causal relationship between <u>any</u> of the independent variables and the dependent variables.

The other significantly different associations among production managers is the fact that business travel is correlated with the number of ideas accepted but not the number evaluated. Thus production managers who travel on business a lot accept more ideas, but do not evaluate more ideas, than production managers who travel on business less. With the same reservations expressed above, if there is causation between this independent variable and the dependent variable, then it would appear that the effect of business travel on production managers is not to provide more ideas for evaluation but to provide more acceptance for the ideas which he evaluates. As in the above case, this is speculation.

To summarize, there are significant differences between the effects of the two independent variables above on idea evaluation and idea acceptance, respectively. This suggests that the processes of idea selection and idea evaluation contain dissimilarities not predicted by the model. We will now examine the group of presidents for further information on this point.

Idea Evaluation and Acceptance among Presidents

Fig. 5.19 shows that four independent variables have significantly different associations with the number of ideas evaluated and the number accepted. As was the case among production managers, dissatisfaction with costs is positively correlated with the number of ideas evaluated but not with the number accepted. The same comments and speculation which apply to production managers apply also to presidents.

The second differential association is that of attendance at professional meetings. Such attendance is positively correlated with the number of ideas evaluated by the presidents but not with the number of ideas accepted. If there is a causal influence from attendance at professional meetings to idea evaluation, it would appear that professional meetings are either a source of ideas or in some other way increase the number of ideas evaluated, but do not

Independent Variable	Production Managers Ideas Evaluated	Production Managers Ideas Accepted	Presidents Ideas Evaluated	Presidents Ideas Accepted
Company size	0	0	0	0
Risk propensity	0	0	0	0
Age	0	0	0	0
Dissatisfaction with costs	+	0	+	0
Dissatisfaction with sales	0	0	0	0
Education	0	0	0	0
Business travel	0	+	+	+
Attendance at trade shows	0	0	0	0
Attendance at professional meetings	0	0	+	0
Reading	0	0	0	-
Freedom to alter the product	0	0	0	-

+ = association in the predicted direction
0 = no association
- = association in a direction opposite to that predicted

Fig. 5.19. Significant associations between independent variables and two dependent variables among production managers and presidents. Associations carrying a confidence level less than .90 are shown as "0".

influence the number of ideas accepted. As indicated previously, this could mean that presidents who attend more professional meetings tend to evaluate more alternatives for each idea they accept than do presidents who attend fewer professional meetings. The third differential association among presidents is that of reading professional, trade, and business publications with idea evaluation and acceptance. Presidents who read more of the above publications tend to evaluate as many ideas as those who read fewer of them, but they tend to accept fewer ideas.

Finally, there is a differential association similar to that above on the variable "freedom to alter the product." Presidents of companies with a high degree of freedom to alter the product evaluate as many ideas as presidents of companies with less freedom to alter the product, but they tend to accept fewer ideas. This result is not intuitively plausible, suggesting that the situation with respect to this independent variable is more complex than was originally postulated.

The above results reinforce the suggestion that the processes of idea selection and evaluation are dissimilar in several respects. The author suggests that future research in this area begin with a model which recognizes the differences pointed out above and attempts to accomodate them. This point is discussed further in the conclusions section.

The stage Ib model is not capable of explaining as large a proportion of the variation in its dependent variable (number of ideas accepted) as the stage Ia model explains for its dependent variable (number of ideas evaluated). This is true for all evaluators, for production managers, and for presidents. Although grouping evaluators by function improves the explanatory powers of both models dramatically, there is still a large amount of variation in the dependent variables unaccounted for. The author feels that the amount of variation accounted for can be improved in future research by sacrificing some of the statistical advantages of a large set of evaluators in exchange for increased knowledge of the factors influencing a smaller set of evaluators.

In the next section we will consider the stage II model which examines the influence of various factors upon the acceptance or non-acceptance of individual ideas.

Discussion of Stage I Cross Correlations

In order to examine the extent to which the "independent" variables of the two stage I models are intercorrelated in the populations tested, the simple correlation coefficients between independent variables for each running of the model are discussed below. For each test, all intercorrelations with absolute magnitude in excess of .30 are reported.

Cross Correlations Among all Idea Evaluators with the Variables Categorized as Indicated in Chapter III

In a model where the basic independent variables are broken down into a number of categories or attributes, cross-correlations between these attributes can occur in two ways. First, there can be a relationship between two attributes of two different variables which were thought to be independent. Second, there can be a relationship between two attributes of the <u>same</u>

variable. In the latter case the relationship is an artifact of the way the variables were categorized, for we know before we start that, for example, membership in age group 30-39 is not independent of membership in age group 40-49. Thus cross-correlations of the second type do not yield any information on the relationships among independent attributes, for they are in fact relationships among attributes which are known to be dependent. Of the cross-correlations of the first type in the stage I models, 3 were found to have an absolute value greater than .30. The three are:

Business travel and attendance at trade shows.....	.43
Attendance at trade shows and attendance at professional meetings.....	.36
Business travel and reading of professional, trade, and business publications.....	.34

The fact that the only correlation coefficients greater than .30 are those various attributes which measure types of exposure to outside contacts and sources of information strengthens confidence in the assumption that the attributes measure manifestations of an underlying variable. This fact also suggests that interrelationships between the other independent variables are of low magnitude.

The cross-correlations discussed above are of interest in checking the extent to which attributes are interdependent, but due to the fact that they are correlations between attributes or intervals of basic variables, they do not yield information on the extent to which the basic variables themselves are interrelated. For example, the information given above cannot answer the question "to what extent are age and risk propensity correlated?" To answer questions such as this, we next consider the intercorrelations between the dichotomized variables.

Cross Correlations among all Idea Evaluators with Variables Dichotomized

Consideration of cross-correlations among all idea evaluators with the variables dichotomized will reveal the extent to which the basic independent variables, as opposed to the attributes or categories considered above, are correlated in the set of idea evaluators.

An examination of cross-correlations for the set of all idea evaluators with the variables dichotomized revealed three correlations in excess of .30. They were:

Business travel and attendance at trade shows.....	.46
Attendance at trade shows and attendance at professional meetings.....	.33
Business travel and reading of professional, trade, and business publications.....	.34

These are the same three sets of independent variables that were cross-correlated in the previous test, and the same comments apply.

Cross Correlations among Production Managers

In this section, as in the previous one, the variables are dichotomized and hence the cross-correlations reported below are between variables themselves, not categories or intervals. For the group of production managers, the set of cross-correlations which exceeded .30 are shown in Fig. 5.20.

There are many more cross-correlations in this subset of idea evaluators than in the set of all idea evaluators. The amount of business travel is negatively correlated with company size, indicating that production managers of small companies travel on business more than those of larger companies, within the size range represented (fewer than 500 employees). On the other hand, attendance at professional meetings is positively correlated with company size, which indicates that production managers of the larger companies in the subset attend more professional meetings than do production managers of the smaller companies. Attendance at professional meetings is also positively correlated with age, indicating that the older production managers attend more professional meetings than do the younger production managers.

Education level of the production manager is positively correlated with both the number of professional, trade, and business publications read and with risk propensity. In other words, the more highly educated production managers read more professional, trade, and business publications and also had higher risk propensity than the less highly educated production managers. In connection with the former result, it will be recalled that both educational level and the number of professional, trade, and business publications read were positively correlated with the number of ideas evaluated by production managers. As will be discussed further in the section on multicollinearity, the cross-correlation between these two variables may be responsible for the low confidence levels attached to the correlation of each of them with the number of ideas evaluated.

Finally, the reading of professional, trade, and business publications is positively correlated with both business travel and attendance at professional meetings. One of the results of the stage Ia model test was that both the number of professional, trade, and business publications read and the number of professional meetings attended were positively correlated with the number of ideas evaluated. The cross correlation above is consistent with this finding and, as in the case discussed previously, may be responsible for the low confidence levels associated with these two correlations in the stage Ia test.

Cross Correlations among Company Presidents

As in the previous section, the cross-correlations reported herein are based on dichotomous variables. The group of company presidents had more cross-correlations of magnitude .30 or greater than did any of the groups previously discussed. These cross-correlations are listed in Fig. 5.21.

Fig. 5.21 shows that the president's age is negatively correlated with educational level, amount of business travel, and attendance at trade shows. The younger company presidents in this sample tend to have a higher educational level, to travel on business more, and to attend more trade shows than do older presidents. Attendance at professional meetings is positively correlated with attendance at trade shows and with reading professional, trade, and business publications. The latter correlation also existed for production managers.

Variables	Correlation Coefficient
Business travel and company size	-.30
Attendance at professional meetings and company size	.50
Attendance at professional meetings and age	.35
Educational level and reading of professional, trade, and business publications	.35
Educational level and risk propensity	.41
Business travel and reading of professional, trade, and business publications	.48
Attendance at professional meetings and reading of professional, trade, and business publications	.41

Fig. 5.20. Cross correlations between independent variables for the subset of production managers. Only those cross correlations whose absolute magnitude exceeded .30 are listed.

Of the five cross correlations mentioned above, the first four represent variables which are correlated with the number of ideas accepted in the stage Ib model results using company presidents. Both of the variables in the last cross-correlation mentioned above are also correlated with the number of ideas accepted in the stage Ib model test, but whereas attendance at professional meetings is positively correlated with the number of ideas accepted by company presidents, reading of professional, trade, and business publications is negatively correlated with the number of ideas accepted. The situation with respect to the latter two variables also occurs in the stage Ia model test where the respective correlations are with the number of ideas evaluated.

Dissatisfaction with sales levels is negatively correlated with educational level and amount of business travel, indicating that the presidents in the sample who are most dissatisfied with sales levels tend to have lower educational levels and to do less business travel than those who are less dissatisfied with sales levels. On the other hand, dissatisfaction with sales levels is positively correlated with dissatisfaction with cost levels, suggesting that the presidents in the sample who are most dissatisfied with sales levels tend also to be more dissatisfied with cost levels than are those presidents who are less dissatisfied with sales levels. Anologous to the negative correlation already reported between dissatisfaction with sales and educational level, there is also a negative correlation between dissatisfaction with costs and educational level. These two findings together indicate that less highly educated presidents in the sample tend to be more dissatisfied with sales and costs than are more highly educated presidents. Both dissatisfaction with costs and educational level, however, are positively correlated with the number of ideas accepted by presidents in the stage Ib model test results.

Variables	Correlation Coefficient
Age and educational level	-.39
Age and amount of business travel	-.33
Age and attendance at trade shows	-.40
Attendance at trade shows and attendance at professional meetings	.40
Attendance at professional meetings and reading of professional, trade, and business publications	.31
Dissatisfaction with sales and educational level	-.38
Dissatisfaction with sales and amount of business travel	-.32
Dissatisfaction with sales and dissatisfaction with costs	.31
Dissatisfaction with costs and educational level	-.31
Risk propensity and freedom to alter the product	-.31
Risk propensity and amount of business travel	.31
Risk propensity and educational level	.32

Fig. 5.21. Cross correlations between independent variables for the subset of company presidents. Only those cross correlations whose absolute magnitude exceeded .30 are listed.

The negative correlation between risk propensity of the presidents and their companies' freedom to alter the product suggests that, in this sample, presidents with high risk propensity tend to be associated with companies with low freedom to alter the product. Both these variables are also negatively correlated with the number of ideas accepted by presidents in the stage Ib model test. On the other hand, risk propensity among the presidents is positively associated with the amount of business travel and with educational level. Presidents in the sample who have high risk propensity tend to do more business travel and to have a higher educational level than do presidents with low risk propensity. The latter finding, which was also true for the group of production managers, raises some interesting questions. Does education tend to increase a person's risk propensity, does high risk propensity influence a person to acquire education, or are both influenced by other factors?

Whatever the answer, why does the effect exist for the presidents and production managers in the sample but not for all the idea evaluators? It would appear that research is warranted into the interrelationships between education, risk propensity and job function.

The above variables are also all correlated with the number of ideas accepted by presidents. Risk propensity is negatively correlated with the number of ideas accepted but positively correlated with the number of ideas evaluated by company presidents, although both correlations carry non-significant confidence levels. The amount a president travels on business is positively correlated with both the number of ideas evaluated and the number accepted. In addition, the educational level of the company presidents is correlated with the number of ideas accepted in the stage Ib model test.

The preceding discussion is presented for the general interest the cross-correlations may generate. The implications of cross-correlation for the accuracy of the correlation coefficients estimated by the multiple regression model are discussed in the section on multicollinearity.

The Stage II Model

The stage II model is concerned with the attributes of individual ideas and the influence of these attributes upon the acceptance or non-acceptance of each idea. The model contains seven propositions.

1. The more fruitful an idea source, as perceived by an idea evaluator, the more likely that a given idea from that source will be accepted.

2. The lower the perceived probability that a given idea will fail, the more likely that the idea will be accepted.

3. The lower the perceived cost of implementing an idea, the more likely that the idea will be accepted.

4. The greater the availability of the people required to implement an idea, the more likely that the idea will be accepted.

5. The higher the projected profit or savings associated with an idea, the more likely that the idea will be accepted.

6. The more urgent the problem to which an idea is a potential solution, the more likely that the idea will be accepted.

7. An idea which is a potential solution to a particular problem for which the evaluator has been actively searching for a solution is more likely to be accepted than an idea which is a potential solution to a general problem area where the evaluator is always looking for ideas. The latter type of idea is, in turn, more likely to be accepted than an unsought idea.

The stage II model was tested using the same program as in the first stage model tests. The only difference in the second stage test is that all the variables are binary, with the dependent variable being set equal to one if the particular idea was accepted, and zero if it was not accepted.

Under the binary model, each regression coefficient is interpreted as the conditional probability that an idea is accepted, given that a variable falls in the category associated with the coefficient (Johnston, 1963, p. 224).

In the above test, an idea is considered accepted if the idea evaluators checked either "accepted in principle" or "accepted and change ordered" on the report form.

It will be recalled that in the stage Ia and Ib model tests, an idea was considered accepted only if the evaluator checked "accepted and change ordered." This was because the commitment connotation was felt to be important from the idea evaluator's point of view. In the stage II model, however, the focus was on those attributes of individual ideas which might make them acceptable to evaluators. For this test it was desirable to remove the influence of organizational factors (such as time lags for approval, waiting for the budget, etc.) which might be responsible for an idea being designated "accepted in principle" instead of "accepted and change ordered." For purposes of the stage II test, therefore, an idea is considered accepted if either of the foregoing dispositions is indicated.

The BMD-29 program printout is shown in Appendix 2 and the results of the stage II test appear in Fig. 5.22.

Results of Stage II Model Test

The fact that an idea has 1 chance in 10 of failure, or less, accounts for the largest percentage of the variation in idea acceptance (11.8%) and carries the highest correlation coefficient (.292). The attribute "idea is a potential solution to a very urgent problem" accounts for 4.42% of the variation and carries a coefficient of .208. The fact that obtaining the money to implement the idea is no problem accounts for 3.85% of the variation and is correlated .215 with idea acceptance. Finally, the attribute "obtaining the people to implement the idea is a moderately difficult problem" accounts for 1.09% of the variation and is negatively correlated with idea acceptance. As an example of the interpretation of the correlation coefficients, the first coefficient in Fig. 5.22 is interpreted as follows: the conditional probability that an idea will be accepted, given it has 1 chance in 10, or less, of failure, is .292.

Discussion of Stage II Model Test

The positive correlation coefficient, and the relatively high (11.8%) percent of variation in the idea acceptance explained, support, the proposition that the lower the risk of failure, the more likely that an idea will be accepted.

The attribute "idea is a potential solution to a very urgent problem" is also correlated with idea acceptance, supporting the proposition that the more urgent the problem, the more likely that an idea which is a potential solution to the problem will be accepted.

The degree of search behavior, which was thought to be related to the degree of urgency, does not appear in the above set of results. Thus proposition 7, which can be paraphrased as "the greater the amount of search for a solution to a problem, the more likely that an idea which is a potential solution to the problem will be accepted," is not supported.

Attribute	Partial Correlation Coefficient	Percent of Variation Explained	Confidence Level
Idea has 1 chance in 10, or less, of failure	.292	11.8%	99.5
Idea is a potential solution to a very urgent problem	.208	4.42%	99.5
Obtaining the money to implement the idea is no problem	.215	3.85%	99.5
Obtaining the people to implement the idea is a moderate problem	-.117	1.09%	95
	TOTAL	21.2%	

Fig. 5.22. Results of the stage II Model test. Numbers have been rounded to three decimal places.

The positive correlation between the attribute "obtaining the money to implement the idea is no problem" and idea acceptance is as predicted and supports the proposition "the lower the perceived cost of implementing an idea, the more likely that the idea will be implemented."

Finally, the negative correlation between the attribute "obtaining the people to implement the idea is a moderate problem" and idea acceptance is in the opposite direction to that predicted by the proposition, for it indicates that an idea for which obtaining the people is a moderate problem is less likely to be accepted than one for which obtaining the poeple is a very difficult problem. Such a result is not intuitive. There were 23 ideas for which the evaluator stated that obtaining the people to implement the idea would be a moderately difficult problem. Apparently some factor other than the ones tested in the model is responsible for the high level of acceptance of these ideas.

The propositions on projected profit of an idea and evaluation of the source of an idea are not supported. The results of testing the stage II propositions are summarized in Fig. 5.23.

Additional Information Regarding the set of Ideas which were Evaluated

The 330 ideas evaluated during this study were distributed among the various types of ideas as follows:

Proposition	Result of Test
The more fruitful an idea source, as perceived by an idea evaluator, the more likely that a given idea from that source will be accepted.	Not supported
The lower the perceived probability that a given idea will fail, the more likely that the idea will be accepted.	Supported
The lower the perceived cost of implementing an idea, the more likely that the idea will be accepted.	Supported
The greater the availability of the people required to implement an idea, the more likely that the idea will be accepted.	Not supported
The higher the projected profit or savings associated with an idea, the more likely that the idea will be accepted.	Not supported
The more urgent the problem to which an idea is a potential solution, the more likely that the idea will be accepted.	Supported
An idea which is a potential solution to a particular problem for which the evaluator has been actively searching for a solution is more likely to be accepted than idea which is a potential solution to a general problem area where the evaluator is always looking for ideas. The latter type of idea, is in turn, more likely to be accepted than an unsought idea.	Not supported

Fig. 5.23. Summary of results of the stage II model test.

Change of input material.....	37 ideas	9.2%
Change in production method.....	175 ideas	43.6%
Change in design of product.....	84 ideas	20.9%
New product.....	58 ideas	14.5%
Other.....	47 ideas	11.7%
	401	

The total is greater than 390 because 11 of the ideas fell into two types of categories. The "other" category contained ideas relating to test equipment and procedures, service facilities, inspections, and other items which were difficult to classify.

The distribution of the ideas among various source categories is shown below.

Source of Idea	No. of Ideas	Percent of Total
Self	205	44.9%
Employee	102	22.3%
Business associate	49	10.3%
Customer	30	6.6%
Supplier	26	5.7%
Trade journal	17	3.7%
Newspaper or magazine	14	3.1%
Trade show	5	1.1%
Other	8	1.7%
	456	100%

As before, the total is greater than 390 because of a number of multiple-source ideas. The above distribution shows more clearly why we obtained a negative correlation between attendance at trade shows and number of idea evaluations. Trade shows were the source of only 1.1% of the ideas evaluated during the study. Apparently for this sample of idea evaluators, trade shows are not a fruitful source of ideas of the type studied in this research, so attendance at trade shows would not increase an idea evaluator's exposure to outside sources of ideas. In fact, such attendance might decrease exposure by occupying time which might otherwise be spent in contact with more productive idea sources.

To the extent that business travel is for the purpose of attending trade shows (the cross correlation between these two is .46, which is higher than any other cross correlation), the fact that trade shows are a source of relatively few ideas helps explain the negative correlation between business travel and number of ideas accepted.

Trade shows, newspapers, and magazines together accounted for the source of 31 ideas, or 6.8% of the ideas evaluated. This collective source accounted for six times as many ideas as did trade shows, and the relative size

of these sources may account for the finding that reading business, trade and professional publications is positively correlated with the number of ideas evaluated, whereas attending trade shows is negatively correlated with the number of ideas evaluated.

The ideas were distributed among various types of evaluators as shown below:

Evaluator Position	No. of Ideas	Percent of Total
President or Vice President and General Manager	106	27.1
Manufacturing or Production Vice President	27	6.9
Chief Engineer	65	16.7
Manufacturing or Production Supervisor	61	15.6
Manager of Quality Control	19	4.9
Various types of engineers	73	18.7
Plant Manager	22	5.6
Production/Production Control Supervisor	14	3.6
Other	3	0.8
	390	100

The distribution indicates that while the president position (President or Vice President and General Manager) evaluated more ideas than any other single position, the ideas above were evaluated by a number of different positions.

Multicollinearity among the Independent Variables

Multicollinearity is the name given to interdependence of the "independent" variables in an econometric or multiple regression model of the type used to test models Ia, Ib and II. Perfect multicollinearity would occur if one "independent" variable were an exact linear function of another. In practice this is rare, but as the section on cross correlation showed, some interdependence or multicollinearity exists as cross correlations between various of the "independent" variables used in this research.

It would be nice if one could measure the presence and effect of multicollinearity by examining the cross correlations between the independent variables as was done for a different purpose in the section on cross correlations, but such is not the case. As Klein points out, "it is not possible to say whether separate influences can be singled out if the inter correlation is .6, .7, .8, .9, or even higher. The sampling error of an individual coefficient depends on both the inter correlation with other explanatory factors and on the overall correlation of the whole equation" (Klein, 1962, p. 64). Klein's

term "intercorrelation" as used above has the same meaning as "cross-correlation" used previously in this chapter.

Thus it is necessary to examine other data in order to assess the effect of multicollinearity. On this subject Goldberger states "multi-collinearity may produce large standard errors of the coefficients; we will be very uncertain of their population values; we will be unable to reject very diverse hypotheses concerning them." (Goldberger, 1964, p. 193). Johnston is somewhat more positive on the detection of the effects of multicollinearity, concluding "thus the standard errors should give ample warning of the imprecision attaching to the estimates of the separate effects of X_2 and X_3 when the two variables are highly correlated." (Johnston, 1963, p. 204).

Klein adds certainty to the point when he states "the warning light to the statistician that multicollinearity is serious, is that sampling errors in individual coefficients become large. The separate influences of each variable are shown by their respective coefficients in a linear equation, and these coefficients will not be very precisely estimated even though the overall correlation for the entire equation is high." (Klein, 1962, p. 64). "Sampling errors" as used by Klein has the same meaning as "standard errors" as used by the other authors above.

Thus all three sources cited above indicate that large sampling errors associated with an estimated regression coefficient are a signal that multi-collinearity is serious. The only question remaining is "how large is large?" Klein answers this question in a discussion of multi-collinearity in the estimates of Cobb-Douglas production functions. "By conventional criteria, the estimated parameters of Douglas and his coworkers in this field, are large relative to sampling error. The coefficients are generally high multiples of sampling errors (certainly more than twice, which is the customary critical value for the five per cent level of significance)." (Klein, 1962, p. 101). Thus the ratio of regression coefficient to sampling error is the relevant statistic for testing for multicollinearity.

As will be shown below, the ratio of the regression coefficient to the standard error is referred to as the t-value for the particular coefficient. This t-value is calculated for every regression coefficient estimated by the BMD-29 program (see the printouts in Appendix 2), and is used, in conjunction with the t-table, to determine the confidence level associated with each coefficient.[1] Thus the confidence level reported for each regression coefficient estimated in the tests of models Ia, Ib, and II, reflects the effects of multi-collinearity. If the confidence level for a coefficient is high, the probability that multicollinearity has affected the estimate is low. For lower confidence levels there is a higher probability that multicollinearity has affected the associated coefficient. Since multicollinearity is not the only potential cause of large standard errors, a low confidence level does not necessarily mean that multicollinearity is the culprit. A high confidence level, however, is an indication that multicollinearity has not affected the estimated coefficient.

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[1]Klein states the case on page 78: "In many economic problems we are interested in the divergence of parameters or simple functions of them from unity or from some other figure. The appropriate ratio is:

$$t = \frac{a - \alpha}{S_a}$$

where a = parameter estimate; α = assumed or hypothetical value; S_a = sample error of the estimate. In the tests referred to above, α was set equal to 0 and the ratio then tests the hypothesis that the estimated coefficient is significantly different from 0.

The Influence of Evaluator Membership in an Autonomous Company Compared to Membership in a Division of a Corporation

Of the 86 idea evaluators participating in the research project, 46 worked in the 18 participating organizations which were divisions of corporations and the other 40 worked for the 16 autonomous companies which participated. To test the possibility that the evaluator's membership in one or the other of these two types of organizations influenced the idea evaluation and acceptance behavior of the evaluator, the stage Ia and Ib models, using dichotomous variables and all idea evaluators, were rerun with a binary variable added which was set equal to one if the evaluator worked for a division of a corporation and zero if he worked for an autonomous company. The new variable did not appear in the results of either model run, nor did the correlation coefficients or the percent of variation explained associated with any of the other variables change. The author concludes that, for this sample of idea evaluators, idea evaluation and acceptance activity is not influenced by whether the evaluator works for an autonomous company or a division of a corporation.

Two interesting cross correlations appeared as a result of the above tests, however. Freedom to alter the product was correlated -.44 with corporate status, indicating that divisions of corporations in the sample tested tended to have less freedom to alter the product than did autonomous companies. And dissatisfaction with sales was correlated .31 with corporate status, indicating that, in the sample tested, idea evaluators who worked for divisions of corporations tended to be more dissatisfied with sales levels than did idea evaluators who worked for autonomous companies.

The Relationship Between Amount of Freedom to Alter the Product and The Source of Limitation on That Freedom

In order to test the possibility that an organization's freedom to alter the product was related to the source of the limitations on that freedom, if any, the companies who reported low or medium freedom to alter the product were divided into those who designated the customer as the source of their limitation on freedom to alter the product, and those who designated other sources of the above limitations (such as industry or association standards or limitations inherent in the production process). Companies who reported high freedom to alter the product reported no limitations on this freedom and thus were not included in the test. The Fisher exact probability test (Siegel, 1956, p. 96) applied to the 2 x 2 frequency table showed no significant relationship between the amount of freedom to alter the product and the source of the limitation on that freedom.

The Variation of Individual Risk Propensity with Company Size

Dr. M. Radnor of Northwestern University suggested the possibility that a relationship existed between organizational size and the risk taking propensities of individual idea evaluators in the organization. The evaluators were divided into a group who worked in organizations with fewer than 100 employees (n = 46) and a group who worked in organizations with more than 100 employees (n = 42). The risk propensities of these two groups were compared using the Kolmogorov-Smirnov two-sample test (Siegel, 1956, p. 127). This test indicates

whether two independent samples have been drawn from the same distribution, and is sensitive to differences in central tendency, dispersion, and skewness. The test showed that there was no significant difference between the two groups in any of the above parameters. Specifically, the null hypothesis of no difference between the two samples could not be rejected at the .10 level of significance. Thus for this sample of idea evaluators, there appears to be no relationship between the size of the organization and the risk propensities of the individual idea evaluators in the organization.

Summary, Conclusions, and Suggestions for Further Research

The model under which this research was initiated contained implicit assumptions that (1) the model was applicable to all idea evaluators in the sample, and (2) the processes of idea selection and idea evaluation were influenced by the same variables in approximately the same way. The results of the stage Ia and Ib model tests indicated that neither of these assumptions was correct. We will first examine assumption (2) above and use the results to justify a separate consideration of the variables influencing the number of ideas evaluated and those influencing the number of ideas accepted. We will then consider the association of the seven variables in the model with the two dependent variables, examine assumption (1) above, and introduce a new independent variable based on job function or role.

The second assumption referred to earlier was that the processes of idea selection and idea evaluation were influenced by the same variables and in approximately the same way. That this assumption is not valid even among the groups of production managers or presidents will be discussed below.

Among production managers, dissatisfaction with costs is significantly correlated with the number of ideas evaluated but not with the number accepted. On the other hand, the amount of business travel is significantly correlated with the number of ideas accepted but not with the number evaluated. Thus on a revised model of the idea selection and evaluation processes among production managers, dissatisfaction with costs should be shown affecting only the selection process, and amount of business travel influencing only the evaluation process.

Among company presidents, dissatisfaction with costs is significantly correlated with the number of ideas evaluated but not with the number accepted. Thus, as was the case among production managers, dissatisfaction with costs appears to influence the idea selection process but not the idea evaluation process. A similar finding appears among presidents with respect to attendance at professional meetings. Such attendance is positively correlated with the number of ideas evaluated but not with the number accepted.

The study of the group of company presidents also reveals two variables which appear to influence the idea evaluation process but not the idea selection process. Both the reading of professional, trade, and business publications and the company's freedom to alter the product are negatively correlated with the number of ideas accepted but show no correlation with the number of ideas evaluated. Among presidents, therefore, the variables "dissatisfaction with costs" and "attendance at professional meetings" appear to affect the idea selection process but not the idea evaluation process, whereas the variables "reading of professional, trade, and business publications" and "freedom to

alter the product" appear to influence the idea evaluation process but not the idea selection process.

The above findings indicate that the processes of selection and evaluation of ideas are not influenced by the same independent variables. For clarity of presentation, we will henceforth refer to and discuss the two processes separately, starting with the selection process, which determines the number of ideas evaluated.

The Number of Ideas Evaluated

Each independent variable originally hypothesized to influence the number of ideas evaluated will be discussed below, followed by a discussion of the differences in the findings between the group of production managers and the group of company presidents. The discussion will conclude with suggestions for including the unexpected effect of evaluator job function in future research.

The number of employees in a firm is significantly correlated with the number of ideas evaluated by all evaluators. This finding, which applies only to companies of fewer than 500 employees, supports the work of Mansfield and others, although Mansfield examined firms of much larger size. The fact that the above correlation does not hold for the subsets of production managers or presidents suggests that the mechanism of the "size effect" is interrelated in some way with an evaluator's job function. In particular, the correlation between company size and the number of ideas evaluated by each evaluator is stronger for the group of idea evaluators who were neither presidents nor production managers than it is for the group of all idea evaluators. The question "is there a connection between the number of employees in the company and the number of ideas evaluated by each idea evaluator?" must then be answered "it depends on the evaluator's job in the company." In connection with this, it will be recalled that the reasons given by Mansfield for his hypothesis were that large companies could better afford to take risks, and that they had more opportunities to make changes in their production process. The author speculates that Mansfield's reasons result in a larger number of ideas being evaluated in large companies, but the increase in idea evaluations is absorbed by the evaluators who are neither production managers nor presidents. This results in a high correlation between company size and number of ideas evaluated for the latter group, but no correlation for presidents or production managers.

The weak and inconclusive association between risk propensity and idea evaluation suggests that either risk propensity is not a significant factor in this context, the measurement of it was poor, or the relationship between these variables is more complex than the simple associations predicted by the propositions. The author believes that the latter is the case. If risk propensity is viewed as a limiting value such that ideas with a riskiness above the limit are not accepted, then the number of ideas accepted might increase with an increase in the risk propensity, causing, through the feedback effect, an increase in the number of ideas evaluated. On the other hand the riskiness of a collection of ideas decreases as the size of the collection increases, so an evaluator with low risk propensity might accept many ideas in order to limit his risk. An alternative possibility is that instead of risk propensity defining a cut-off point, it defines some measure of a band of acceptable risks. In such a case, the width of the band of acceptable risks would influence the number of ideas evaluated. In addition, ideas themselves are of various perceived riskiness. On top of these considerations there is the presumption that an

idea evaluator's behavior is not independent of his past evaluation behavior, particularly since that group of his past evaluations whose outcome is not yet known may be perceived by him as being more or less risky than he would prefer. Finally, Edwards has found that some people show a preference for certain mathematical probabilities in gambling situations, independent of the expected outcome (Edwards, 1954, p. 388). This finding suggests that there may be a utility associated with gambling or risk-taking itself, at least for some people.

These considerations suggest that knowledge of an individual's risk propensity is not sufficient information on which to base a prediction of the number of ideas he will either evaluate or accept. Once sufficient knowledge is available to answer the questions above on utility of gambling and the "band" interpretation of risk propensity, it may be possible to build a model linking risk propensity with idea acceptance and evaluation behavior. The author suggests that such a model recognize that individual risk propensities, the perceived riskiness of the current portfolio of ideas already accepted, and the number and riskiness of the individual ideas under consideration may all influence the idea evaluation and idea acceptance processes.

There was no significant relationship between evaluator age and idea evaluation activity for the group of all evaluators. Even where organizational level was controlled, as in the president and production manager subsets, no significant relationships appeared. As was pointed out in the theoretical background, research findings on the relationship between age and idea evaluation activity are divided, with some researchers insisting there is no relationship. The results of the test with the number of ideas evaluated, tend to support the latter position.

Results of testing the "dissatisfaction" variable are different for the two types of dissatisfaction tested. Dissatisfaction with costs is positively and significantly correlated with the number of ideas evaluated by all evaluators, presidents, and production managers. On the other hand, dissatisfaction with sales is uncorrelated with the number of ideas evaluated for all evaluators and for presidents, and carries a moderately-significant negative correlation among production managers. Both variables sprang from the March and Simon proposition that dissatisfaction with achievement levels leads to search for ways to improve performance. Apparently there either were differences in our ability to measure the two types of dissatisfaction mentioned, or else there was at least one additional variable at work in the relationship. Since the two types of dissatisfaction were measured by identical questions except that the words "costs" and "sales" were interchanged, the author concludes that measurement was not the trouble and that there was at least one additional relevant variable. Comments by some of the evaluators during the study provide a clue as to what this variable might be. One evaluator remarked that he had not made an "honest sales effort" in over a year, and many others indicated that they were selling everything they could manufacture. Thus it appeared that, at the time the research was conducted, at least some of the participants perceived sales levels as being non-expandable in the short run. Costs, on the other hand, were not perceived as being minimal, and many of the participating companies were attempting to reduce them. Thus it may be that the idea evaluators perceived cost levels as more controllable than sales levels; therefore a given amount of dissatisfaction with costs produced more idea evaluation activity than the same amount of dissatisfaction with sales. To the extent that this speculation is sound, it suggests that to the March and Simon model linking dissatisfaction with search there should be added an intervening variable denoting the extent to which the potential searcher perceives that he can control or influence the performance

in question. To the extent that the potential searcher (idea evaluator in this case) perceives that he cannot influence a given type of performance, he may not search for ways to improve it even though he is dissatisfied with it.

Educational level is uncorrelated with the number of ideas evaluated among all evaluators and among presidents, but positiely correlated among production managers. The confidence level associated with the latter correlation coefficient is so low (.70) as to cast doubt on the existence of any correlation in the sample. The author concludes that there is no correlation among any of the groups, which result is at odds with the prediction. It will be recalled that two predicted effects of education were to make the evaluators sensitive to developments in certain technical areas, and to enable the evaluators to make difficult techno-economic evaluations of ideas, which evaluations might involve an ability to deal with abstractions. The results of testing the proposition suggest that either measurement was inadequate, education did not make the evaluators sensitive to technical areas or help them deal with difficult techno-economic evaluations, or the two predicted effects did not influence the number of ideas evaluated. The author believes that the latter explanation is correct, and that the reason for the failure lies in the level of technical or economic sophistication of the ideas studied during this research. Most of the companies participating in the study manufactured products of low sophistication, to which sophisticated technical ideas were not appropriate. Partly as a result of this and partly because most of the firms studied sold to other firms on the basis of orders rather than to a final consumer, tough techno-economic evaluations were probably rare. For these reasons the author speculates that the market uncertainty and technical sophistication of the products were not sufficiently high that educational level made a difference in the number of ideas evaluated. The author suggests that further research in this area take cognizance of the effect of market conditions and the technical sophistication of the product.

The four attributes which were thought to be indices of exposure to outside contacts and sources of information have varying degrees of association with the number of ideas evaluated among the groups tested. Business travel is significantly correlated with the number of ideas evaluated among presidents, but not among production managers or among the group of all evaluators. Apparently, for all evaluators and for production managers, business travel is not a significantly more productive source of ideas than are the activities undertaken when the evaluators are not travelling on business. This result will be discussed further in the section on job functions.

Attendance at trade shows is negatively correlated with the number of ideas evaluated among all evaluators, production managers, and presidents. While the confidence level associated with the result for production managers is not significant, the evidence as a whole suggests that those idea evaluators who attended more trade shows evaluated fewer ideas than those who attended fewer trade shows. These findings plus the result, discussed earlier, that trade shows were given as the source of only 1.1% of the ideas in this study, suggest that trade shows were not a fruitful source of ideas of the type studied. In fact, the negative nature of the results suggests that trade shows were less productive as a source of ideas than were the activities that would be undertaken had the evaluators not attended trade shows. This may be due to the sales orientation of most trade shows.

Attendance at professional meetings shows markedly different results. Such attendance is significantly correlated with the number of ideas evaluated among presidents, but not among all evaluators or production managers. The difference between the result for presidents and that for production managers

will be discussed in the section on job function. Among evaluators as a group, it appears that attendance at professional meetings is no more productive of the types of ideas investigated in this study than are the activities undertaken when the evaluators are not attending professional meetings. This could be a result of the technical sophistication of the product, mentioned above in connection with educational level. If the ideas at professional meetings were more or less of state of the art sophistication, whereas the products manufactured by the companies in this study were considerably less sophisticated, then there might be no transfer of ideas from the meetings to the companies. This speculation suggests that the variable "exposure to outside contacts and sources of information" should perhaps be modified to include the concept of the degree of potential usefulness of the contacts and sources of information. This point is discussed further below.

The fourth index of exposure to outside contacts and sources of information is the number of professional, trade, and business publications read or scanned each month. This number is significantly correlated with the number of ideas evaluated among all evaluators but not among production managers or presidents. While business travel is frequently for purposes other than acquiring ideas, and while the individual idea evaluator has little control over the idea content of trade shows or professional meetings, reading would seem to be a potential opportunity for idea evaluators to obtain controlled exposure to ideas and sources of information. It is therefore somewhat surprising that reading of the publications indicated should not be correlated with the number of ideas evaluated among presidents or production managers, particularly in view of the highly significant correlation for all evaluators as a group. It may be that the types of ideas found in professional, trade, and business publications are appropriate to the job functions of the group of evaluators who are neither presidents nor production managers but are not appropriate to the idea evaluation activity of presidents and production managers. The author speculates that the types of ideas evaluated by presidents and production managers are sufficiently unique and/or proprietary that they do not appear in the publications indicated above.

The mixed set of results obtained for the various indices of exposure to outside contacts and sources of information suggests that the situation with respect to this variable is more complicated than was originally thought. In particular, the potential usefulness of various idea sources for various evaluator job functions may be relevant. As a starting point for needed further research in this area, the author suggests a picture of the idea evaluator surrounded by opportunities for exposure to outside contacts and sources of information. These opportunities compete with all the other demands on the idea evaluator's time, and in addition the opportunities are of varying fruitfulness and potential usefulness. Choosing an opportunity to pursue, if this choice involves foregoing other opportunities, could thus result in being exposed to fewer or less useful contacts and sources of information than would have been the case under another choice. Such a situation could account for the various correlations described above. If, for some evaluators, reading and attendance at trade shows are inefficient ways of obtaining exposure to outside contacts and sources of useful information, as compared to alternative ways which were foregone, then these two activities would not be associated with idea evaluation. Further research into this question is suggested, for there is extensive support in the literature for the importance of exposure in this area of research.

Freedom to alter the product is not associated with idea evaluation activity among any of the subsets of evaluation in the sample. Contrary to the

prediction, freedom to alter the product is clearly not a factor tending to increase idea evaluation activity. As explained by several participant idea evaluators, the variable was perceived more as a constraint on idea evaluation activity than as a positive influence on it. Thus it may be that the levels of idea evaluation activity measured in this study were not sufficient to make the constraint binding, whereas higher levels of idea evaluation would "bump into" the constraint. The speculation is rather far-fetched and indicates that more knowledge of the nature of freedom to alter the product would probably assist in understanding the relevant organizational processes.

The above variables were all that were originally hypothesized to influence the number of ideas evaluated. Grouping the idea evaluators by job function, however, made such a dramatic difference in the explanatory power of the model that it became obvious that the job function or work role of the evaluator was also an important variable in this process. We will first review the most significant differences in findings between the groups of company presidents and production managers and then will discuss aspects or the job functions of these groups which might help explain this difference.

One effect of grouping idea evaluators by job function has already been discussed. In addition to the improvement in the explanatory power of the model which this grouping yielded, we found that business travel was significantly correlated with the number of ideas evaluated among presidents but not among production managers.

Some reflection on the job functions or work roles of these groups indicates a difference in orientation between presidents and production managers. Presidents usually occupy a boundary position in the organization (as described by Kahn et al., 1964, p. 101), whereas production managers are more "inside oriented." A boundary position in an organization is a job which involves significant contact with people outside the organization. An inside position is a job which largely or completely involves contact with people who are members of the organization.

In addition to this difference, presidents are usually expected to lead the organization, whereas production managers are not. In the abstract sense, then, the president's job might be considered to include interpreting the environment to the rest of the organization and leading the organization accordingly, whereas the production manager's job is to oversee the combination of labor and capital into a product. In a more concrete sense this set of functions might involve the president in the task of bringing ideas into the organization, whereas the production manager might evaluate and transmit ideas only to the extent that they assist him in his job of maintaining production.

To the extent that this discussion is an accurate reflection of conditions among the idea evaluators during this study, we can interpret the positive correlation between business travel and number of ideas evaluated among presidents as indicating that the presidents received ideas for evaluation during the business travel because it was part of their job and may in some cases have been the reason for the travel. Similarly, the lack of correlation between the same variables among production managers might indicate that they were travelling for reasons other than to get ideas (for example, troubleshooting) and did not percieve idea reception and evaluation to be a significant part of their job.

Regardless of the validity of the above speculation, it is clear that job function or work role was a significant independent variable influencing the number of ideas evaluated by the idea evaluators in this sample. This "new" independent variable should be incorporated into future models of the idea evaluation process.

We have considered the influence of seven original independent variables upon the dependent variable "number of ideas evaluated," discussing interpretations and implications of the results and introducing a new independent variable. We will now proceed to discuss the process of idea acceptance in a similar way.

The Number of Ideas Accepted

The number of employees in a firm is significantly correlated with the number of ideas accepted among all evaluators but not among presidents or production managers. As mentioned earlier, this finding applies to firms with fewer than 500 employees. The above correlation was stronger for the group of evaluators who were neither presidents nor production managers than it was for the group of all evaluators, suggesting that the evaluator's job function is a significant variable in this process. As was the case with the number of ideas evaluated, it appears that more ideas are accepted in large companies than in small companies, but the increase is absorbed by idea evaluators who are neither presidents nor production managers. Neither the number of ideas evaluated nor the number accepted by presidents and production managers seem to be influenced by the number of employees in the company, at least for this particular sample of companies. The author speculates that presidents and production managers in large companies may delegate more idea evaluation activity to others in the company than do presidents and production managers of smaller companies, with the result that the number of ideas evaluated and accepted by these two groups remains approximately constant as the number of employees changes.

Risk propensity is not significantly correlated with the number of ideas accepted among any of the three groups tested. As was the case where the dependent variable was the number of ideas evaluated, the author believes the complexity of risk propensity relationships is the reason for this result. Until more knowledge of risk propensity and related variables is acquired, the earlier discussion of risk propensity and its connection with the number of ideas evaluated would also apply to the number of ideas accepted.

No significant relationships between age and the number of ideas accepted appeared in any of the groups of evaluators. As discussed earlier, the prediction that older evaluators would accept and evaluate fewer ideas was based on empirical work in the innovation field, some of which indicated that there was an "age effect" and some of which indicated that there was none. To the best of the author's knowledge, none of the literature suggests a mechanism or explanation for the age effect beyond some vague references to rigidity. The implications of the finding of this research cannot therefore be carried beyond the statement that age did not appear to influence the idea evaluation activity of the evaluators studied.

Dissatisfaction with costs was not significantly correlated with the number of ideas accepted among any of the three groups of evaluators. This result is in marked contrast to that obtained with respect to the number of ideas evaluated. In that case there were significant positive correlations among all three groups of evaluators. Keeping in mind the proposed intervening relationships of the extent to which the evaluator feels he can control or influence the performance measure with which he is dissatisfied, it appears that higher dissatisfaction with costs is associated with a greater number of idea evaluations than is low dissatisfaction with costs, but not with a greater

number of ideas accepted. This implies that evaluators who are highly dissatisfied with costs evaluate more ideas per idea accepted than do evaluators who are less dissatisfied with costs. Thus high dissatisfaction with costs seems to be associated with the consideration of more alternatives but not with more idea acceptances. This situation has interesting implications, for if each idea accepted can be considered to be a change in the company's way of doing business, then dissatisfaction with costs would appear to influence the type of changes made (by influencing the number of alternatives considered) but not the number of changes. Whereas the finding of a relationship between dissatisfaction and the number of ideas evaluated suggested the possibility of an intervening variable, the finding of no relationship between dissatisfaction with costs and the number of ideas accepted suggests that further research is needed into the process of translating the results of search behavior into organizational change. Dissatisfaction with costs does not appear to influence this process, and the results for dissatisfaction with sales are equivocal, as is explained below.

Dissatisfaction with sales is significantly negatively correlated with the number of ideas accepted among all evaluators. There is no significant relationship among presidents or production managers. The result for all evaluators is in the opposite direction to that predicted, for it means that evaluators who are highly dissatisfied with sales levels accept fewer ideas than do evaluators who are less dissatisfied with sales levels. The author can offer no explanation for this result.

Educational level is not correlated with the number of ideas accepted among any of the three groups. The speculation, advanced earlier, that the ideas under consideration were not sufficiently sophisticated and the market conditions were not sufficiently uncertain to make educational level a relevant variable, is equally applicable to the number of ideas accepted.

Turning to the various indices of exposure to outside contacts and sources of information, we find varied relationships with the number of ideas accepted. The amount of business travel is uncorrelated with the number of ideas accepted among all evaluators but is significantly correlated with the number of ideas accepted among production managers and presidents. Business travel apparently does not contribute to idea acceptance among evaluators who are neither presidents nor production managers, possibly because, as was discussed earlier, it does not contribute to the number of ideas evaluated. The result above for presidents may also be due to the fact that presidents who travelled on business more evaluated more ideas. For production managers, however, idea acceptance is correlated with business travel whereas idea evaluation was not. For this group, then, it would appear that business travel is associated with greater receptivity to ideas, even though the travel does not appear to be a fruitful source of ideas. There is no evidence that such an effect does not also appear among presidents and among all evaluators, but there is evidence that the effect does appear among production managers. The author speculates that business travel exposes the production manager to new ways of producing products, and that even though he may not be able to use the new way he sees, the evidence that there are alternatives may make him more receptive to altering his own production process.

Attendance at trade shows was not significantly correlated with the number of ideas accepted among any of the three groups. This result might be due to the apparent low yield of ideas from trade shows, but in fact the number of ideas evaluated was negatively correlated with attendance at trade shows. Since the number of ideas accepted is not negatively correlated but in fact is

uncorrelated with attendance at trade shows, it may be that such attendance is associated with receptivity to ideas even though it is not associated with the number of ideas evaluated. More research would be required before the above speculation could be seriously advanced.

Attendance at professional meetings was not significantly correlated with the number of ideas accepted among any of the three groups. Since the same lack of correlation appeared with the number of ideas evaluated, the above finding may be a result of the latter relationship.

The number of professional, trade, and business publications read is positively correlated with the number of ideas accepted among all evaluators, uncorrelated among production managers, and negatively correlated among presidents. Among all idea evaluators, the number of such publications read was also correlated with the number of ideas evaluated, so the above result for the number of ideas accepted may simply be a result of the increase in number of ideas evaluated. As mentioned previously, professional, trade, and business publications appear to be a fruitful source of ideas for those evaluators who were neither presidents nor production managers. Among production managers, the number of such publications read is uncorrelated with both the number of ideas evaluated and the number accepted. Thus the latter lack of correlation may be the result of the former.

Among presidents, however, the number of professional, trade, and business publications read is uncorrelated with the number of ideas accepted. This result suggests that the reading of the above types of publications may have a negative effect on the receptivity of the presidents to ideas, with those presidents who read more of the above publications accepting fewer ideas than those who read fewer of the above publications. This result is the opposite of that predicted, and the author can offer no explanation for it.

Freedom to alter the product is uncorrelated with the number of ideas accepted among all evaluators and among production managers, but negatively correlated among company presidents. It will be recalled that such freedom was uncorrelated with the number of ideas evaluated among all three groups of evaluators. The results for all evaluators and forproduction managers are not surprising, but those for the presidents suggest that the freedom to alter the product is negatively associated with the acceptance of ideas even where there is no negative influence on the number of ideas evaluated. It may be that in companies with low freedom to alter the product this fact acts as a screen on ideas, and the president receives for evaluation only those ideas which have been previously checked for both value and feasibility, whereas in companies with high freedom to alter the product those ideas which reach the president have not been so carefully checked and therefore fewer are acceptable. This is pure speculation, but the author suggests that a check for the existance of screening devices be incorporated into future research in this field.

Stage II Results

The above conclusions and implications have dealt with variables at the organizational and idea evaluator level. We will now examine the findings at the individual idea level.

An idea evaluator's evaluation of the source of a particular idea does not appear to affect the acceptance or non-acceptance of the idea. Neither does the degree to which the evaluator had been searching for a solution to the problem for which the idea is a potential solution. Perhaps more surprising

is the finding that the potential dollar value of an idea does not influence its acceptance or non-acceptance, other things being equal.

On the other hand, the perceived riskiness of accepting an idea is strongly correlated with acceptance, high-risk ideas having a significantly lower probability of acceptance than low-risk ideas. High-cost ideas are also less likely to be accepted than low-cost ideas. Since the cost referred to here is largely initial investment cost, the fact that interest rates were very high during the period of this study may have influenced this finding.

Ideas perceived as solutions to very urgent problems had a significantly higher probability of acceptance than did ideas which were perceived to be solutions to less urgent problems. Finally, one category of availability of people to implement an idea was associated with non-acceptance of the idea, but another category which represented a lower availability of people to implement was not so associated. Other exploratory work reported herein indicates that the idea evaluation activity of evaluators in this study who worked for divisions of corporations is not significantly different from that of evaluators who worked for autonomous companies. In another exploratory effort, it was discovered that the risk propensities of the idea evaluators in the sample who worked for small companies were not significantly different from the risk propensities of those who worked for larger companies.

This research has dealt with the evaluation and acceptance of production-oriented ideas in small industrial companies. In the process of testing the proposed model many questions have been raised. It is hoped that future research in this area will benefit from the findings reported herein.

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APPENDIX 1. QUESTIONNAIRES AND LETTERS

ORGANIZATIONAL QUESTIONNAIRE

1. How many people are employed at this plant? _____

2. If a multi-plant company, approximately how many people are employed by the whole company? _____

3. How many employees of this plant hold B.S. or higher degrees in a technical field? _____

4. If a multi-plant company, approximately how many employees of the whole company hold B.S. or higher degrees in a technical field? _____

5. What percentage of this plant's total costs are represented by costs of material purchased? _____

6. Into which category does the majority of your products (by sales volume fall?

   ___ a. We can alter both the electrical and the mechanical specification subject to the market.
   ___ b. We can alter the mechanical specifications within limits, but work to relatively fixed electronic specifications, or vice versa.
   ___ c. We work to fixed mechanical and electronic specifications.

7. If the answer to question 6 above is b. or c., please indicate whether the specifications referred to are fixed by:

   ___ Customer.
   ___ Industry or association standards.
   ___ Limitations inherent in the production process.
   ___ Other (please specify) _____

December, 1966
R. B. Martin
Org. No.

Idea Evaluator Questionnaire

1. Position in the company
   ( ) President or General Manager
   ( ) Chief Engineer
   ( ) Production Manager
   ( ) Quality Control Manager
   ( ) (Other) _____

2. Date of birth _____.

3. Formal education (Please check the highest completed and indicate the major field).

Level	Major
( ) High school	_____
( ) Technician training	_____
( ) Junior college	_____
( ) One or more years toward Bachelors degree	_____
( ) Bachelors degree	_____
( ) Master's degree	_____
( ) Doctorate	_____
( ) Other (please specify)	_____

4. During the past 12 months, about how many days have you spent traveling on business outside the Chicago area? _____

5. During the past 12 months, about how many trade shows have you attended?
   _____

6. During the past 12 months, about how many professional meetings or conventions have you attended? _____

7. About how many of the following types of publications do you read or scan each month?

   ___ Professional journals
   ___ Trade journals or magazines
   ___ Business and management magazines (such as Fortune, Business Week, etc.)
   ___ Other magazines.

8. How many technical or professional college, university, night school or correspondence courses have you completed within the last 12 months?
   _____

December, 1966
R. B. Martin
Org. No.

9. How does the current level of sales compare with your personal current sales goal?

( ) Sales exceed goal
( ) Sales are meeting goal
( ) Sales are slightly below goal
( ) Sales are moderately below goal
( ) Sales are far below goal
( ) I do not have a sales goal but I feel sales are:

( ) highly satisfactory.
( ) satisfactory.
( ) slightly unsatisfactory.
( ) moderately unsatisfactory.
( ) very unsatisfactory.

10. How do current costs compare with your personal current cost goals?

( ) Costs are lower than goals.
( ) Costs are meeting goals.
( ) Costs are slightly higher than goals
( ) Costs are moderately higher than goals
( ) Costs are far above goals.
( ) I do not have a cost goal but I feel costs are:

( ) highly satisfactory.
( ) satisfactory.
( ) slightly unsatisfactory.
( ) moderately unsatisfactory.
( ) very unsatisfactory.

11. Technological change seems to be a way of life in some industries. How do you feel about the current rate of technological change in this industry?

( ) it is much too fast.
( ) it is somewhat too fast.
( ) it is slightly too fast.
( ) it is neither too fast nor too slow.
( ) it is too slow.

On the following pages, you will find a series of situations that are likely to occur in everyday life. The central person in each situation is faced with a choice between two alternative courses of action, which we might call X and Y. Alternative X is more desirable and attractive than alternative Y, but the probability of attaining or achieving X is less than that of attaining or achieving Y.

For each situation on the following pages, you will be asked to indicate the minimum odds of success you would demand before recommending that the more attractive or desirable alternative, X, be chosen.

Read each situation carefully before giving your judgment. Try to place yourself in the position of the central person in each of the situations. Please do not omit any of the situations.

Mr. A, an electrical engineer, who is married and has one child, has been working for a large electronics corporation since graduating college five years ago. He is assured of a lifetime job with a modest, though adequate salary, and liberal pension benefits upon retirement. On the other hand, it is very unlikely that his salary will increase much before he retires. While attending a convention, Mr. A is offered a job with a small, newly founded company which has a highly uncertain future. The new job would pay more to start and would offer the possibility of a share in the ownership if the company survived the competition of the larger firms.

Imagine that you are advising Mr. A. Listed below are several probabilities or odds of the new company's proving financially sound.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. A to take the new job.

___ The chances are 1 in 10 that the company will prove financially sound.
___ The chances are 3 in 10 that the company will prove financially sound.
___ The chances are 5 in 10 that the company will prove financially sound.
___ The chances are 7 in 10 that the company will prove financially sound.
___ The chances are 9 in 10 that the company will prove financially sound.
___ Place a check here if you think Mr. A should not take the new job no matter what the probabilities.

* * *

Mr. B, a 45-year-old accountant, has recently been informed by his physician that he has developed a severe heart ailment. The disease would be sufficiently serious to force Mr. B to change many of his strongest life habits - reducing his work load, drastically changing his diet, giving up favorite leisure-time pursuits. The physician suggests that a delicate medical operation could be attempted which, if successful, would completely relieve the heart condition. But its success could not be assured, and in fact, the operation might prove fatal.

Imagine that you are advising Mr. B. Listed below are several probabilities or odds that the operation will prove successful.

Please check the lowest probability that you would consider acceptable for the operation to be performed.

___ Place a check here if you think Mr. B should not have the operation no matter what the probabilities.
___ The chances are 9 in 10 that the operation will be a success.
___ The chances are 7 in 10 that the operation will be a success.
___ The chances are 5 in 10 that the operation will be a success.
___ The chances are 3 in 10 that the operation will be a success.
___ The chances are 1 in 10 that the operation will be a success.

Mr. C, a married man with two children, has a steady job that pays him about $6000 per year. He can easily afford the necessities of life, but few of the luxuries. Mr. C's father, who died recently, carried a $4000 life insurance policy. Mr. C would like to invest this money in stocks. He is well aware of the secure "blue-chip" stocks and bonds that would pay approximately 6% on his investment. On the other hand, Mr. C has heard that the stocks of a relatively unknown Company X might double their present value if a new product currently in production is favorably received by the buying public. However, if the product is unfavorably received, the stocks would decline in value.

Imagine that you are advising Mr. C. Listed below are several probabilities or odds that Company X stocks will double their value.

Please check the lowest probability that you would consider acceptable for M C to invest in Company X stocks.

___ The chances are 1 in 10 that the stocks will double their value.
___ The chances are 3 in 10 that the stocks will double their value.
___ The chances are 5 in 10 that the stocks will double their value.
___ The chances are 7 in 10 that the stocks will couble their value.
___ The chances are 9 in 10 that the stocks will double their value.
___ Place a check here if you think Mr. C should not invest in Company X stocks, no matter what the probabilities.

* * *

Mr. D is the captain of College X's football team. College X is playing its traditional rival, College Y, in the final game of the season. The game is in its final seconds, and Mr. D's team, College X, is behind in the score. College X has time to run one more play. Mr. D, the captain, must decide whether it would be best to settle for a tie score with a play which would be almost certain to work or, on the other hand, should he try a more complicated and risky play which could bring victory if it succeeded, but defeat if not.

Imagine that you are advising Mr. D. Listed below are several probabilities or odds that the risky play will work.

Please check the lowest probability that you would consider acceptable for the risky play to be attempted.

___ Place a check here if you think Mr. D should not attempt the risky play no matter what the probabilities.
___ The chances are 9 in 10 that the risky play will work.
___ The chances are 7 in 10 that the risky play will work.
___ The chances are 5 in 10 that the risky play will work.
___ The chances are 3 in 10 that the risky play will work.
___ The chances are 1 in 10 that the risky play will work.

Mr. E is president of a light metals corporation in the United States. The corporation is quite prosperous, and has strongly considered the possibilities of business expansion by building an additional plant in a new location. One choice is to build another plant in the U.S., where there would be a moderate return on the initial investment. On the other hand, there is a chance to build a plant in a foreign country. Lower labor costs and easy access to raw materials in that country would mean a much higher return on the initial investment. Unfortunately, there is a history of political instability and revolution in the foreign country under consideration. In fact, the leader of small minority party is committed to nationalizing, that is, taking over, all foreign investments.

Imagine that you are advising Mr. E. Listed below are several probabilities or odds of continued political stability in the foreign country under consideration.

Please check the lowest probability that you would consider acceptable for Mr. E's corporation to build a plant in that country.

___ The chances are 1 in 10 that the foreign country will remain politically stable.
___ The chances are 3 in 10 that the foreign country will remain politically stable.
___ The chances are 5 in 10 that the foreign country will remain politically stable.
___ The chances are 7 in 10 that the foreign country will remain politically stable.
___ The chances are 9 in 10 that the foreign country will remain politically stable.
___ Place a check here if you think Mr. E's corporation should not build a plant in the foreign country, no matter what the probabilities.

Mr. F is currently a college senior who is very eager to pursue graduate study in chemistry leading to the Doctor of Philosophy degree. He has been accepted to both University X and University Y. University X has a world-wide reputation for excellence in chemistry. While a degree from University X would signify outstanding training in this field, the standards are so very rigorous that only a fraction of the degree candidates actually receive the degree. University Y, on the other hand, has much less of a reputation in chemistry, but almost everyone admitted is awarded the Doctor of Philosophy degree, though the degree has much less prestige than the corresponding degree from University X.

Imagine that you are advising Mr. F. Listed below are several probabilities or odds that Mr. F would be awarded a degree at University X, the one with the greater prestige.

Please check the lowest probability that you would consider acceptable to me it worthwhile for Mr. F to enroll in University X rather than University Y.

___ Place a check here if you think Mr. F should not enroll in University X no matter what the probabilities.

___ The chances are 9 in 10 that Mr. F would receive a degree from University X.

___ The chances are 7 in 10 that Mr. F would receive a degree from University X.

___ The chances are 5 in 10 that Mr. F would receive a degree from University X.

___ The chances are 3 in 10 that Mr. F would receive a degree from University X.

___ The chances are 1 in 10 that Mr. F would receive a degree from University X.

Mr. G, a competent chess player, is participating in a national chess tournament. In an early match he draws the top-favored player in the tournament as his opponent. Mr. G has been given a relatively low ranking in view of his performance in previous tournaments. During the course of his play with the top-favored man, Mr. G notes the possibility of a deceptive though risky maneuver which might bring him a quick victory. At the same time, if the attempted maneuver should fail, Mr. G would be left in an exposed position and defeat would almost certainly follow.

Imagine that you are advising Mr. G. Listed below are several probabilities or odds that Mr. G's deceptive play would succeed.

Please check the lowest probability that you would consider acceptable for the risky play in question to be attempted.

___ The chances are 1 in 10 that the play would succeed.
___ The chances are 3 in 10 that the play would succeed.
___ The chances are 5 in 10 that the play would succeed.
___ The chances are 7 in 10 that the play would succeed.
___ The chances are 9 in 10 that the play would succeed.
___ Place a check here if you think Mr. G should not attempt the risky play, no matter what the probabilities.

* * *

Mr. H, a college senior, has studied the piano since childhood. He has won amateur prizes and given small recitals, suggesting that Mr. H has considerable musical talent. As graduation approaches, Mr. H has the choice of going to medical school to become a physician, a profession which would bring certain prestige and financial rewards; or entering a conservatory of music for advanced training with a well-known pianist. Mr. H realizes that even upon completion of his piano studies, which would take many more years and a lot of money, success as a concert pianist would not be assured.

Imagine that you are advising Mr. H. Listed below are several probabilities or odds that Mr. H would succeed as a concert pianist.

Please check the lowest probability that you would consider acceptable for Mr. H to continue with his musical training.

___ Place a check here if you think Mr. H should not pursue his musical training, no matter what the probabilities.
___ The chances are 9 in 10 that Mr. H would succeed as a concert pianist.
___ The chances are 7 in 10 that Mr. H would succeed as a concert pianist.
___ The chances are 5 in 10 that Mr. H would succeed as a concert pianist.
___ The chances are 3 in 10 that Mr. H would succeed as a concert pianist.
___ The chances are 1 in 10 that Mr. H would succeed as a concert pianist.

Mr. J is an American captured by the enemy in World War II and placed in a prisoner-of-war camp. Conditions in the camp are quite bad, with long hours of hard physical labor and a barely sufficient diet. After spending several months in this camp, Mr. J notes the possibility of escape by concealing himself in a supply truck that shuttles in and out of the camp. Of course, there is no guarantee that the escape would prove successful. Recapture by the enemy could well mean execution.

Imagine that you are advising Mr. J. Listed below are several probabilities or odds of a successful escape from the prisoner-of-war camp.

Please check the lowest probability that you would consider acceptable for an escape to be attempted.

___ The chances are 1 in 10 that the escape would succeed.
___ The chances are 3 in 10 that the escape would succeed.
___ The chances are 5 in 10 that the escape would succeed.
___ The chances are 7 in 10 that the escape would succeed.
___ The chances are 9 in 10 that the escape would succeed.
___ Place a check here if you think Mr. J should not try to escape no matter what the probabilities.

* * *

Mr. K is a successful businessman who has participated in a number of civic activities of considerable value to the community. Mr. K has been approached by the leaders of his political party as a possible congressional candidate the next election. Mr. K's party is a minority party in the district, though the party has won occasional elections in the past. Mr. K would like to be political office, but to do so would involve a serious financial sacrifice, since the party has insufficient campaign funds. He would also have to endure the attacks of his political opponents in a hot campaign.

Imagine that you are advising Mr. K. Listed below are several probabilities or odds of Mr. K's winning the election in his district.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. K to run for political office.

___ Place a check here if you think Mr. K should not run for political offic no matter what the probabilities.
___ The chances are 9 in 10 that Mr. K would win the election.
___ The chances are 7 in 10 that Mr. K would win the election.
___ The chances are 5 in 10 that Mr. K would win the election.
___ The chances are 3 in 10 that Mr. K would win the election.
___ The chances are 1 in 10 that Mr. K would win the election.

Mr. L, a married 30-year-old research physicist, has been given a five-year appointment by a major university laboratory. As he contemplates the next five years, he realizes that he might work on a difficult, long-term problem which, if a solution could be found, would resolve basic scientific issues in the field and bring high scientific honors. If no solution were found, however, Mr. L would have little to show for his five years in the laboratory, and this would make it hard for him to get a good job afterwards. On the other hand, he could, as most of his professional associates are doing, work on a series of short-term problems where solutions would be easier to find, but where the problems are of lesser scientific importance.

Imagine that you are advising Mr. L. Listed below are several probabilities or odds that a solution would be found to the difficult, long-term problem that Mr. L has in mind.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. L to work on the more difficult long-term problem.

___ The chances are 1 in 10 that Mr. L would solve the long-term problem.
___ The chances are 3 in 10 that Mr. L would solve the long-term problem.
___ The chances are 5 in 10 that Mr. L would solve the long-term problem.
___ The chances are 7 in 10 that Mr. L would solve the long-term problem.
___ The chances are 9 in 10 that Mr. L would solve the long-term problem.
___ Place a check here if you think Mr. L should not choose the long-term, difficult problem, no matter what the probabilities.

* * *

Mr. M is contemplating marriage to Miss T, a girl whom he has known for a little more than a year. Recently, however, a number of arguments have occurred between them, suggesting some sharp differences of opinion in the way each views certain matters. Indeed, they decide to seek professional advice from a marriage counselor as to whether it would be wise for them to marry. On the basis of these meetings with a marriage counselor, they realize that a happy marriage, while possible, would not be assured.

Imagine that you are advising Mr. M and Miss T. Listed below are several probabilities or odds that their marriage would prove to be a happy and successful one.

Please check the lowest probability that you would consider acceptable for Mr. M and Miss T to get married.

___ Place a check here if you think Mr. M and Miss T should not marry, no matter what the probabilities.
___ The chances are 9 in 10 that the marriage would be happy and successful.
___ The chances are 7 in 10 that the marriage would be happy and successful.
___ The chances are 5 in 10 that the marriage would be happy and successful.
___ The chances are 3 in 10 that the marriage would be happy and successful.
___ The chances are 1 in 10 that the marriage would be happy and successful.

Your position in company
( ) President (Vice President and Gen'l. Manager if a subsidiary)
( ) Manufacturing or Production Vice President
( ) Chief Engineer
( ) Manufacturing or Production Supervisor
( ) Manager of Quality Control
( ) Other

_____

Idea Report

Name of idea

Date you heard of the idea ___/___/ 66

Type of Idea ( ) Change of input material
( ) Change in production method
( ) Change in design of a product
( ) New product
( ) Other

_____

Source of Idea ( ) Self ( ) Employee ( ) Business Associate
( ) Newspaper or magazine ( ) Trade Journal ( ) Trade Show
( ) Customer ( ) Supplier ( ) Other

_____

Considering both the number and value of previous ideas from this particular source (particular person, magazine, etc.), how fruitful has this source been?
( ) Not fruitful ( ) Somewhat fruitful
( ) Moderately fruitful ( ) Highly fruitful
( ) No previous experiences with this particular source

How risky is this idea, i.e., how high is the probability that it will either fail to accomplish its intended purpose or will have undesirable side effects?
( ) About 1 chance in 10, or less, of failure
( ) About 3 chances in 10 of failure
( ) About 5 chances in 10 of failure
( ) About 7 chances in 10 of failure
( ) About 9 chances in 10 of failure

Considering the cost of this idea but not any of its other advantages or disadvantages, how difficult would it be to obtain the amount of money necessary to implement the idea?
( ) No problem getting this amount of money
( ) Slight problem getting this amount of money
( ) Some problem getting this amount of money
( ) Considerable problem getting this amount of money
( ) Very difficult problem getting this amount of money

To what extent are the people necessary to implement this idea available?
( ) No problem getting the people
( ) Slight difficulty in getting the people
( ) Some difficulty in getting the people
( ) Considerable difficulty in getting the people
( ) Almost impossible to get the people

If successful, what will be the approximate total value of this idea to the company?
( ) A saving or profit of less than $1000
( ) A saving or profit of $1000 - $10,000
( ) A saving or profit of $10,000 - $100,000
( ) A saving or profit of over $100,000
( ) Other

_____

Is this idea ( ) a potential solution to a particular problem to which you have been actively searching for a solution?
( ) a potential solution to a general problem area where you are always looking for ideas?
( ) an unexpected or unsought idea?

How urgent is the problem to which this idea is a potential solution?
( ) very urgent
( ) moderately urgent
( ) not urgent

What is the present disposition of the idea?

( ) Rejected ( ) Under study ( ) Dormant ( ) Accepted in principle ( ) Accepted and change ordered
( ) Other

_____

Date today ___/___/ 66

NORTHWESTERN UNIVERSITY
EVANSTON, ILLINOIS 60201

DEPARTMENT OF INDUSTRIAL ENGINEERING
AND MANAGEMENT SCIENCES

THE TECHNOLOGICAL INSTITUTE

July 1, 1966

The Department of Industrial Engineering and Management Sciences invites the participation of your company in a research project on innovation in the electronic industry. The research is part of the Program of Research on the Management of Research and Development at Northwestern University, under my direction. The investigator for the project is Mr. Robert B. Martin, holder of a B.S.E.E. and a doctoral candidate in Industrial Engineering and Management Sciences at Northwestern.

The project will involve several Chicago area companies engaged in the manufacture of electronic components, equipment, or systems. The research will involve interviews with several key people over a four-month period. Data gathering techniques have been designed to minimize the time required for such interviews. All information gathered by the investigator, including the identity of the participating companies, will be strictly confidential and will not be divulged to anyone.

Hopefully, the knowledge gained in this project will throw light on the factors which influence business decisions to accept or reject new products and materials and suggested changes in the production process.

We sincerely hope that your organization will be able to participate in the study. Mr. Martin will call you in a few days to see if an appointment can be arranged for further discussion of the study.

Thank you for your consideration.

Sincerely,

Albert H. Rubenstein

Albert H. Rubenstein
Professor

AHR/db

INSTRUCTIONS FOR USE OF IDEA REPORTS

Idea Reports will be a primary source of data for research into the processing of ideas and suggestions by businessmen. I would greatly appreciate a filled out Idea Report for every idea or suggestion which you evaluate that would, if implemented, change your production process or product line. I am interested in all such idea evaluations, whether they occur at home, at work, or anywhere else. I am just as interested in those which you decide not to implement, or decide to think about awhile, as I am in those which you decide to implement or recommend for implementation.

It is my belief that this research will help you by giving you information on the flow of ideas into your organization. Toward this end I will be glad to give you a summary of the information gathered from your company. When the research is completed you may also compare your company's information with similar information compiled from all the companies in the study. This latter information will be in aggregate form, not broken down by individual companies.

My longer range hope is that this study will increase our knowledge of how business really works, and thus perhaps enable the academic community to better prepare students for business careers.

Please feel free to write additional comments on the back of the card and to call me if you have questions. I am particularly interested in comments and suggestions for improving the Idea Report form itself. My office phone number is 492-3579, and if I am not there someone will take a message.

Thank you for your assistance

Robert B. Martin

NORTHWESTERN UNIVERSITY
EVANSTON, ILLINOIS 60201

DEPARTMENT OF INDUSTRIAL ENGINEERING
AND MANAGEMENT SCIENCES

THE TECHNOLOGICAL INSTITUTE

Dear Mr.

I would like to express my appreciation for your cooperation in my research project last fall. You and your people were most cooperative and I learned a lot from the information you provided me.

I am sending under separate cover a copy of my dissertation, which contains the results of my analysis of the information which your company and 33 others gave me. I think you will find some of the results interesting. I certainly did, and I appreciate the time you spent providing me with the information which led to them.

Sincerely,

Robert B. Martin

RM/jw

APPENDIX 2. COMPUTER PRINTOUTS

ANALYSIS OF VARIANCE FOR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	9	288.54942	32.06105	3.78928
DEVIATION ABOUT REGRESSION...	76	643.03489	8.46099	
TOTAL...	85	931.58430		

THE RESULTS ABOVE ARE ACCURATE TO NO MORE THAN SIX DECIMAL PLACES
DESPITE THE POSSIBLE ILLUSION OF GREATER ACCURACY

INTERCEPT (A VALUE) IS 1.28547

VARIABLE NO.	NAME	MEAN	STANDARD DEVIATION	REG. COEF.	STD. ERROR OF REG.COEF.	COMPUTED T VALUE	PARTIAL CORR. COEF.
1	SIZE	155.39535	197.57353	0.00633	0.00162	3.91239	0.40944
13	EXP5	0.47674	0.50239	1.65394	0.67210	2.46084	0.27166
21	CSAT4	0.32558	0.47134	1.74937	0.73169	2.39088	0.26449
11	EXP3	0.33721	0.47553	-1.12648	0.73300	-1.53681	-0.17361
2	FREEM	0.24419	0.43212	1.09743	0.78915	1.39065	0.15753
29	RISK7	0.01163	0.10783	4.86945	3.06012	1.59126	0.17956
22	CSAT5	0.08140	0.27505	1.58344	1.22873	1.28869	0.14623
27	RISK5	0.39535	0.49179	0.80169	0.66394	1.20747	0.13720
8	ED2	0.25581	0.43888	-0.82192	0.73517	-1.11800	-0.12720
DEPENDENT							
30	IDEAS	3.80814	3.31056				

COMPARE CHECK ON FINAL COEFFICIENT..... -0.82192

INCREMENTS FOR INDEPENDENT VARIABLES					CUMULATIVE REGRESSIONS			
VARIABLE NO.	NAME	SUMS OF SQUARES	PROP. VAR.	F VALUE EACH TERM	STD. ERROR OF ESTIMATE	SUMS OF SQUARES	PROP.VAR. = R SQ.	F VALUE
1	SIZE	105.96204	0.11374	10.78073	3.13510	105.96204	0.11374	10.78073
13	EXP5	48.02239	0.05155	5.12585	3.06083	153.98443	0.16529	8.21805
21	CSAT4	38.42226	0.04124	4.26234	3.00239	192.40669	0.20654	7.11482
11	EXP3	30.48488	0.03272	3.48427	2.95792	222.89157	0.23926	6.36885
2	FREEM	19.00561	0.02040	2.20455	2.93617	241.89718	0.25966	5.61175
29	RISK7	12.43939	0.01335	1.45104	2.92793	254.33657	0.27302	4.94467
22	CSAT5	12.15047	0.01304	1.42496	2.92008	266.48704	0.28606	4.46465
27	RISK5	11.48682	0.01233	1.35323	2.91349	277.97386	0.29839	4.09341
8	ED2	10.57555	0.01135	1.24992	2.90878	288.54942	0.30974	3.78928

PROPORTION OF VARIANCE SPECIFIED TO LIMIT VARIABLES 0.01000

Stage Ia model test results using all evaluators and with the variables cate as indicated in Chapter III.

DEPENDENT VARIABLE IS NOW 13
NUMBER OF VARIABLES DELETED 0

ANALYSIS OF VARIANCE FOR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	4	232.76355	58.19089	7.03458
DEVIATION ABOUT REGRESSION...	81	670.04169	8.27212	
TOTAL...	85	902.80523		

THE RESULTS ABOVE ARE ACCURATE TO NO MORE THAN SIX DECIMAL PLACES
DESPITE THE POSSIBLE ILLUSION OF GREATER ACCURACY

INTERCEPT (A VALUE) IS 1.80820

VARIABLE NO.	NAME	MEAN	STANDARD DEVIATION	REG. COEF.	STD. ERROR OF REG.COEF.	COMPUTED T VALUE	PARTIAL CORR. COEF.
1	SIZE	155.04651	197.37733	0.00642	0.00160	4.01804	0.40767
11	CSAT	0.40698	0.49415	1.21950	0.64532	1.88977	0.20549
8	PURS	0.47674	0.50239	1.63444	0.64130	2.54865	0.27247
6	SHOWS	0.32558	0.47134	-1.25918	0.68721	-1.83231	-0.19950
DEPENDENT 13	IDEAS	3.66860	3.25902				

COMPARE CHECK ON FINAL COEFFICIENT..... -1.25918

INCREMENTS FOR INDEPENDENT VARIABLES				*	CUMULATIVE REGRESSIONS			
VARIABLE NO.	NAME	SUMS OF SQUARES	PROP. VAR.	F VALUE EACH TERM	* STD. ERROR OF ESTIMATE	SUMS OF SQUARES	PROP.VAR. = R SQ.	F VALUE
1	SIZE	121.61501	0.13471	13.07705	3.04957	121.61501	0.13471	13.07705
11	CSAT	44.40568	0.04919	5.00237	2.97942	166.02069	0.18389	9.35125
8	PURS	38.97041	0.04317	4.57941	2.91718	204.99110	0.22706	8.02949
6	SHOWS	27.77244	0.03076	3.35736	2.87613	232.76355	0.25782	7.03458

PROPORTION OF VARIANCE SPE-
CIFIED TO LIMIT VARIABLES 0.01000

Stage Ia model test results using all evaluators and dichotomous variables.

ANALYSIS OF VARIANCE FOR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	6	106.62088	17.77015	1.92797
DEVIATION ABOUT REGRESSION...	21	193.55769	9.21703	
TOTAL...	27	300.17857		

THE RESULTS ABOVE ARE ACCURATE TO NO MORE THAN SIX DECIMAL PLACES
DESPITE THE POSSIBLE ILLUSION OF GREATER ACCURACY

INTERCEPT (A VALUE) IS 1.88877

VARIABLE NO.	NAME	MEAN	STANDARD DEVIATION	REG. COEF.	STD. ERROR OF REG.COEF.	COMPUTED T VALUE	PARTIAL CORR. COEF.
10	CSAT	0.50000	0.50918	3.13551	1.23260	2.54383	0.49111
4	EDUC	0.50000	0.50918	1.41669	1.31492	1.07740	0.22887
9	SSAT	0.42857	0.50395	-1.99559	1.25968	-1.58421	-0.32673
7	MEETS	0.39286	0.49735	0.96918	1.30659	0.74177	0.15979
6	SHOWS	0.42857	0.50395	-1.23980	1.20566	-1.02832	-0.24656
8	PUBS	0.46429	0.50787	0.96517	1.35646	0.71154	0.15343
DEPENDENT 12	IDEAS	3.60714	3.33433				

COMPARE CHECK ON FINAL COEFFICIENT..... 0.96517

INCREMENTS FOR INDEPENDENT VARIABLES				*	CUMULATIVE REGRESSIONS			
VARIABLE NO.	NAME	SUMS OF SQUARES	PROP. VAR.	F VALUE EACH TERM	* STD. ERROR OF ESTIMATE	SUMS OF SQUARES	PROP.VAR. = R SQ.	F VALUE
10	CSAT	30.03571	0.10006	2.89080	3.22337	30.03571	0.10006	2.89080
4	EDUC	31.11429	0.10365	3.25424	3.09211	61.15000	0.20371	3.19784
9	SSAT	19.49174	0.06493	2.13086	3.02446	80.64174	0.26865	2.93861
7	MEETS	11.07914	0.03691	1.22241	3.01054	91.72088	0.30555	2.52999
6	SHOWS	10.23356	0.03409	1.13578	3.00170	101.95444	0.33965	2.26309
8	PUBS	4.66644	0.01555	0.50628	3.03596	106.62088	0.35519	1.92797

PROPORTION OF VARIANCE SPECIFIED TO LIMIT VARIABLES 0.01000

Stage Ia model test results using production managers.

NUMBER OF VARIABLES DELETED 0

ANALYSIS OF VARIANCE FOR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	6	197.67128	32.94521	3.78890
DEVIATION ABOUT REGRESSION...	17	147.81830	8.69519	
TOTAL...	23	345.48958		

THE RESULTS ABOVE ARE ACCURATE TO NO MORE THAN SIX DECIMAL PLACES
DESPITE THE POSSIBLE ILLUSION OF GREATER ACCURACY

INTERCEPT (A VALUE) IS 0.05701

VARIABLE NO.	NAME	MEAN	STANDARD DEVIATION	REG. COEF.	STD. ERROR OF REG.COEF.	COMPUTED T VALUE	PARTIAL CORR. COEF.
10	CSAT	0.33333	0.48154	3.79822	1.35495	2.80321	0.55264
5	TRAVEL	0.54167	0.50898	3.27401	1.34350	2.43692	0.50881
7	MEETS	0.45833	0.50898	3.76877	1.45554	2.58926	0.53182
6	SHOWS	0.50000	0.51075	-2.14753	1.43172	-1.49997	-0.23751
8	PUBS	0.45833	0.50898	-1.88025	1.38950	-1.35318	-0.31183
11	RISK	0.54167	0.50898	1.55234	1.37848	1.12612	0.26347
DEPENDENT 12	IDEAS	3.72917	3.87573				

COMPARE CHECK ON FINAL COEFFICIENT..... 1.55234

INCREMENTS FOR INDEPENDENT VARIABLES				*	CUMULATIVE REGRESSIONS			
VARIABLE NO.	NAME	SUMS OF SQUARES	PROP. VAR.	F VALUE EACH TERM	* STD. ERROR OF ESTIMATE	SUMS OF SQUARES	PROP.VAR. = R SQ.	F VALUE
10	CSAT	80.08333	0.23180	6.63825	3.47332	80.08333	0.23180	6.63825
5	TRAVEL	44.81645	0.12972	4.26650	3.24103	124.89978	0.36152	5.94519
7	MEETS	29.42258	0.08516	3.07820	3.09166	154.32236	0.44668	5.38176
6	SHOWS	21.37244	0.06186	2.39157	2.98941	175.69480	0.50854	4.91505
8	PUBS	10.94964	0.03169	1.24079	2.97064	186.64444	0.54023	4.23003
11	RISK	11.02684	0.03192	1.26815	2.94876	197.67128	0.57215	3.78890

ANALYSIS OF VARIANCE FOR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	10	861.23962	86.12396	3.09560
DEVIATION ABOUT REGRESSION...	75	2086.60922	27.82146	
TOTAL...	85	2947.84884		

THE RESULTS ABOVE ARE ACCURATE TO NO MORE THAN SIX DECIMAL PLACES
DESPITE THE POSSIBLE ILLUSION OF GREATER ACCURACY

INTERCEPT (A VALUE) IS -1.91087

VARIABLE NO.	NAME	MEAN	STANDARD DEVIATION	REG. COEF.	STD. ERROR OF REG.COEF.	COMPUTED T VALUE	PARTIAL CORR. COEF.
1	SIZE	155.39535	197.57353	0.00786	0.00302	2.60618	0.28817
21	CSAT4	0.32558	0.47134	3.09030	1.30076	2.37576	0.26455
2	FREEM	0.24419	0.43212	4.67829	1.44289	3.24231	0.35062
17	SSAT4	0.19767	0.40058	3.12866	1.54074	2.03062	0.22828
13	EXP5	0.47674	0.50239	2.23130	1.30289	1.71258	0.19399
26	RISK4	0.19767	0.40058	-3.21224	1.54917	-2.07352	-0.23285
8	ED2	0.25581	0.43888	-1.23428	1.73776	-0.71027	-0.08174
10	EXP2	0.45349	0.50075	-1.85397	1.32701	-1.39710	-0.15926
9	ED3	0.48837	0.50280	1.74187	1.59534	1.09185	0.12509
29	RISK7	0.01163	0.10783	5.77730	5.59199	1.03314	0.11846
DEPENDENT 30	IDEAS	2.26744	5.88902				

COMPARE CHECK ON FINAL COEFFICIENT..... 5.77730

INCREMENTS FOR INDEPENDENT VARIABLES * CUMULATIVE REGRESSIONS

VARIABLE NO.	NAME	SUMS OF SQUARES	PROP. VAR.	F VALUE EACH TERM	* STD. ERROR OF ESTIMATE	SUMS OF SQUARES	PROP.VAR. = R SQ.	F VALUE
1	SIZE	155.95070	0.05290	4.69210	5.76514	155.95070	0.05290	4.69210
21	CSAT4	130.60099	0.04430	4.07316	5.66249	286.55170	0.09721	4.46846
2	FREEM	162.03617	0.05497	5.31636	5.52076	448.58786	0.15217	4.90601
17	SSAT4	82.34437	0.02793	2.75967	5.46246	530.93223	0.18011	4.44839
13	EXP5	61.04115	0.02071	2.07281	5.42664	591.97338	0.20082	4.02041
26	RISK4	82.54861	0.02800	2.86663	5.36435	674.52199	0.22882	3.90670
8	ED2	71.36147	0.02421	2.52783	5.31322	745.88346	0.25303	3.77448
10	EXP2	52.54828	0.01783	1.88247	5.28342	798.43173	0.27085	3.57534
9	ED3	33.11200	0.01123	1.18911	5.27694	831.54373	0.28208	3.31801
29	RISK7	29.69589	0.01007	1.06737	5.27460	861.23962	0.29216	3.09560

PROPORTION OF VARIANCE SPECIFIED TO LIMIT VARIABLES 0.01000

Stage Ib model test using all evaluators and with the variables categori
as indicated in Chapter III.

NUMBER OF VARIABLES DELETED 0

ANALYSIS OF VARIANCE FOR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	6	41.12848	6.85475	2.66823
DEVIATION ABOUT REGRESSION...	79	202.95292	2.56902	
TOTAL...	85	244.08140		

THE RESULTS ABOVE ARE ACCURATE TO NO MORE THAN SIX DECIMAL PLACES
DESPITE THE POSSIBLE ILLUSION OF GREATER ACCURACY

INTERCEPT (A VALUE) IS 1.32409

VARIABLE NO.	NAME	MEAN	STANDARD DEVIATION	REG. COEF.	STD. ERROR OF REG.COEF.	COMPUTED T VALUE	PARTIAL CORR. COEF.
1	SIZE	155.04651	197.37733	0.00209	0.00091	2.28698	0.24919
8	PUBS	0.47674	0.50239	0.59730	0.34845	1.71414	0.18937
10	SSAT	0.46512	0.50171	-0.62391	0.35644	-1.75039	-0.19322
12	RISK	0.50000	0.50293	-0.40797	0.35072	-1.16323	-0.12977
11	CSAT	0.40698	0.49415	0.43672	0.36855	1.18498	0.13215
2	FREE	0.46512	0.50171	-0.40002	0.36354	-1.10033	-0.12286
DEPENDENT 13	IDEAS	1.43023	1.69456				

COMPARE CHECK ON FINAL COEFFICIENT..... -0.40002

INCREMENTS FOR INDEPENDENT VARIABLES				*	CUMULATIVE REGRESSIONS			
VARIABLE NO.	NAME	SUMS OF SQUARES	PROP. VAR.	F VALUE EACH TERM	* STD. ERROR OF ESTIMATE	SUMS OF SQUARES	PROP.VAR. = R SQ.	F VALUE
1	SIZE	19.69985	0.08071	7.37488	1.63438	19.69985	0.08071	7.37488
8	PUBS	6.23579	0.02555	2.37259	1.62119	25.93564	0.10626	4.93399
10	SSAT	5.42302	0.02222	2.09046	1.61065	31.35866	0.12848	4.02936
12	RISK	4.19040	0.01717	1.62767	1.60452	35.54906	0.14564	3.45207
11	CSAT	2.46901	0.01012	0.95855	1.60493	38.01807	0.15576	2.95195
2	FREE	3.11040	0.01274	1.21073	1.60282	41.12848	0.16850	2.66823

PROPORTION OF VARIANCE SPE-

Stage Ib model test results using all evaluators and dichotomous variables.

DEPENDENT VARIABLE IS NOW 12
NUMBER OF VARIABLES DELETED 0

ANALYSIS OF VARIANCE FOR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	4	21.83337	5.45834	2.06846
DEVIATION ABOUT REGRESSION...	23	60.69342	2.63884	
TOTAL...	27	82.52679		

THE RESULTS ABOVE ARE ACCURATE TO NO MORE THAN SIX DECIMAL PLACES
DESPITE THE POSSIBLE ILLUSION OF GREATER ACCURACY

INTERCEPT (A VALUE) IS 1.38230

VARIABLE NO.	NAME	MEAN	STANDARD DEVIATION	REG. COEF.	STD. ERROR OF REG.COEF.	COMPUTED T VALUE	PARTIAL CORR. COEF.
5	TRAVEL	0.50000	0.50918	1.19099	0.66816	1.78248	0.34839
9	SSAT	0.42857	0.50395	-0.68158	0.69222	-0.98463	-0.20112
3	AGE	0.50000	0.50918	-0.49092	0.63010	-0.77912	-0.16035
11	RISK	0.50000	0.50918	0.44099	0.66816	0.66000	0.13633
DEPENDENT 12	IDEAS	1.66071	1.74830				

COMPARE CHECK ON FINAL COEFFICIENT..... 0.44099

INCREMENTS FOR INDEPENDENT VARIABLES				*	CUMULATIVE REGRESSIONS		
VARIABLE NO.	NAME	SUMS OF SQUARES	PROP. VAR.	F VALUE EACH TERM	* STD. ERROR OF ESTIMATE	SUMS OF SQUARES	PROP.VAR. = R SQ.	F VALUE
5	TRAVEL	13.58036	0.16456	5.12121	1.62843	13.58036	0.16456	5.12121
9	SSAT	5.06575	0.06138	1.98250	1.59851	18.64610	0.22594	3.64862
3	AGE	2.03779	0.02469	0.79082	1.60524	20.68389	0.25063	2.67567
11	RISK	1.14948	0.01393	0.43560	1.62445	21.83337	0.26456	2.06846

PROPORTION OF VARIANCE SPE-
CIFIED TO LIMIT VARIABLES 0.01000

Stage Ib model test results using production managers.

NUMBER OF VARIABLES DELETED 0

ANALYSIS OF VARIANCE FOR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	9	45.74420	5.08269	1.37515
DEVIATION ABOUT REGRESSION...	14	51.74538	3.69610	
TOTAL...	23	97.48958		

THE RESULTS ABOVE ARE ACCURATE TO NO MORE THAN SIX DECIMAL PLACES
DESPITE THE POSSIBLE ILLUSION OF GREATER ACCURACY

INTERCEPT (A VALUE) IS 0.85575

VARIABLE NO.	NAME	MEAN	STANDARD DEVIATION	REG. COEF.	STD. ERROR OF REG.COEF.	COMPUTED T VALUE	PARTIAL CORR. COEF.
5	TRAVEL	0.54167	0.50898	3.01561	1.04737	2.87922	0.60985
2	FREE	0.37500	0.49454	-2.07600	1.12537	-1.84472	-0.44220
10	CSAT	0.33333	0.48154	1.22413	0.98952	1.23709	0.27696
8	PURS	0.45833	0.50898	-1.70663	0.99392	-1.71706	-0.41708
7	MEETS	0.45833	0.50898	1.05241	1.01439	1.03747	0.26720
3	AGE	0.45833	0.50898	-1.73639	1.09718	-1.58259	-0.38955
6	SHOWS	0.50000	0.51075	0.82118	1.15764	0.70936	0.16048
4	EDUC	0.70833	0.46431	1.04287	1.13212	0.92116	0.23905
11	RISK	0.54167	0.50898	-0.81818	1.16811	-0.70043	-0.18400
DEPENDENT 12	IDEAS	1.72917	2.05880				

COMPARE CHECK ON FINAL COEFFICIENT..... -0.81818

INCREMENTS FOR INDEPENDENT VARIABLES				*	CUMULATIVE REGRESSIONS			
VARIABLE NO.	NAME	SUMS OF SQUARES	PROP. VAR.	F VALUE EACH TERM	* STD. ERROR OF ESTIMATE	SUMS OF SQUARES	PROP.VAR. = R SQ.	F VALUE
5	TRAVEL	12.18539	0.12499	3.14262	1.96913	12.18539	0.12499	3.14262
2	FREE	5.94244	0.06095	1.57244	1.94400	18.12783	0.18595	2.39841
10	CSAT	4.43210	0.04546	1.18300	1.93558	22.55993	0.23141	2.00721
8	PURS	3.99585	0.04099	1.07031	1.93219	26.55578	0.27240	1.77828
7	MEETS	7.40824	0.07599	2.09913	1.87862	33.96402	0.34839	1.92474
3	AGE	4.89424	0.05020	1.41907	1.85712	38.85825	0.39859	1.87781
6	SHOWS	3.43825	0.03527	0.99672	1.85730	42.29650	0.43386	1.75163
4	EDUC	1.63436	0.01676	0.45773	1.88960	43.93087	0.45062	1.53795
11	RISK	1.81334	0.01860	0.49061	1.92252	45.74420	0.46922	1.37515

DEPENDENT VARIABLE IS NOW 25
NUMBER OF VARIABLES DELETED 0

ANALYSIS OF VARIANCE FOR REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARES	F VALUE
DUE TO REGRESSION.....	4	19.69701	4.92425	25.88414
DEVIATION ABOUT REGRESSION...	386	73.43343	0.19024	
TOTAL...	390	93.13043		

THE RESULTS ABOVE ARE ACCURATE TO NO MORE THAN SIX DECIMAL PLACES
DESPITE THE POSSIBLE ILLUSION OF GREATER ACCURACY

INTERCEPT (A VALUE) IS 0.24292

VARIABLE NO.	NAME	MEAN	STANDARD DEVIATION	REG. COEF.	STD. ERROR OF REG.COEF.	COMPUTED T VALUE	PARTIAL CORR. COEF.
5	RISK1	0.56522	0.49636	0.27324	0.04555	5.99846	0.29201
23	VERURG	0.28389	0.45146	0.20689	0.04957	4.17350	0.20779
9	COST1	0.74425	0.43684	0.22228	0.05139	4.32536	0.21501
15	PEOPL3	0.05882	0.23560	-0.21811	0.09459	-2.30599	-0.11657
DEPENDENT 25	DISP	0.60870	0.48867				

COMPARE CHECK ON FINAL COEFFICIENT..... -0.21811

INCREMENTS FOR INDEPENDENT VARIABLES				*		CUMULATIVE REGRESSIONS		
VARIABLE NO.	NAME	SUMS OF SQUARES	PROP. VAR.	F VALUE EACH TERM	* STD. ERROR OF ESTIMATE	SUMS OF SQUARES	PROP.VAR. = R SQ.	F VALUE
5	RISK1	10.97795	0.11788	51.98164	0.45955	10.97795	0.11788	51.98164
23	VERURG	4.11767	0.04421	20.47364	0.44846	15.09562	0.16209	37.52876
9	COST1	3.58976	0.03855	18.66126	0.43859	18.68538	0.20064	32.37844
15	PEOPL3	1.01163	0.01086	5.31757	0.43617	19.69701	0.21150	25.88414

PROPORTION OF VARIANCE SPECIFIED TO LIMIT VARIABLES 0.01000

Stage II model test results with the variables categorized as indicated in Chapter III.

APPENDIX 3. CONTINGENCY TABLES FOR VARIOUS IDEA EVALUATOR ATTRIBUTES AGAINST THE NUMBER OF IDEAS EVALUATED.

	Number and percentage of idea evaluators in each category n = 86	Number of ideas evaluated per evaluator					
		Less than 2	2-3.99	4-5.99	6-7.99	8 or more	Total
Amount of freedom the evaluator's company has to alter its product	Low	9 (36%)	4 (19%)	5 (26%)	4 (44%)	3 (25%)	25 (29%)
	Medium	3 (12%)	7 (33%)	6 (32%)	1 (12%)	4 (33%)	21 (24%)
	High	13 (52%)	10 (48%)	8 (42%)	4 (44%)	5 (42%)	40 (47%)
	TOTAL	25 (100%)	21 (100%)	19 (100%)	9 (100%)	12 (100%)	86

Table 1. Amount of freedom the evaluator's company has to alter its product versus number of ideas evaluated by the evaluator.

	Number and percentage of idea evaluators in each category n = 86	Number of ideas evaluated per evaluator					
		Less than 2	2-3.99	4-5.99	6-7.99	8 or more	Total
Education of the Evaluator	High School or Technician Training	7 (28%)	7 (33%)	2 (11%)	2 (22%)	4 (33%)	22 (26%)
	1 or more years of College	7 (28%)	3 (14%)	8 (42%)	3 (33%)	1 (8%)	22 (26%)
	B.S. Degree or More	11 (44%)	11 (52%)	9 (47%)	4 (44%)	7 (59%)	42 (48%)
	TOTAL	25 (100%)	21 (100%)	19 (100%)	9 (100%)	12 (100%)	86

Table 2. Amount of the evaluator's formal education versus number of ideas evaluated by the evaluator.

	Number and percentage of idea evaluators in each category n = 86	Number of ideas evaluated per evaluator					
		Less than 2	2-3.99	4-5.99	6-7.99	8 or more	Total
Age of the Evaluator	20's	4 (15%)	3 (14%)	2 (11%)	0 (0%)	2 (17%)	11 (13%)
	30's	9 (36%)	3 (14%)	7 (37%)	2 (22%)	1 (8%)	22 (26%)
	40's	10 (40%)	8 (38%)	7 (37%)	2 (22%)	7 (59%)	34 (40%)
	50's	2 (7%)	4 (19%)	3 (16%)	5 (56%)	1 (8%)	15 (17%)
	60's	0 (0%)	3 (14%)	0 (0%)	0 (0%)	1 (8%)	4 (5%)
	TOTAL	25 (100%)	21 (100%)	19 (100%)	9 (100%)	12 (100%)	86

Table 3. Age of the evaluator versus number of ideas evaluated by the evaluator.

	Number and percentage of idea evaluators in each category	Number of ideas evaluated per evaluator					
	n = 86	Less than 2	2-3.99	4-5.99	6-7.99	8 or more	Total
Amount of Business Travel per Evaluaotr	Low	15 (60%)	10 (48%)	10 (53%)	6 (67%)	6 (50%)	47 (55%)
	High	10 (40%)	11 (52%)	9 (47%)	3 (33%)	6 (50%)	39 (45%)
	TOTAL	25 (100%)	21 (100%)	19 (100%)	9 (100%)	12 (100%)	86

Table 4. Amount of business travel by the evaluator versus number of ideas evaluated by the evaluator. "High" refers to amounts of travel in excess of the group median.

	Number and percentage of idea evaluators in each category	Number of ideas evaluated per evaluator					
	n = 86	Less than 2	2-3.99	4-5.99	6-7.99	8 or more	Total
Amount of attendance at trade shows per evaluator	Low	16 (64%)	13 (62%)	13 (68%)	6 (67%)	9 (75%)	57 (66%)
	High	9 (36%)	8 (38%)	6 (32%)	3 (33%)	3 (25%)	29 (34%)
	TOTAL	25 (100%)	21 (100%)	19 (100%)	9 (100%)	12 (100%)	86

Table 5. Amount of the evaluator's attendance at trade shows versus number of ideas evaluated by the evaluator. "High" refers to attendance in excess of the group median.

	Number and percentage of idea evaluators in each category	Number of ideas evaluated per evaluator					
	n = 86	Less than 2	2-3.99	4-5.99	6-7.99	8 or more	Total
Professional meetings per evaluator	Low	19 (76%)	12 (57%)	15 (79%)	6 (67%)	7 (59%)	59 (69%)
	High	6 (24%)	9 (43%)	4 (21%)	3 (33%)	5 (41%)	27 (31%)
	TOTAL	25 (100%)	21 (100%)	19 (100%)	9 (100%)	12 (100%)	86

Table 6. Amount of the evaluator's attendance at professional meetings versus number of ideas evaluated by the evaluator. "High" refers to attendance in excess of the group median.

	Number and percentage of idea evaluators in each category n = 86	Number of ideas evaluated per evaluator					
		Less than 2	2-3.99	4-5.99	6-7.99	8 or more	Total
Number of publications read per evaluator	Low	16 (64%)	12 (57%)	10 (53%)	4 (49%)	3 (33%)	45 (52%)
	High	9 (36%)	9 (43%)	9 (47%)	5 (56%)	9 (67%)	41 (48%)
	TOTAL	25 (100%)	21 (100%)	19 (100%)	9 (100%)	12 (100%)	86

Table 7. Number of professional, trade, and business publications read by the evaluator versus the number of ideas evaluated by the evaluator. "High" refers to a number of publications read which is in excess of the group median.

	Number and percentage of idea evaluators in each category n = 86	Number of ideas evaluated per evaluator					
		Less than 2	2-3.99	4-5.99	6-7.99	8 or more	Total
Evaluator's perception of cost levels relative to personal cost goals	Costs are below Goals	2 (8%)	2 (10%)	1 (5%)	0 (0%)	0 (0%)	5 (6%)
	Costs are meeting Goals	6 (24%)	8 (38%)	2 (11%)	0 (0%)	3 (25%)	19 (22%)
	Costs are slightly above goals	7 (26%)	7 (33%)	7 (37%)	3 (33%)	3 (25%)	27 (31%)
	Costs are moderately above goals	9 (36%)	2 (10%)	7 (37%)	5 (56%)	5 (42%)	28 (34%)
	Costs are far above goals	1 (4%)	2 (10%)	2 (11%)	1 (12%)	1 (8%)	7 (8%)
	TOTAL	25 (100%)	21 (100%)	19 (100%)	9 (100%)	12 (100%)	86

Table 8. Evaluator's perception of cost levels relative to personal cost goals versus number of ideas evaluated by the evaluator.

	Number and percentage of idea evaluators in each category n = 84	Number of ideas evaluated per evaluator					
		Less than 2	2-3.99	4-5.99	6-7.99	8 or more	Total
Evaluator's perception of sales levels relative to personal sales goals	Sales are above goals	5 (21%)	3 (15%)	5 (26%)	3 (33%)	3 (25%)	19 (23%)
	Sales are meeting goals	7 (29%)	8 (40%)	4 (21%)	2 (22%)	3 (25%)	24 (29%)
	Sales are slightly below goals	4 (17%)	3 (15%)	4 (21%)	1 (12%)	1 (8%)	13 (15%)
	Sales are moderately below goals	5 (21%)	4 (20%)	5 (26%)	1 (12%)	2 (16%)	7 (21%)
	Sales are far below goals	3 (13%)	2 (10%)	1 (6%)	2 (22%)	3 (25%)	11 (14%)
	TOTAL	24 (100%)	20 (100%)	19 (100%)	9 (100%)	12 (100%)	84

Table 9. Evaluator's perception of sales levels relative to personal sales goals versus number of ideas evaluated by the evaluator. The number of evaluators represented is 84 instead of 86 because two idea evaluators reported they had no personal sales goals.

	Number and percentage of idea evaluators in each category n = 86		Number of ideas evaluated per evaluator					
			Less than 2	2-3.99	4-5.99	6-7.99	8 or more	Total
Evaluator Risk Propensity	Lowest	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (8%)	1 (1%)
		2	0 (0%)	0 (0%)	0 (0%)	1 (12%)	0 (0%)	1 (1%)
		3	5 (20%)	6 (29%)	7 (37%)	2 (22%)	1 (8%)	21 (24%)
		4	13 (52%)	5 (24%)	5 (26%)	3 (33%)	8 (67%)	24 (40%)
		5	3 (12%)	7 (33%)	3 (16%)	2 (22%)	2 (17%)	17 (19%)
		6	2 (8%)	2 (10%)	2 (11%)	1 (12%)	0 (0%)	7 (8%)
		7	2 (8%)	1 (5%)	2 (11%)	0 (0%)	0 (0%)	5 (6%)
	Highest	8	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	TOTAL		25 (100%)	21 (100%)	19 (100%)	9 (100%)	12 (100%)	86

Table 10. Evaluator risk propensity, measured by the Kogan-Wallach Choice Dilemmas procedure, versus number of ideas evaluated by the evaluator.