Technological Innovation Studies Program

Research Report

RISKS IN NEW PRODUCT DEVELOPMENT

by

Blair Little

School of Business Administration,
University of Western Ontario.
June, 1972

Rapport de recherche

Programme des études sur les innovations techniques

Industry, Trade and Commerce
Technology Branch
Ottawa, Canada

Industrie et Commerce
Direction de la technologie
Ottawa, Canada

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"Risks in New Product Development"
by B. Little, University of Western Ontario.

EXECUTIVE SUMMARY

(a) The perceptions and practices of managers in Canadian industrial goods firms were analyzed to determine their perceptions of risk in new product development. The objectives of the analysis were to see how managers in different kinds of firms differed in their perceptions of risk and to determine how they assessed the risk in several of the factors of the new product decision.

(b) The 152 interviewed companies studied were chosen, first, on the basis that they manufactured industrial goods in specific industry segments, and second, that they were known to have engaged in at least some new product development work. Beyond these first two criteria, companies were sought which would represent a limited number of manufacturing industries and a range of sizes. In addition, preference was given to companies located near main transportation routes between Windsor and Quebec City. The main source from which the sample was selected was: Directory of Scientific Research and Development Establishments in Canada, Department of Industry Trade and Commerce, 1969.

(c) The purpose of the analysis was to isolate, measure, and place on view the components of risk as perceived by managers in different new product situations. This display of risk components should lead to a better understanding of new product decisions from the manager's viewpoint. From this understanding, some of the obstacles to new product development can be more clearly defined and efforts to stimulate new product development can be better directed.

MANAGEMENT CONFERENCE
ON DEVELOPING AND MARKETING NEW PRODUCTS

School of Business Administration, University of Western Ontario

September 11th and 12th 1972

THEME: "Exploiting New Product Opportunities"

OBJECTIVE: Stimulation of profitable new product development by industrial goods firms in Canada.

The conference is being planned for owners and top managers of industrial goods manufacturing firms in Canada. A survey of interest recently conducted indicates about fifty to sixty individuals will attend. The industries from which we expect most representation are: electrical and electronics, instruments, chemicals, machinery, vehicles and components. Although some very large firms will be represented, we are designing the conference mainly for small and medium size firms. There may also be a handful of government officials and business school professors who are interested in problems of new product development and marketing.

Within the theme of the conference, the focus of discussions will be on: assessing market opportunities, orienting technology development to the market, introducing new products, and exploiting new markets. The conference will not deal directly with the management of R&D activities nor with engineering problems. The attached reprint outlines some recent research which led to the organization of the conference and to the selection of the conference theme.

Within the broad objective of stimulating profitable new product development, there are four specific objectives:

1. To provide some managers with solutions to current problems.
2. To help managers to define some problems more clearly and to identify some alternative approaches to problems.
3. To generate contacts among managers for their mutual benefit.
4. To obtain guidance for further research by the group at the University of Western Ontario Business School.

The conference format--the meeting rooms, schedule and selection of speakers and panelists--will be designed to encourage discussion among those attending and to stimulate a free exchange with speakers and panelists. Daytime sessions will be held on the U.W.O. campus. Evening gatherings will be at a downtown hotel where a block of rooms has been reserved for participants. Transportation will be provided for the 15 minute trip to and from campus. Conference registration fee will be set to cover only out-of-pocket expenses for the University.

RISKS IN NEW PRODUCT DEVELOPMENT

Blair Little*

INTRODUCTION

The successful development and marketing of new products is vital to the long term profitability of most firms and important to the stability and growth of Canadian industry. A number of studies have reported the high extent to which companies rely on new products for profit and sales growth,[1] and the Science Council of Canada has outlined the importance of innovation in the manufacturing sector of the Canadian economy[2]. Facing this crucial role of new products is the suggestion that Canadian firms, especially those in the industrial goods sector, need to become even more concerned with developing new products than they have been in the past in order to remain viable in international competition.

[1] See for example: "The Marketing Executive Looks Ahead", Experiences in Marketing Management, No. 13, National Industrial Conference Board, 1967; A Study of Forty Companies and How They Grew, Time Magazine Marketing Information Report No. 1306, 1964.

[2] Innovation in a Cold Climate: The Dilemma of Canadian Manufacturing, report No. 15, Science Council of Canada, Oct. 1971.

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(Revised: June 15, 1972)

Developing new products is an activity that is frought with uncertainty and management difficulty. In one study of several hundred U.S. firms in a variety of industries, it was calculated that 70% of expenditures to develop new products were for unsuccessful new products--products that didn't reach the market, or products that failed after market launch[3]. In the same study, it was found that about one-third of the new products which did reach the market turned out to be failures, in the sense that they fell far short of expectations[4]. This one-third failure rate for newly introduced products was also the experience of a Conference Board sample of 87 companies[5].

The management of the firm's new product development function can look to an even more difficult situation in the future as technology becomes more sophisticated more rapidly, as markets become more complex and as buyers become more discriminating. In order to survive and thrive in these circumstances, new product managers will have to develop fresh views of the new product process and be able to translate those views into effective operating procedures. The paths of progress will be rocky but the potential for high payoff makes a substantial effort worthwhile.

[3]Reported by Joseph Mendell in an address to the 1972 National Industrial Marketing Conference (American Marketing Association), Cleveland, May 1, 1972.

[4]See footnote 3.

[5]"Why New Products Fail," The Conference Board Record, Oct. 1964, p.11.

This paper presents a view of the new product problem that focuses on the risks faced by managers in developing new products. A picture of the general process of new product development is outlined in the following section, followed by a discussion of risk in new product development. Then, the methodology of research study which examined the new product practices and perceptions of operating managers is described. Certain components of risk were assessed empirically in the study, and these are described. Finally, the results of the analysis of the research data are presented and some management implications are drawn.

THE NEW PRODUCT PROCESS

New product development can be thought of as 1) a series of management decisions, and 2) sets of activities in a number of functional areas of the firm. The first activity in a new product's development is the preliminary screening of a new product idea, an idea which may have originated in any one of a number of sources. With relatively little expenditure of time or money, information about the suitability of the product idea is assembled for the first decision.* The first decision is to judge whether the idea merits establishing a project for the expenditure of funds to gather further information about the market potential, about the feasibility of achieving the technical aspects of the idea, about the manufacturing costs, and so on. If the product idea is judged at this stage to be promising, a limited budget is allocated in order to undertake the second set of activities--engineering feasibility studies, market analysis, etc.--which lead to a subsequent decision.

*An earlier decision, of course, is to propose the idea for screening. But that in turn is preceded by decisions to check preliminary ideas, and so forth. In most firms the first formally noted decision is the one concerned with establishing a project.

The sets of activities, in essence then, are operations to provide information for the decisions. The decisions are at two levels; first, judgements as to whether the new product idea is likely to become a profitable product for the company; and second, selections of subsequent information gathering activities. So long as profit estimates are promising, information gathering continues in stages (some stages being repeated) through further development of product features, further refinement of estimates of manufacturing and other operating requirements and costs, to product testing in the market and to a full scale product launch. Exhibit 1 illustrates the sequence of activities and decisions in one view of the new product development process. Not all companies, obviously, have a new product process as formal as that depicted here, nor is the sequence of decisions and activities always separated so distinctly. In some companies, however, the process is extensively organized, information gathering procedures are rigorously followed, and decisions are formally analyzed and documented.

Exhibit 1 About Here

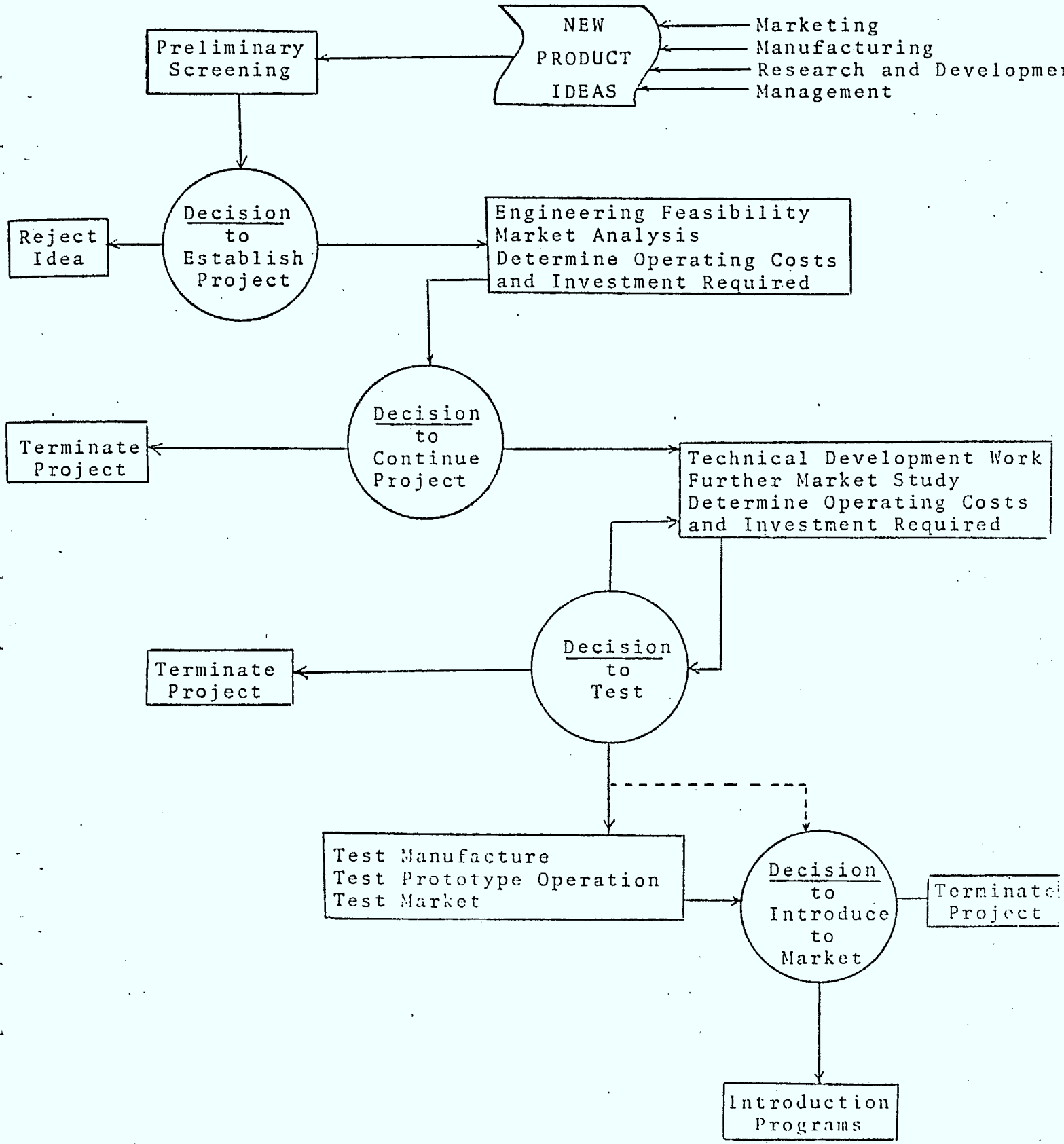
Formal or not, the periodic decisions to commit further funds to a new product project are based on estimates of several factors which will affect the product's profitability. The principal factors of profitability are usually the following:

1. Sales--number of units sold per year; price per unit; market life of the product.
2. Operating Costs--manufacturing; marketing.
3. Investment--product's technical development; new plant and equipment; market introduction.

The above three factors actually incorporate two other important factors which may in practice be separately considered: length of product development period, and competitive actions. Implicitly, if not explicitly, new product managers assess the proposed new product in profitability terms such as these.

Exhibit 1

THE NEW PRODUCT DEVELOPMENT PROCESS



RISK IN THE NEW PRODUCT DECISION

A common view of risk in new product development places almost total emphasis on the amount at stake in a new product project, and especially on the amount of the possible loss in the event the new product is a failure. In such a view, the major barrier to new product development is a lack of "risk capital", a supply of funds for development of projects with considerable chance of loss. Another view of risk is outlined below. This view is based on the framework of a sequential decision process. It is also based on the notion that risk has several dimensions and that the relevant risks are those perceived by managers who are confronted with new product decisions.

The commitment of funds to progressive product development stages is based on profitability estimates that are subject to error. The amount at stake in the decision (that is, the potential loss in the event of failure or the potential gain from success) and the amount of potential error in the estimate of profitability (that is, the uncertainty associated with the factors affecting profit) together constitute the risk in the new product decision. Where the amount at stake is high and the certainty in the profit estimate is low, the manager will generally consider the project to be a risky one. Depending on his ability to handle losses and on his new product strategy, he may withdraw from risky projects, or persist with especially thorough information gathering to sharpen the estimate of profit, or he may proceed quickly to a market introduction on the gamble that he might win with a low development cost and short development time.

Different managers may perceive different levels of risk for the same project, depending on how they see the profit factors. For example, one manager may believe he "knows" the market whereas another with the same actual market knowledge may believe there is much more he needs to learn about the market before being confident of his estimate of unit sales. The notion of risk, then, can be thought of as residing in the perception of the manager, not only in some kind of "objective" calculation of dollars and amount of information.

A manager may perceive a level of risk for a project in total, and he may also attribute a level of risk to each factor in the profitability estimate. One factor, such as investment in technical development, for example, may be considered to be a very important ingredient in the new product decision. If the manager is very unsure how much investment will be required, the two elements of risk--importance and uncertainty--would combine to register this factor as rather "risky". The risks perceived in each factor in the profitability estimates are in some fashion combined by the manager into a perception of the overall risk for the project.

A STUDY OF INDUSTRIAL GOODS FIRMS IN CANADA

Objectives

The perceptions and practices of managers in Canadian industrial goods firms were analyzed to determine their perceptions of risk in new product development. The objectives of the analysis were to see how managers in different kinds of firms differed in their perceptions of risk and to determine how they assessed the risk in several of the factors of the new product decision.

The purpose of the analysis was to isolate, measure, and place on view the components of risk as perceived by managers in different new product situations. This display of risk components should lead to a better understanding of new product decisions from the manager's viewpoint. From this understanding, some of the obstacles to new product development can be more clearly defined and efforts to stimulate new product development can be better directed.

Source of the Data

During the months of June, July, and August 1971, interviews were conducted with management personnel in 152 industrial products manufacturing firms located in Ontario and Quebec. Most interviews were with one person only, although in a number of instances other management personnel were brought into the discussion; in all cases the interviewers attempted to deal with persons most familiar with the firm's overall new product development activities. Interviews lasted from two to four hours and were based on a lengthy printed questionnaire.

Information about new product development activities were obtained from companies on two levels of detail: first of all, descriptions of company new product development practices were obtained at a general level along with information describing overall company operations; then the history of a specific new product project was obtained in some detail.

The companies studied were chosen, first, on the basis that they manufactured industrial goods in specific industry segments, and second, that they were known to have engaged in at least some new product development work. Beyond these first two criteria, companies were sought which would represent a limited number of manufacturing industries and a range of sizes. In addition, preference was given to companies located near main transportation routes between Windsor and Quebec City. The main source from which the sample was selected was: Directory of Scientific Research and Development Establishments in Canada, Department of Industry, Trade and Commerce, 1969. Other private lists of companies were the source of part of the sample. A description of the sample by industry and size is shown in Table 1. Certain industries are not represented in the sample, such as mining and smelting, wood products, pulp and paper, food product, apparel. New processes were specifically not examined, although it was recognized that process development was an important part of product development in some cases, such as in heavy chemicals.

Table 1 About Here

The title of this section and the presentation of results implies that the data obtained in this research is wholly representative of industrial goods product development in Canada. In fact, it is not, since the sampling procedure was not random. In addition to the geographic and industry boundaries, no very new firms (less than two years old) were contacted. Moreover, all but six of the

projects offered for study were considered by the respondents to be successes. Furthermore, the source of companies comprising the list from which the sample was drawn makes it likely that the bias in the sample is toward an over-representation of the more innovative, better managed firms from the industries included. (Note especially that consumer goods firms are not included in the study).

The cooperation extended to this research project by Canadian industry was outstanding. Interviewers were well received and information was given fully and willingly. Confidentiality of individual company data was promised and was upheld throughout the study. With this assurance, only a few companies felt it necessary to withhold certain pieces of company information. The high level of acceptance of this research project by Canadian managers and the enthusiasm for the topic which they exhibited in the interviews are indicative of their concern for the new product process and their interest in seeking improvement.

In spite of the cooperation of the studied companies, the data contain a number of limitations. In the first place, the answers provided by an individual manager may not be truly representative of the facts of an organization, knowledgeable and experienced though that individual may be. Secondly, some data represent past history, and although in a number of instances these data were supported by documents, in other instances they represent the memory of the interviewee. Finally, some information was gathered with questions that the interviewee had not himself addressed

while engaged in new product development problems; they sometimes required him to think about his business from an unfamiliar framework. The usual problems of interviewer bias were addressed by having extensive interviewer training prior to the main data gathering phase and holding frequent discussions among the interviewers during the course of their data gathering. It is quite possible, however, that there remains in at least some areas of the data the selective perceptions of the interviewers, and also some effects of their interaction with the interviewees.

MEASURES OF RISK

Perceived Risk

As they began to describe the specific new product project, respondents were asked to rate on a 5-point scale "what the degree of risk was to your company in developing this particular new product". Respondents used their own perceptions of risk--"to your company" was the standard against which risk was measured. Note that the manager's personal risk in a particular decision was not being measured. The distribution of responses for this question, called Perceived Project Risk, was as follows:

Perceived Project Risk	Percentage of Responses
Negligible	10.5 %
Low	28.9
Moderate	26.3
Considerable	18.4
High	15.7
	(n=152)

For some analyses where cell sizes would otherwise become very small, the extreme ratings were collapsed so that responses were represented by Low, Moderate and High categories containing respectively 39%, 26%, and 34% (rounded) of the responses.

After considerable discussion of the steps in developing the product, respondents were asked about management estimates of several profit calculation factors at the beginning of the project, before any special attempt had been made by the firm to gather information about such factors. The respondents reported the estimates, and then for each factor, they rated on a 5-point scale how confident management was that the estimate was correct. Next, respondents were asked, using a 5-point scale, how important management felt it was eventually going to be to have an accurate estimate of the factor.

Respondents' ratings of Confidence and Importance with respect to each factor were given values from 1 to 5 and combined to give a measure of Perceived Factor Risk. Low Confidence and High Importance indicated a High Perceived Factor Risk; High Confidence and Low Importance was taken to indicate Low Perceived Factor Risk. Risk was assumed to be a multiplicative function of Confidence and Importance.[6]

[6]There is no real basis for assuming that values from 1 to 5 represent the correct relative weights of each point on the rating scale, nor that a given rating on the scale of Importance should have the same weight as the equivalent rating on the scale of Confidence. On the other hand, there is no basis for applying any other weights. A parrallel situation is discussed in Scott M. Cunningham, "The Major Dimensions of Perceived Risk", in Donald F. Cox (ed.), Risk Taking and Information Handling in Consumer Behavior, Boston: Division of Research, Harvard Business School, 1967.

Perceived Competitive Strength

The manager's feelings about his firm's relative competitive strength might be an integral part of his perception of risk in a particular project, assuming his risk perception lies in the context of a company goal of maximum profits to be gained from a competitive market place. Respondents were asked to rate, on a 5-point scale, the overall degree of competition they perceived that they faced in the market for the new product. Their ratings were as follows:

Degree of Competition	Percentage of Responses
Don't Know	6.5 %
Very Low	10.5
Low	13.1
Moderate	19.0
Considerable	26.3
Very High	24.3
	(n=152)

The overall rating of competition was, presumably, a combination of the respondent's own firm's competitive strength in each functional area, as he perceived it. Perceptions of strength in the major new product functional areas of Marketing, Finance, R&D, and Manufacturing were assessed by questions of the form: "what proportion of your competitors for this product do you exceed in R&D strength?" The respondents, as a group, perceived some weakness in Marketing and Finance but they generally presented a picture of fairly uniform perceived strength in functional areas, as

shown below. Individual respondents, not surprisingly, frequently reported differences in competitive strength in different functional areas.

New Product Functional Area

(Percentage of Responses)

Company Strength in New Product	Marketing	Finance	R&D	Manufacturing
Don't Know	16%	19%	16%	16%
Stronger than None of Its Competitors	20	20	16	21
Stronger than Some But Weaker Than At Least Half of Its Competitors	26*	21	19	14
Stronger Than At Least Half of Its Competitors	38	41	49	49
	(n=152)	(n=152)	(n=152)	(n=152)

*Read: 26% of respondents thought their firm was stronger in Marketing than some of their competitors but weaker than at least half their competitors in Marketing, for the new product examined.

RESULTS

Perceived Project Risk

All size categories of companies (as measured by annual sales) had remarkably similar Perceived Project Risk (PPR) responses, as shown in Table 2. There appeared to be a slight tendency for firms in the $10 Million to $40 Million class to rate their projects as having higher risk, but these differences were not significant.

Table 2 About Here

Industry differences were similarly not significant, as Table 3 shows, although firms in the Equipment industry were somewhat more likely to perceive their projects to be in higher risk categories.

Table 3 About Here

Canadian-owned and foreign-owned firms produced an almost identical picture of PPR.

From the point of view of the manager, risky new product projects are not (according to these results) the private preserve of any particular nationality or size of company or any particular industry. That is, managers in each of these categories of firms, as a whole, feel they face about the same level of risk in new products.

Perceived Project Risk may, of course, be quite a different thing from financial risk for a project, so far as the individual firm is concerned. Taking all respondents together, however, projects with High PPR would be expected, as a rule, to involve High potential financial risks. To obtain a measure of the financial magnitude of projects, respondents were asked to "estimate the potential financial loss if for some reason the new product had achieved absolutely no sales". The following results confirm the expected relationship for the total group of firms studied:

Perceived Project Risk

(Percentage of Respondents)

Potential Financial Loss ($000)	Low	Moderate	High
No Ans.	0%	3%	4%
Up to 25	45*	20	10
>25 to 100	27	30	33
Over 100	28	48	54
	(n=60)	(n=40)	(n=52)

*Read: Of the 60 respondents with Low PPR, 45% had a project with a potential financial loss of $25,000 or less.

Although the overall relationship shown above was as expected, there were some differences in responses by size and nationality of ownership and minor differences by industry. Larger firms were much more likely to have projects involving large amounts at stake, as one would expect, even though PPR was not more likely to be higher for larger firms. Similarly, foreign-owned firms (which were generally larger than Canadian-owned firms) were more likely to be involved in projects that were financially significant, again with PPR fairly constant. Industry differences were minor--Vehicle and Vehicle Component manufacturers were more likely to be involved in larger dollar projects than other manufacturers. Interestingly enough, Equipment industry firms did not have especially large dollar projects to match their higher levels of PPR. These results are presented in Tables 4, 5 and 6.

Tables 4,5, & 6 About Here

Whereas the general relationship of High Perceived Risk and High potential loss was as expected, for the individual firm the relationship is more complex than a simple economic analysis would suggest. An analysis was made of the "copers", those respondents whose PPR was Low although the potential financial loss was High. Apart from being larger, firms in this group were less likely than average to report that their projects required the company to acquire new marketing skills. And projects of this group, besides having a High potential financial loss, had very much larger long-run market potentials.

By contrast, analysis of "worriers", those respondents whose PPR was High although potential financial loss was Low produced a very different profile. They were smaller firms--only one out of twenty-four in this group had sales of over $40 Million--but the market potentials for their projects were about the same as the average for the whole study group. In other words, the projects were financially large for the size of the company. Projects of this group were much more likely than average to require the firm to acquire new technical development skills and even more likely to require that new marketing skills be acquired. The "worriers", it seems, had relatively much more change to deal with in their projects.

When respondents were classified according to how they saw the overall competition for their projects, there was little difference in the pattern of PPR. That is, those who perceived competition to be High were no more likely than others to report High PPR (see Table 7). This pattern emerged even though those with High perceived competition for their projects were more likely to be involved with large projects than the average firm in the study. Clearly, some respondents had more confidence than others in their firm's ability to handle potentially difficult management situations.

Table 7 About Here

If a manager feels his firm's functional area strengths are superior to his competitors, he would probably have some confidence in his ability to cope and be more likely to downgrade his feelings of risk in a given new product project. These feelings of less risk may rest on the perception of strength in only certain functional areas, not necessarily on a perception of across-the-board strength. For firms in this study, company R&D strength was perceived similarly by firms grouped at all levels of PPR. So was Manufacturing strength, by and large. In other words, perceived strength in these two functional areas did not explain differences in PPR.

Differences in perceived strength in Marketing and Finance were another matter. It was apparent that High PPR was associated with Low perceived strength in both Finance and Marketing areas (see Tables 8, 9, 10, and 11). These two functional areas seemed to be important to the firms as a group in differentiating levels of perception of project risk.

Tables 8,9,10 & 11 About Here

Perceived Factor Risk

The respondents, taken as a group, assigned different weights to the several principal decision factors for which Perceived Factor Risk (PFR) was calculated. The risk perceived in the estimates of Unit Volume and Unit Selling Price were rated highest whereas the risk perceived in the estimate of Total Investment required was rated lowest. Table 12 shows the weights for each factor.

Table 12 About Here

Inherent in the estimates of the two market factors of Selling Price and Unit Volume are estimates of certain market factors that are often considered in more qualitative terms. The perceived risk for three such factors was measured with the following results, showing percentages of respondents:

Perceived Factor Risk	Knowledge of Product Characteristics Required by Customers	Knowledge of Buying Behavior and Purchase Systems of Customers	Knowledge of Who are Innovative and Influential Customers
Don't Know	3%	10%	23%
Low	7*	38	34
Low Moderate	24	19	16
High Moderate	41	26	20
High	27	7	8
	(n=152)	(n=152)	(n=152)

*Read: 7% of respondents perceived the risk associated with the factor, "Knowledge of Product Characteristics Required by Customers", to be Low.

Respondents did see some risk attached to their estimates of the product characteristics required by customers to which their development efforts were to be directed, but they perceived very little risk in their estimates of their potential customers' buying processes and informal patterns of influence in new product purchasing. Moreover, there

were relatively large numbers of "Don't Know" responses on these latter two factors, reflecting a widespread tendency for managers in industrial goods firms to ignore these factors altogether in new product planning. Respondents tended not to know about these factors because such factors hadn't occurred to them as being necessary to analyse or estimate explicitly.

There were no clear patterns in how managers in firms of different sizes perceived risks in each factor. Firms with sales from $2 million to $10 million were somewhat more likely than others to rate PFR as Low on most factors except that on their estimates of customer product requirements such firms assigned the highest risk ratings. On the factors of Selling Price, Manufacturing Cost and Total Investment, the very largest firms for some reason had the highest PFR. The reasons for such differences are not clear but the results emphasize the need to examine the individual firm's situation carefully.

The only noticeable departure from the average on an industry basis was that Vehicle and Vehicle Component manufacturers had especially High PFR on their estimates of Unit Volume and Total Investment. These factors may have been important underpinnings to the earlier noted tendency of managers in this industry to assign High PPR ratings.

The difference in PFR between Canadian-owned and foreign-owned firms was only that managers in the latter tended to assign higher risk ratings to the Total Investment factor. Otherwise, they reported similar factor risk perceptions. This difference is likley related to the larger projects which the foreign-owned firms tended to have.

It would be reasonable to expect that when a manager believed that a particular functional area of his firm was relatively strong, the decision factor most closely associated with that area would have a Low PFR. This is roughly the way it turned out in the relationship between PFR for Unit Volume (a market factor) and perceived strength in Marketing. Respondents who perceived their firms were competitively strong in marketing indicated a Low PFR for Unit Volume (although the level of PFR for this factor remained fairly high even in firms strong in Marketing). The expected relationship also held for the PFR for Manufacturing Costs and perceived Manufacturing strength.

For two other factors, PFR was related in a manner that was rather unexpected. For the factors of Development Costs and Total Investment, the relationship with R&D strength and Financial Strength, respectively, was that the firms perceived to be strongest tended to have a PFR that was midway between that of the weakest firms and the medium strength firms (Tables 13 and 14). The relationship between PFR for Selling Price and perceived Marketing strenght was unsystematic. The reasons for these relationships emerging as they did are, once again, difficult to explain. There were apparently other factors operating which affected the results.

Tables 13 & 14 About Here

RISK IN THE MIND OF THE MANAGER

Risk in new product development is a many faceted concept. Some sides of risk can be assessed in fairly clear economic terms, but other sides are clouded by individual managerial judgements. The concept of perceived risk, the way a manager

calculates the impact on his own firm of the elements of risk, is appealing in approach but elusive in assessment. Yet it is important to understand from as many angles as possible what constitutes risk in the perception of the individual manager, for what he sees as risk determines what activities he will undertake to reduce or avoid risk.

One element of perceived risk that emerged with some consistency was the problem of handling the marketing factors in the development of new industrial products. Managers were unsure of their market information, considered it to be important, and tended to be concerned about the ability of the firm to handle the marketing function in a competitive environment. There is growing evidence that successful new product development results when all functional areas are operating in balance.[10] The imbalance in risk in the Marketing area which is indicated by this study may indicate that a major hindrance to new product success is the set of problems implied by the relatively higher perceived risk in the Marketing area.

For those who design programs for better new product management--managers, venture capitalists, governments, teachers--it is important to realize that managers react to the risks they perceive. To give aid to the manager means to give aid to him in addressing his perceptions of risk. Risk perceptions form certain general patterns, but for the most part, risk stands uniquely in the mind of the individual.

[10] Blair Little, Robert G. Cooper and Roger A. More, "Putting The Market Into Technology to Get Technology Into The Market", Business Quarterly, Summer, 1972. p. 62.

Table 1

Description of Firms Studied
By Industry and Annual Sales.

Industry	Annual Sales ($ Millions) No. of Firms						
	No Resp	Up to 2	>2 to 10	>10 to 40	>40 to 100	>100	Totals
Electrical Equipment, small and large; Electronic products; Scientific Instrumentation; Process Instrumentation.	2	17	16	4	1	3	43
Chemicals, heavy; Specialty; Pharmaceutical; Protective and Coatings.	1	4	12	5	3	6	31
Equipment, light industrial, components; Machine Tools and Supplies; Material Handling, Vehicles and Equipment; Air-conditioning and other Building Equipment.	0	12	13	9	4	2	40
Vehicles, components, fabricated metal parts Aircraft, Automotive, Agricultural.	1	2	3	10	3	3	22
Miscellaneous, including Industrial Textiles; Plastic and Rubber Fabricated Parts, Construction Materials, Packaging Materials, other Raw Materials.	2	0	4	5	4	1	16
Totals	6	35	48	33	15	15	152

Table 2

Perceived Project Risk By Company Sales Level

Company's Annual Sales ($Millions)

(Percentage of Respondents)

Perceived Project Risk	No Ans	Up to 2	> 2 to 10	> 10 to 40	> 40 to 100	Over 100
Low	33%	40%	42%	30%	53%	40%
Moderate	17	29	27	30	7	33
High	50	31	31	40	40	27
Total	(n=6)	(n=35)	(n=48)	(n=33)	(n=15)	(n=15)

Table 3

Perceived Project Risk By Industry

Industry*

(Percentage of Respondents)

Perceived Project Risk	Electrical	Chemical	Equipment	Vehicle	Misc.
Low	53 %	35%	25%	32%	56 %
Moderate	19	32	30	36	13
High	28	32	45	32	31
	(n=43)	(n=31)	(n=40)	(n=22)	(n=1

*See Table 1 for fuller description of industries.

Table 4

Potential Project Loss By Company Size

Annual Sales ($Millions)

(Percentage of Respondents)

Potential Loss on Project ($000)	No Ans	Up to 2	> 2 to 10	> 10 to 40	> 40 to 100	Over 100
No Ans	17%	3%	0%	3%	0%	0%
Up to 25	50	29	38	15	13	13
>25 to 100	0	43	31	36	20	0
>100 to 1,000	33	23	27	27	33	53
Over 1,000	0	3	4	18	33	33
	(n=6)	(n=35)	(n=48)	(n=33)	(n=15)	(n=15)

Table 5

Potential Financial Loss By Industry

Industry*

(Percentage of Respondents)

Potential Financial Loss ($000)	Electrical	Chemical	Equipment	Vehicle	Misc.
No Ans	5%	0%	3%	0%	0%
Up to 25	26	35	13	32	38
>25 to 100	37	23	40	9	25
>100 to 1,000	26	32	33	32	25
Over 1,000	7	10	13	27	13
	(n=43)	(n=31)	(n=40)	(n=22)	(n=16)

*See Table 1 for fuller description of industries.

Table 6

Potential Financial Loss Related to Nationality of Ownership

Potential Financial Loss ($000)	Nationality of Ownership (Percentage of Respondents)		
	No Ans	Canadian-Owned	Foreign-Owned
No Ans	0%	0%	4%
Up to 25	100	27	25
>25 to 100	0	36	25
>100 to 1,000	0	32	28
Over 1,000	0	5	19
	(n=1)	(n=66)	(n=85)

Table 7

Perceived Project Risk Compared to Potential Project Financial Loss, By Levels of Perceived Competition

Perceived Project Risk	Potential Financial Loss ($000)	No Ans	Perceived Level of Competition (Percentage of Respondents) Low	Moderate	High
	No Ans	10%	3%	0%	1%
	<25	10%	31%*	48%	18%
Low			44%*	38%	39%
	>25 to 100	30%	31%	21%	32%
Moderate			22%	31%	27%
	Over 100	50%	36%	31%	48%
High			33%	31%	34%
		(n=10)	(n=36)	(n=29)	(n=77)

*Read: Of 36 respondents reporting Perceived Competition for the new product to be Low, 31% had a project with a potential financial loss of $25,000 or less; of these 36 respondents, 44% indicated PPR to be Low.

Table 8

Perceived Project Risk Related to

Perceived R&D Strength

Perceived R&D Strength Company is Stronger than	Perceived Project Risk (Percentage of Respondents) Low	Moderate	High
Don't Know	15%	13%	19%
None of its Competitors	15	23	13
Some of its Competitors But Weaker Than at Least Half	18	20	19
At Least Half of Its Competitors	52	45	48
	(n=60)	(n=40)	(n=52)

Table 9

Perceived Project Risk Related to

Perceived Manufacturing Strength

Perceived Manufacturing Strength. Company is Stronger Than	Perceived Project Risk (Percentage of Respondents) Low	Moderate	High
Don't Know	15%	13%	19%
None of its Competitors	17	25	21
Some of its Competitors But Weaker Than at Least Half	20	7	12
At Least Half of Its Competitors	48	55	48
	(n=60)	(n=40)	(n=52)

Table 10

Perceived Project Risk Related to

Perceived Marketing and Sales Strength

Perceived Marketing And Sales Strength Company is Stronger Than	Perceived Project Risk (Percentage of Respondents) Low	Moderate	High
Don't Know	17%	13%	19%
None of its Competitors	17	23	23
Some of Its Competitors But Weaker Than at Least Half	18	28	33
At Least Half of Its Competitors	48	38	25
	(n=60)	(n=40)	(n=52)

Table 11

Perceived Project Risk Related to

Perceived Financial Strength

Perceived Financial Strength Company is Stronger Than	Perceived Project Risk (Percentage of Respondents) Low	Moderate	High
Don't Know	22%	15%	19%
None of its Competitors	15	30	17
Some of Its Competitors But Weaker Than at Least Half	17	13	31
At Least Half of Its Competitors	47	43	33
	(n=60)	(n=40)	(n=52)

Table 12

Perceived Factor Risk for Principal Decision Factors

Perceived Factor Risk	Decision Factor (Percentage of Respondents)				
	Selling Price	Unit Volume	Manufacturing Costs	Development Costs	Total Investment
No. Ans.	3%	3%	3%	3%	7%
Low	15	5	7	14	21
Low Moderate	12	14	18	23	24
High Moderate	36	34	41	33	28
High	34	43	30	27	20
	(n=152)	(n=152)	(n=152)	(n=152)	(n=152)

Table 13

Relationship Between Perceived R&D Strength
And Perceived Factor Risk For Development Costs

Perceived R&D Strength

(Percentage of Respondents)

Development Costs PFR	Don't Know	Stronger Than None of its Competitors	Stronger Than Some of its Competitors But Weaker Than at Least Half	Stronger Than At Least Half of Its Competitors
No Ans	0%	4%	3%	3%
Low	8	16	14	16
Low Moderate	21	28	14	26
High Moderate	54	36	28	27
High	17	16	41	28
Totals	(n=24)	(n=25)	(n=29)	(n=74)

Table 14

Relationship Between Perceived Financial Strength And Perceived Factor Risk For Total Investment

Perceived Financial Strength

(Percentage of Respondents)

Total Investment PFR	Don't Know	Stronger Than None of its Competitors	Stronger Than Some of its Competitors But Weaker Than at Least Half	Stronger Than At Least Half of Its Competitors
No Ans	7%	10%	6%	5%
Low	17	37	16	19
Low Moderate	21	20	16	32
High Moderate	34	20	26	29
High	21	13	34	15
Totals	(n=29)	(n=30)	(n=31)	(n=62)

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