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AN EMPIRICAL STUDY OF THE RELATIONSHIP BETWEEN
FINANCIAL ACCOUNTING MEASUREMENTS AND
RESEARCH AND DEVELOPMENT EXPENDITURES
IN PUBLIC CORPORATIONS

DISSERTATION

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North Texas State University in Partial
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By

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The primary objective of this study is to gain a greater understanding of how the level and type of research and development expenditures are influenced by accounting measurement, if at all. To accomplish this primary objective, the following proposition was considered: the level of research and development expenditures fluctuates directly with the accounting measurements of profit and cash flow from operations. If this relationship exists, research and development expenditures will fluctuate in the short-run with these accounting measurements. Budgeting of research and development expenditures, therefore, will be on a short-term basis and may lead to undue emphasis on products and processes as opposed to projects requiring a long-run budgetary commitment. To test the existence of the proposed relationship, the following steps were taken:

1. to establish that research and development expenditures are material items among a large segment of the business firms;

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2. to study the effect of the accounting change required by Statement Two of the Financial Standards Board on the level of research and development expenditures in the firms included in the study; and
3. to study the economic and accounting literature regarding the budgeting of research and development expenditures.

Financial reports, Securities Exchange Commission Form 10-K and Compustat data on research and development expenditures are utilized for 182 companies.

A comparison of research and development with profit, sales and cash flow for 1974 in these 182 companies is done to determine the materiality of research and development. Then a search in the financial statements of the 182 companies is made to determine which companies disclosed a change in accounting for research and development in 1974 and 1975. Twenty-one companies disclosed a change from capitalizing research and development costs to current expensing of these costs, as a result of Statement Two.

Research and development was found to be a material expenditure in the 182 companies and in the twenty-one companies that changed accounting methods as a result of Statement Two.

The proposition is tested using coefficient of correlation and one-way covariance. The statistical testing indicates that the level of research and development expenditures may be effected by Statement Two. However, none of the results of such tests afford a sound statistical basis for such an inference; i.e., that Statement Two and/or other accounting measurements affected research and development expenditures.

Library research discloses that management goals relate very closely to the accounting model, particularly during a profit squeeze. Consequently, research and development tends to become a function of short-term profits.

This phenomenon is intensified by the current expense treatment of research and development expenditures as required by Statement Two. If research and development expenditures are capitalized, the effect on current profits is removed to some extent.

The Financial Accounting Standards Board should reconsider its decision to currently write-off private research and development expenditures. Research and development expenditures should not be a function of current profitability during business recessions and/or during times of prosperity.

Research should be undertaken to establish criteria for capitalizing research and development expenditures.

The life of research and development expenditures should either be estimated or a reasonable alternative developed.

Research and development is an expensive and difficult undertaking. An acceptable accounting treatment for research and development expenditures will occur only after an in-depth understanding of possible alternatives.

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CHAPTER I

INTRODUCTION

The Nature and Significance of the Problem

Technology defines the limits of resources over time. Consequently, a world of scarce resources is highly dependent upon technology, and the rate of change in total resources is strongly influenced by the amount of research and development expenditures.

Solow (9) is one of the first researchers to measure the impact of technology quantitatively. He estimated that 90 percent of the per capita increase in output between 1909 and 1949 was caused by technological change. Furthermore, only a small amount was caused by an increase in capital. This new outlook--that resources can be defined only in terms of technology--is causing considerable interest in the determinants of research and development expenditures.

Concerning the technological impact on the economy, the Committee for Economic Development (2) studied the determinants of output per worker in the United States between 1929 and 1957. Its results are surprising. It estimates that 36 percent of the increase in output per worker in the United States is caused by research and development, 42 percent by increased education, and only 9 percent by capital intensiveness.

The studies of Solow and of the Committee for Economic Development are controversial since only crude economic models were used to make the estimates. The effects of known inputs, such as capital and labor, were estimated and then the balance was attributed to technological change (6, p. 32). However, the studies emphasize the importance of investigating what may influence research and development expenditures.

Many research studies have been undertaken to attempt to discover the determinants of industrial research and developmental expenditures. Probably the best known research in this area is the Brabowski Study (4) on the chemical, drug and petroleum industries. Generally, the results of Brabowski's study and of other studies have been inconclusive because relevant data has not been obtainable. Only recently has new data (8) become available regarding private research and development. Because of the availability of this new information, a study at this time may increase our general knowledge of determinants of this important cost and may serve as a basis for the improvement of the accounting treatment of costs for both financial reporting and managerial accounting.

Two variables affecting the expenditures for research and development are operating net income and liquidity. Operating net income is an important measure of the business firm's return to the stockholder and contribution to the economic system. However, stockholder insistence for

profits may exert pressure on management to maximize profit over the short run. Consequently, management may cut certain expenditures that have a short run negative effect on profits. However, capitalization and future amortization of these costs reduces this negative impact on current profits. An example of a cost wherein the accounting method adopted affects current profits is a major expenditure on previously existing plant and equipment. If the expenditure is treated as a repair, it is charged to current expense, but if it is treated as a capital asset, the cost is amortized over future time periods. Although research and development expenditures are essential for the long run growth of the business firm, they may be reduced to increase short run profits. Thus, technological progress may be retarded. This phenomenon may be true particularly when the business firm is required to write-off research and development expenditures during the time period they are incurred. Thus, we find short run profitability may influence research and development expenditures.

Firm liquidity may be another determinant of research and development since research and development, capital expenditures, interest, operating expenses, taxes and dividends are in competition for a limited amount of funds. Capital expenditures for replacement and for new capacity are normally funded internally in competition with research and development and other cash outlays. If necessary,

business firms sell stocks and bonds for capital expansion. Seldom, however, do firms enter the capital market for research and development expenditures. Interest, taxes and operating expenses are usually paid out of working capital, and most firms have a relatively stable dividend policy. Research and development, on the other hand, may be decreased or increased at a company's discretion. Firms with ample funds can undertake projects with perhaps a highly profitable but uncertain payoff. In a liquidity crisis, however, projects of a risky nature and long-run payoff may be the first to be discontinued. As a result, research and development projects possessing these same characteristics may be reduced. Furthermore, firm liquidity fluctuates with the business cycle. The possibility that research and development is affected by liquidity should be investigated.

Liquidity is affected by profitability in the business firm. Consequently, the relationship of research and development to both liquidity and profitability should be explored. The effect of cutting back on research and development during a recession may be detrimental both to the growth of the business firm and to the economy as a whole.

The recent Financial Accounting Standards Board decision on research and development expenditures offers a unique opportunity to study this problem. As of January, 1975, the Financial Accounting Standards Board (3) requires the expensing of research and development expenditures

during the year incurred. Prior to this decision, business firms could either currently expense or capitalize research and development expenditures. Under capitalization the amortization period could be up to forty years (1). Thus, amortization allowed the expensing of research and development over the estimated life that was determined by management. The recent decision does away with this flexibility. The effect of the decision by the Financial Accounting Standards Board may decrease short-run profits for some firms in the year of the accounting change and in future years. These firms may react to this decision by reducing research and development expenditures so that present profit is unaffected. Thus, technological progress may be retarded in these firms in the year of the accounting change and in later years because of the immediate impact on short-run profits.

The significance of this study is twofold. One, and perhaps most important, the interaction of research and development expenditures with the accounting measurements of sales, profitability and liquidity should be more clearly understood so that improved financial reporting may lead to a better allocation of scarce resources and aid the development of new resources. Two, a study relating research and development expenditures to the liquidity and/or profitability of business firms may be of particular importance to policy decisions of the federal government. Tax policy

could possibly be devised to affect research and development expenditures through the flow of funds to the business firm.

Objectives of the Study

The primary objective of this study is to gain a greater understanding of how the level and type of research and development expenditures are influenced by accounting the measurements of sales, profitability and liquidity, if at all. To accomplish this primary objective, the following proposition was considered: The level of research and development expenditures fluctuates directly with the accounting measurement of profit and cash flow from operations. If this relationship exists, research and development expenditures will fluctuate in the short run with the accounting measurements. Budgeting of research and development expenditures, therefore, will be on a short-term basis and may lead to undue emphasis on products and processes as opposed to projects requiring a long-run budgetary commitment. To test the existence of the proposed relationship the following steps were taken: 1. to establish that research and development expenditures are material items among a large segment of the business firms; 2. to study the effect of the accounting change required by Statement Two of the Financial Accounting Standards Board on the level of research and development expenditures in the firms included in the study; and 3. to study the economic,

financial accounting and managerial accounting literature regarding the budgeting of research and development expenditures.

Research Methodology

The research methodology includes a review of the literature to determine if research and development was material with respect to accounting measurements. Following the literature review, the companies to be individually tested were selected. Three hundred of the largest industrial companies with over 10,000 employees accounted for over four-fifths of all industrial research in 1971 (7). Annual financial reports were requested from 650 of the largest non-financial corporations in the United States in a previous study (5). These 650 corporations consist of Fortune's top 500 industrials and the top fifty transportation, retailing, and utilities corporations. Four hundred of these 650 companies furnished the required information. In addition to these financial reports Securities Exchange Commission Form 10-K and Compustat data on research and development expenditures is utilized for these 400 companies. The sample for this study is the 400 corporations except the following: 1. those companies that do not engage in a significant amount of research and development and, therefore, are not required to disclose their research and development expenditures; and 2. those companies that do not segregate

private from outside research and development funds. One hundred and eighty-two of the 400 companies in the sample satisfied the established criteria.

The next step in research methodology is to determine if research and development is material with respect to accounting measurement in the majority of the individual companies studied. This step is accomplished by a comparison of research and development with profit, sales and cash flow for 1974 in these 182 companies.

Next, the question is to determine how research and development expenditures, when significant, should be treated in accounting measurement of sales, profits and liquidity. A literature review on the accounting treatment of research and development prior to Statement Two is undertaken to secure an answer to this question. Then, since Statement Two of the Financial Accounting Standards Board offers an unusual opportunity to analyze the effect of profit on research and development expenditures, a model for testing is developed.

The variables in the model include the required accounting change of Statement Two, research and development expenditures, profit, sales and liquidity. Excluded are certain exogenous variables that are disclosed when the model is constructed. The model provides a framework to analyze the effect of Statement Two on profits and on the level of research and development expenditures.

After the model is constructed, a search in the financial statements of the 400 companies is made to determine which companies disclosed a change in accounting for research and development in 1974 and in 1975. Twenty-one companies disclosed a change from capitalizing research and development costs to charging these costs to current expense, as a result of Statement Two. The financial statements of these twenty-one companies are then examined in detail to determine the materiality of research and development in relationship to other variables in the model. Then, since the sample size is small, numerous statistical tests are used to study the relationships of the variables in the model. The most important of these tests are correlation, covariance, and multiple regression analysis. Furthermore, the estimated effect of Statement Two on the earnings of the companies included in the study as determined from financial statement data is computed, assuming research and development budgeting was unaffected. These computations disclose whether or not profit in the individual companies is significantly affected. Also, exogenous variables and their possible effect on research and development expenditures during the time period under study are briefly studied.

Because only the twenty-one companies that changed accounting reporting are examined, no statistically valid generalizations about total research and development in industry can be made from the results of testing the

theoretical model; only tentative generalizations can be stated. Therefore, further research is conducted. This research involves the relationship of research and development expenditures to the accounting measurements, i.e., sales, profit and liquidity. It discloses whether or not research supports the general proposition that research and development expenditures may be a function of profit and/or other accounting measurements.

Organization of the Study

Chapter II of the study presents a review of the literature on the materiality of research and development expenditures in American business and includes tests on 182 companies concerning materiality in relationship to sales, profit and cash flow. Also included in Chapter II is a literature review on the accounting treatment of research and development prior to Statement Two and a brief summary and critique of Statement Two.

Chapter III presents a model, which is developed to analyze the effects, if any, of statement Two on research and development expenditures. Also included in Chapter III is the company selection, data gathering procedures, materiality tests on companies selected and proposed tests of the theoretical model.

Chapter IV includes the testing results of the data analyses on the model and a critique of these results,

including the estimated effect of Statement Two on the earnings of these companies, assuming research and development budgeting is unaffected.

Chapter V includes additional library research regarding the relationship of research and development expenditures to the accounting measurements.

Chapter VI presents conclusions reached from research and testing and includes recommendations for further research.

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CHAPTER II

REVIEW OF THE LITERATURE

Introduction

This chapter reviews research and development expenditures in public United States corporations to determine the materiality of this cost compared to other accounting measurements.

The chapter also includes a brief review of the accounting treatment of research and development costs over the last several decades so that Statement Two may be reviewed in the light of historical perspective.

Also, the chapter presents a brief summary and critique of Statement Two, which requires the immediate write-off of research and development costs.

The Materiality of Private Research and Development Expenditures in United States Corporations

The materiality of research and development compared to accounting measurements; i.e., sales, profitability and liquidity, has not been thoroughly explored. Although total industry research and development expenditure data is readily available from the National Science Foundation Studies, information regarding the materiality of research and development expenditures in individual business firms is

surprisingly lacking. A brief discussion on research and development expenditures in the United States will emphasize the need for additional research on the potential material effects of research and development expenditures in financial reporting. A discussion of the materiality of research and development will reveal the importance of Statement Two, which affects the accounting for all private research and development expenditures.

The total national expenditure for research and development in 1974 is estimated at 32.1 billion dollars. Of this amount, 41 percent; i.e., 13.2 billion dollars, was provided by private industry. Private industry performed 67 percent of the total research and development dollars which included 21.5 billion dollars of contractual research and development for the government (21, p. vi). Therefore, based on 1974 data, an estimated 13.2 billion dollars of private research and development expenditures are affected each year by the Financial Accounting Standard Board's current expense decision (21, p. vi).

Research and development expenditures have varied from 2.3 to 3 percent of Gross National Product during the 1964 to 1974 period. (See Figure 1, page 15.) In 1964 research and development was over three percent of Gross National Product, but gradually declined to two and three-tenths percent in 1974. During the same time period, private

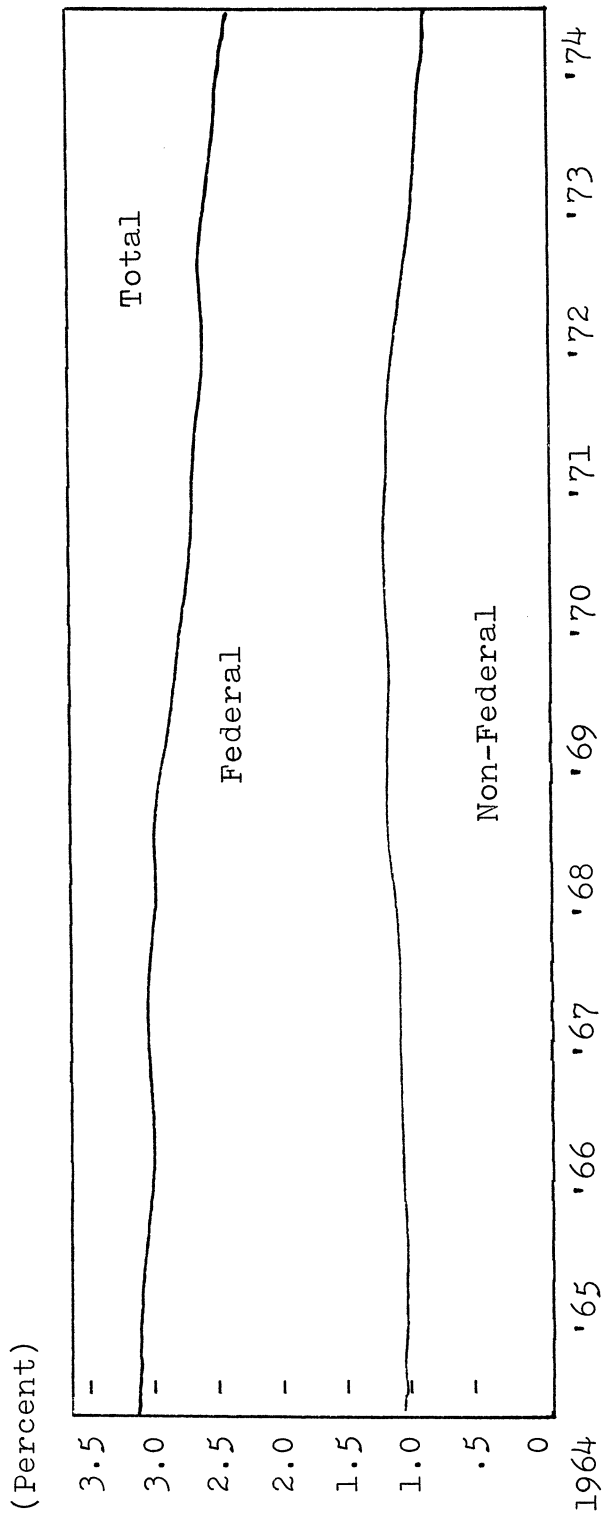


Fig. 1--Research and development compared to Gross National Product: 1964-1965*

*Source: (21; 3)

research and development had remained fairly stable as a percent of the Gross National Product.

In recent years the pattern of total research and development support has changed drastically. The Federal Government contributed over 60 percent of the total research and development effort between the late 1950s and the late 1960s. Currently, the Federal Government supplies only slightly over 50 percent of research and development funds. The average rate of growth of research and development by source in the United States is shown in Table I.

The importance of research and development in relationship to the total economic system has been well established. If this nation is to progress economically through the stimulus of research and development, larger expenditures for research and development must be supplied by private and/or government sources.

The materiality of research and development within the individual business firm is less clearly understood. Surprisingly little research has been done regarding the materiality of research and development in relationship to profit, sales and cash flow in financial reporting for the individual firm. Financial Accounting Standards Board research (10, para. 20) simply cites total research and development expenditures as evidence of the materiality of research and development and the necessity to establish

TABLE I*

THE ANNUAL RATE OF GROWTH OF RESEARCH AND DEVELOPMENT
BY SOURCE IN THE UNITED STATES

Year	Average Annual Rate of Growth					
	Current Dollars			Constant Dollars		
	Total	Federal	Non Federal	Total	Federal	Non Federal
1953-61	13.7%	16.3%	10.1%	11.3%	13.9%	7.8%
1961-67	8.4	7.7	9.6	6.3	5.6	7.5
1967-74	4.5	2.4	7.3	- .5	-2.4	2.2

*Source: (21, p.2).

uniform rules for the accounting treatment of such a material item.

Accounting Research Study No. 7 provides some general guidelines for determining materiality.

A statement, fact, or item is material, if giving full consideration to surrounding circumstances, as they exist at the time, it is of such a nature that its disclosure, or the method of treating it, would be likely to influence or "to make a difference" in the judgement and conduct of a reasonable person. The same tests apply to such words as significant, consequential, or important (12, p. 40).

But, no specific criterion exists; however, an expenditure affecting net income by 5 percent will be arbitrarily considered material in this discussion. The person utilizing the 5 percent criterion can disclose how many firms are materially effected by research and development expenditures within the firms in the study group. This information may help guide future decision making in the financial reporting of research and development expenditures. Consequently, the next step in this study involves computing the materiality of research and development expenditures compared to accounting measurements, i.e., sales, profit, and cash flow, in individual business firms.

The data gathering procedure and analysis of these business firms are composed of three steps: 1. the selection of the corporations to be included in the study group; 2. the collection of the data; and 3. the materiality tests for each of the corporations selected.

Three hundred of the largest United States industrial companies--those with 10,000 or more employees--accounted for over four-fifths of all industrial research in the United States in 1971. In a previous study (1), the annual financial reports were requested from 650 of the largest non-financial corporations in the United States. These 650 companies consisted of Fortune's top 500 industrial and fifty top transportation, top retailing and top utilities corporations. These 650 companies are selected for this study because they account for a significant amount of industry and commerce, and account for the majority of the research and development in the United States.

Four hundred of these 650 companies furnished the required information. The sample of the 1974 materiality tests in this study is these 400 corporations, except for the following: 1. those companies which do not engage in a material dollar value of research and development and are, therefore, not required to disclose their expenditures for research and development, and 2. those companies which do not segregate private funds from outside research and development funds. One hundred and eighty-two of the 400 companies in the sample satisfy the established criteria. Data for the materiality tests are obtained as follows:

1. sales, profits and beginning cash are derived from the financial statements;
2. cash flow is either computed or obtained from the Klammer-Morris Study (1); and
3. research

and development expenditures are drawn from a compustat data bank (4).

First, the percentage of research and development compared to profit is computed for each of the 182 corporations. (See Table II and Appendix A, Tables XXI and XXII.)

TABLE II
RESEARCH AND DEVELOPMENT AS A PERCENTAGE OF
PROFIT FOR 182 UNITED STATES CORPORATIONS
IN 1974: FOURTEEN CLASSES*

% of Companies	# of Companies	Research and Development as a % of Profit
20	37	2- 9
13	24	9- 17
5	9	17- 25
11	20	25- 32
11	21	32- 40
7	12	40- 48
2	3	48- 52
16	29	52-102
8	14	102-152
3	6	152-202
2	4	202-252
1	2	252-302
0	0	302-352
1	1	352-402
Total: 100	182	

*Source--Appendix A

Based upon the data in Table II for the 182 major United States corporations, the following information is determined: 1. over sixty-one spent 50 percent or more of profit for research and development; and 2. over 27 spent

100 percent or more of profit for research and development. One hundred forty-five, 80 percent, of the 182 companies spent nine percent or more of profit for research and development. Thus, when 5 percent of profit is arbitrarily considered material, then over 80 percent of the 182 companies spent a significant dollar amount on research and development in 1974.

Next, research and development was compared to sales for each of the 182 corporations, in 1974. The percentage

TABLE III

RESEARCH AND DEVELOPMENT AS A PERCENTAGE OF
SALES FOR 182 UNITED STATES CORPORATIONS
IN 1974: FOURTEEN CLASSES*

% of Companies	# of Companies	Research and Development as a % of Sales
8	14	.024- .244
15	27	.245- .461
9	17	.462- .677
7	12	.678- .893
5	10	.894- 1.109
8	14	1.110- 1.326
8	15	1.327- 1.542
17	32	1.543- 3.141
14	25	3.142- 4.712
3	6	4.713- 6.283
2	4	6.284- 7.854
2	3	7.855- 9.425
1	2	9.426-10.996
1	1	10.997-12.567
Total: 100	182	

*Source--Appendix A

of research and development of sales is computed for each of the 182 companies. The results of the computations are shown in Table III and Appendix A. Based upon the data in Table III for the 182 major United States corporations, the majority, 109, spent between .02 and 1.5 percent of sales for research and development. Forty percent spent more than one percent of sales.

The last step in the materiality tests compared research and development with liquidity; i.e., cash flow from operations in 1974. The percentage of research and development of cash flow is computed for each of the 182 companies. (See Table IV and Appendix A.)

Based upon the data in Table IV for the 182 major United States corporations, 76 spent between 348 percent of negative cash flow and 12 percent of positive cash flow for research and development. Ninety-eight spent more than 12 percent of cash flow for research and development.

In conclusion, from the 1974 data, the majority of the 182 companies' expenditures on research and development are material in relationship to profit, sales and cash flow.

The Accounting Treatment of Research and Development Costs Prior to Statement Two

Research and development has been determined to be a material expenditure in relationship to other accounting measurements in the majority of firms in this study.

TABLE IV
 RESEARCH AND DEVELOPMENT AS A PERCENTAGE OF
 CASH FLOW FOR 182 UNITED STATES CORPORATIONS
 IN 1974: TEN CLASSES*

% of Companies	# of Companies	Research and De- velopment as a % of Cash Flow
1	2	(2508.2) - (2148.2)
3	5	(1068.196) - (708.196)
42	77	(348.194) - 11.806
36	64	12.029 - 62.029
8	14	62.030 - 112.030
4	7	112.031 - 162.031
3	6	162.032 - 212.032
1	1	212.033 - 262.033
2	4	262.034 - 312.034
1	2	312.035 - 372.035
Total: 100	182	

*Source--Appendix A

Because of the materiality of research and development relative to sales, cash flow, and profits for many corporations, the correct treatment of this expenditure on the accounting statements has been a controversial issue for the last three decades. The following is a brief discussion of the history of accepted accounting practice for research and development prior to the issuance of Statement Two by the Financial Accounting Standards Board.

A search of accounting literature reveals no reference to this problem prior to 1917. However, in 1917, the Federal Reserve Board (7; 10, p. 277; 11) accepted research

and development as a deferred charge in published financial statements. The Federal Reserve Board (8; 11, pp. 13-14; 11) re-affirmed this position in 1929.

Other institutions promoted the deferral treatment, including the National Association of Cost Accountants. In the 1924 edition of the National Association of Cost Accountants' Bulletin, the following statement is found.

It is perfectly proper to carry [the cost of developing a new article or line] as a deferred account, and an estimate should be made to ascertain the number of units or volume of sale or units, as well as an estimate of the length of time over which this development will be spread (19; 11, p. 1407; 13).

But,

. . . experimenting [covering the current or minor experimenting that is continual in most manufacturing establishments] should be charged against current operations each month as the money is expended and assessed against the lines of products affected (19; 11, p. 1407; 13).

In 1926, the National Association of Cost Accountants again stated that it is all right to capitalize the cost of developing a new product, ". . . if you are starting out with a new product in which you have a very definite knowledge that there is a field for it, and you are going to spend a lot of money, and you know it is going to come back to you" (20; 11, p. 264; 14). Thus, cost accountants supported deferral of research and development.

The most prominent accounting organization, the American Institute of Certified Public Accountants, supported the deferral treatment of research and development in a 1936 bulletin. "If development and similar expenditures are deferred, they should be written off over a reasonable period having regard to the character of the expenditures" (2; 11, p. 23; 15). In 1954 the American Institute of Certified Public Accountants supported the deferral treatment only if future benefits are definite in its annual meeting papers. "Development expenses should be deferred only in those cases where they have a reasonable connection with future operations" (14; 11, p. 125; 18). Thus, accounting organizations generally support the deferral treatment for research and development expenditures.

Paton supported the deferral treatment in an accounting text in 1955. "On the other hand, whenever research and related costs are incurred in substantial amount on a particular project which is expected to result in a valuable new process, perhaps patentable, there is much to be said for deferring followed by systematic absorption in later years" (22; 11, p. 312; 19).

Perhaps the most influential institution affecting the accounting treatment of research and development costs is the Internal Revenue Service. The Internal Revenue Service tax policy in the 1920's and 1930's favored the deferral

treatment of research and development costs. From the beginning, early tax court decisions and accounting literature support research and development cost deferral; but scientists and economists support immediate write-off for tax purposes to stimulate research and development. Businessmen constantly on the alert for tax benefits increased political pressure for Congress to act. Congress did pass legislation favoring immediate write-off in 1954 (11, p. 19-20).

A discussion of the tax effect on research and development expenditures will perhaps clarify the support of these demands for tax legislation. All accountants are familiar with the stimulus provided to capital investment by the 7 percent investment tax credit. An even greater affect on research is provided by direct write-off of research and development costs. A common denominator used in capital budgeting techniques is the profitability index. This index is computed by dividing the present value of the cash inflows by the present value of the cash outflows. An index of one indicates that the investment criterion has been met. An index greater than one increases the desirability of the investment. Raby (23, p. 55) compared the desirability of a fixed asset investment with a 7 percent investment tax credit to a research and development project with direct tax write-off. He assumed a 50 percent tax rate,

a desired after tax return of 10 percent, and the same estimated life. Table V shows his analyses. Table V shows that in the pre-tax analysis, the fixed asset proposal is more attractive than the research and development investment, i.e., profitability indices of 1.17 and .99, respectively; but in the post tax analysis, the research and development investment is much more attractive than the fixed asset expenditure, i.e., profitability indices of 1.72 and 1.27 respectively.

Subject to the previously mentioned economic and social forces, Congress took political action. It passed Section 174 of the Revenue Act in 1954 which allows expensing of research and development in the year incurred for tax purposes regardless of how research and development is treated in financial reporting. Tax law prior to 1954 allowed the current expensing of research and development only when the same procedure was followed in the financial statements. Thus, business firms, before 1954, may have switched from deferral to current expensing of research and development in published financial statements for tax purposes. Raby logically asserts that the majority of the companies were probably currently expensing research and development in the mid sixties because of income tax law prior to 1954. "Perhaps a major factor underlying this accounting treatment is that before 1954 what was done in the books and financial statements controlled what was allowed to be done on tax

TABLE V

A FIXED ASSET INVESTMENT COMPARED TO A RESEARCH AND DEVELOPMENT PROJECT*

	Pre-tax Analysis (20% R. O. I.)**		Post-tax Analysis (10% R. O. I.)	
	R & D	FA	R & D	FA
Cash Outflow:				
Year 1	\$ 100,000	\$ 1,000,000	\$ 50,000	\$ 930,000
Year 2	100,000		50,000	
Year 3	200,000		100,000	
Year 4	200,000		100,000	
Year 5	300,000		150,000	
Year 6	300,000		150,000	
Total	1,200,000	1,000,000	600,000	930,000
Present Value	\$ 584,000	\$ 1,000,000	\$ 406,000	\$ 930,000
Cash Inflow:				
Years 1-15 (per year)	\$ 430,000	\$ 250,000	\$ 215,000	\$ 156,000
Years 7-15 (per year)				
Total	3,870,000	3,750,000	1,935,000	2,340,000
Present Value	580,500	1,168,750	699,000	1,185,600
Inflow Outflow	.99	1.17	1.72	1.27

*Source--(25, p. 55).

**R. O. I. = Return on Investment

returns" (23, p. 56). Furthermore, once this practice was established it was continued, regardless of the post 1954 tax impact. Raby states, "As a consequence, companies quite logically set up the practice of expensing research expenditures, and this practice has continued since, even though the tax justification for doing so has ceased to exist" (23, p. 56).

Indeed, a survey (11, p. 23) of 244 companies in the 1960's disclosed that the common practice was to currently expense research and development expenditures. The investigation also revealed that 60 percent of the companies disclosed the dollar amount of research and development in some way, but that only 10 percent disclosed the accounting treatment in published financial statements. Therefore, comparability of financial statements is difficult.

The acceptance of the current expense treatment of research and development expenditures by accounting practice is revealed in accounting literature. Braithwaite said in an article in the Accountancy, "The auditor . . . will take a jaundiced attitude to any attempt to capitalize research expenditures on the grounds of expected future benefits to the company" (3, p. 248). Thus, the auditor should press for direct write-off of research and development; but Braithwaite stated further, "The auditor . . . may agree that in the long run a research program necessarily must be judged by its overall fruitfulness" (3, p. 248). The contradiction in

Braithwaite's statements about current expensing of research and development and future benefits from research and development is obvious. When research and development produces future revenue, then under the matching concept, it should be capitalized and amortized over the future time period it benefits.

Auditors probably support the immediate write-off research and development expenditures to avoid unnecessary audit risk. Previous to the current expense requirement, business firms would quite often capitalize research costs that had little future benefit so that current earnings would be more impressive. When it became apparent to the auditor and to others that these costs had no future benefit, they were written off. A sharp reduction in profits occurred and the auditor might then face a liability suit for being a party to misleading financial statements.

Consequently, prior to Statement Two, four basic questions regarding the official accounting treatment of research and development in financial statements remained unanswered. These are: 1. What activities should be included in research and development?; 2. What portion of the costs related to these research and development activities should be deferred?; 3. How should these deferred costs be amortized?; and 4. How should research and development be disclosed in the financial statements? (11, p. 15).

These unanswered questions made the comparability of research and development information in financial statements very difficult. Research and development expenditures were sometimes classified as separate expenses and sometimes were included in the cost of goods sold. Also, management had the flexibility of either currently expensing research and development or capitalizing research and development and writing it off over future time periods. A large write-off of research and development costs could occur unexpectedly when it suddenly became apparent that the expenditures would no longer have a future benefit.

Some action was taken by the Accounting Principles Board and the Securities Exchange Commission in 1972. The Accounting Principles Board Opinion Number Twenty-Two (1) made the disclosure of research and development expenditures in financial statements mandatory in 1972. Also, the Securities Exchange Commission (25) has required the reporting of research and development in the Annual 10-K Report since 1972.

Although badly needed, the disclosure requirements of the Accounting Principles Board and the Securities Exchange Commission did not solve the problem of the proper accounting treatment for research and development costs in financial reporting. From these disclosures, however, the significance of private research and development expenditures in relationship to accounting measurements became apparent.

A Brief Summary and Critique
Of Statement Two

The Financial Accounting Standards Board, whose predecessor was the Accounting Principles Board, recognized that the problem of accounting for research and development costs must be solved. However, in attempting to solve the problem of accounting for research and development costs, the Financial Accounting Standards Board did not do a significant amount of research on the problem before making its decision in 1974. "The FASB did not undertake a major research effort for the project. The FASB staff interviewed a limited number of selected financial analysts and commercial bankers and reviewed a substantial number of published financial statements" (10, para. 20). Consequently, the effect of the current expense treatment on the level and type of research and development expenditures was not carefully considered. Instead, the established practice of currently expensing research and development costs is now required for all business firms.

A brief summary and critique of Statement Two is essential for clarification of the current expense requirement in the financial reporting of research and development expenditures.

Statement Two establishes standards for the financial reporting of research and development. The major objectives of the Statement are 1. to provide more uniformity in

accounting reporting for research and development; and 2. to provide useful financial information about research and development. Statement Two defines research and development activities, identifies costs associated with these activities, and specifies the accounting treatment and disclosure of these costs.

Statement Two specifically excludes certain activities that are found only in the extractive industries, but includes research and development in these industries that can be compared to research and development in other industries. Also, Statement Two amended two Accounting Principles Board Opinions: 1. Number Seventeen that specified the amortization of intangibles, and 2. Number Twenty-two that covered research and development disclosure. These amendments removed research and development from coverage by these prior statements.

The Financial Accounting Standards Board generally accepts the National Science Foundation definition of research and development. However, the pronouncement also includes research and development in the service industries that is excluded in the National Science Foundation definition. The pronouncement specifically defines research and development as follows:

- a. Research is planned search or critical investigation aimed at discovery of new knowledge with the hope that such knowledge

will be useful in developing a new product or service (hereinafter "product") or a new process or technique (hereinafter "process") or in bringing about a significant improvement to an existing product or process.

b. Development is the translation of research findings or other knowledge into a plan or design for a new product or process or for a significant improvement to an existing product or process whether intended for sale or use. It includes the conceptual formulation, design, and testing of product alternatives, construction of prototypes, and operation of pilot plants. It does not include routine or periodic alterations to existing products, production lines, manufacturing processes, and other on-going operations even though those alterations may represent improvements and it does not include market research or market testing activities (10, para. 8).

All significant research and development encompassed by this definition will be expenses when incurred rather than capitalized and then amortized over a future time period, with this one exception--contractual research and development for others (10, para. 9). Contractual research and development expenditures are generally shown in the financial statements as ordinary receivables.

Concerning the effective date and transition, the following is quoted from the Financial Accounting Board's Statement Number Two:

This Statement shall be effective for fiscal years beginning on or after January 1, 1975, although earlier application is encouraged. The requirement of paragraph 12 that research and development costs be charged to expense when incurred shall be applied retroactively by prior period adjustment (described in paragraphs 18 and 26 of APB Opinion No. 9,

"Reporting the Results of Operations"). When financial statements for periods before the effective date or financial summaries or other data derived therefrom are presented, they shall be restated to reflect the prior period adjustment. The prior period adjustment shall recognize any related income tax effect. The nature of a restatement and its effect on income before extraordinary items, net income, and related per share amounts for each period presented shall be disclosed in the period of change (10, para. 15).

As stated, the Financial Accounting Standards Board required retroactive prior period adjustment for the expense of capitalized research and development. This requirement allowed companies to write off the previous years capitalized research and development over past years without negatively affecting the current year's profits. For example, Lockheed Aircraft Corporation retroactively wrote off almost \$308 million of previously capitalized research and development over the years 1970 through 1973. Normally, as specified by Opinion Twenty of the Accounting Principles Board, Lockheed would have had to expense the entire amount of the capitalized research and development in the year of the accounting change. This action would have reduced 1974 earnings; but Statement Two explicitly exempts research and development costs from Opinion Twenty.

The Financial Accounting Standards Board discusses four alternatives in accounting for research and development. These four alternatives are

1. charge all costs to expense when incurred;
2. capitalize all costs when incurred; 3.

capitalize costs when incurred if specified conditions are fulfilled and charge all other costs to expense; 4. accumulate all costs in a special category until the existence of future benefits can be determined (10, para. 37).

Accounting theory supports alternative number three, which is to ". . . capitalize costs when incurred if specified conditions are fulfilled and charge all other costs to expense" (10, para. 37). Consequently, when research and development benefits future time periods, it should be capitalized and amortized over the time period benefited. This capitalization and future write off is consistent with the matching concept as referenced by the Financial Accounting Standards Board. The pronouncement refers to matching as, "Identifying, measuring, and relating revenues and expenses of an enterprise for an accounting period" (10, para. 47).

However, the Financial Accounting Standards Board supports the first alternative which is, ". . . charge all costs to expense when incurred" (10, para. 37). As support for this decision, the Financial Accounting Standards Board utilizes research studies that emphasize a high failure rate for research and development. For example, ". . . one study of a number of industries found that an average of less than 2 percent of new product development projects were commercially successful" (14, para. 37). Another study (10, para. 40) referred to by the Financial

Accounting Standards Board estimated new product failure rates extremely high, ranging from 30 to 90 percent. These studies are not representative of typical research and development projects. Other studies show more optimistic results. Mansfield and Brandenberg (16; 24, p. 55, 355) found that in more than 75 percent of the projects, the estimated probability of success was 80 percent or greater. Forty-four percent of these projects were technically successful, and only 16 percent, technically unsuccessful. Scherer attributes this high success ratio to the fact that ". . . business firms do not as a rule begin new product or process development projects until the principal technical difficulties have been whittled down through inexpensive research, conducted either by their own personnel or by outsiders" (24, p. 355). Thus, research and development success is much higher than inferred in the Board's decision. Consequently, the Financial Accounting Standards Board is clearly in error in using the matching concept as support for its decision.

The Financial Accounting Standards Board also states that, ". . . a direct relationship between research and development and specific future revenue generally has not been demonstrated" (10, para. 41). However, as previously stated, many projects are successful and future revenue must be directly related to them. Numerous studies (17) have been undertaken to show this relationship. Some degree of

success has been achieved in spite of the lack of sufficient data. Most of these studies use the number of patents or number of employees as statistical data, rather than the dollar value spent on research and development. Additional research in this area, with actual research and development expenditure data, could prove highly productive.

The Financial Accounting Standards Board also indicated that at the time of the research and development expenditure, tangible evidence of resource creation is lacking. ". . . at the time most research and development costs are incurred, the future benefits are at the most uncertain. In other words, there is no indication that an economic resource has been created" (10, para. 45). But, usually, resource creation occurs or the research and development would not be undertaken. Many studies show that the marginal rate of return on research and development is either comparable to or greater than the investment return on other capital expenditures. Denison (6; 17, p. 34) calculated the rate of return on research and development to be about the same as that for plant and equipment expenditures, but he assumed no time lag. The return possibly would have been much greater with a time lag. Grilich (13; 17, p. 35) found that the rate of return for investment in agricultural research is between 35 and 170 percent. More specifically, Mansfield (17) estimates the marginal rate of return of research and development in the petroleum industry to be

over 40 percent, while in the chemical industry, Minasian (18; 17, p. 36) estimates a 50 percent marginal rate of return on research and development.

Referring to the total economy, Fellner (9; 17, p. 43) estimates the rate of return for research and development to be in excess of 18 percent. Eighteen percent is much greater than the marginal rate of return from plant and equipment, assuming a static technology. Consequently, contrary to the Financial Accounting Standards Board opinion, tangible evidence of resource generation is generally present at the time of the research and development expenditure.

Perhaps the final irony is the following statement from the Financial Accounting Standards Board. Research and development should not be capitalized even when future benefits are known simply because they ". . . cannot be measured with a reasonable degree of accuracy. . ." (10, para. 45). Following this reasoning, many fixed assets, such as plant and equipment, would not be capitalized. The future productiveness of fixed assets is subject to uncertain marketing conditions and rapid technological change. Who can accurately estimate the business life of fixed assets? For example, Anaconda Corporation recently installed a new multi-million dollar arbiter plant for copper refining. The commercial success of the project is subject to speculation, and the entire Butte, Montana mining operation may be

discontinued at any time, depending upon copper prices. Thus, the life of the plant cannot be predicted with any degree of accuracy.

Summary

A literature review on the materiality of research and development costs in relationship to the United States economy and to accounting measurements discloses these facts.

1. Total expenditures for research and development were over three percent of Gross National Product in 1964, but gradually declined to 2.3 percent in 1974. During the same time period, private expenditures for research and development remained fairly stable at one and two-tenths percent of Gross National Product.

2. Individual business firms' information on the materiality of research and development expenditures in relationship to accounting measurements was available only after some involved computations. Results of these computations disclosed the materiality of research and development compared to sales, profit, and cash flow for 182 corporations in 1974. These companies account for approximately nine billion dollars of research and development compared to sales, profits, and cash flow of 519, 28 and 40 billion dollars respectively. Research and development expenditures in the 182 corporations were approximately 1.7 percent of sales, 32 percent of profit and 23 percent of cash flow.

3. The materiality of research and development in comparison to sales, profit, and cash flow in each of the 182 corporations was computed for the year 1974. Over 80 percent of the business firms spent a material dollar amount on research and development; i.e., 9 percent or more of profit. Furthermore, 61 business firms spent 50 percent or more of profit, and 91 business firms spent 100 percent or more of profit for research and development. Seventy-three business firms spent more than twelve percent of cash flow for research and development. Therefore, expenditures for research and development are material in relationship to accounting measurements when a 5 percent criterion is utilized.

Since research and development expenditures are significant in financial reporting, the historical accounting treatment of this important cost was investigated. Historical research reveals that early accounting organizations, the Internal Revenue Service, and accounting practice support capitalization and future amortization of research and development expenditures. However, economic and social forces exerted pressure for immediate write-off of research and development because of the income tax advantages.

The Internal Revenue Service yielded to these forces but required that research and development costs be currently expensed in published financial statements when immediate write-off for tax purposes was to be allowed. This tax law was reversed in 1954, but the current expensing technique

had already become institutionalized into accounting thought because of the impact of tax policy on public reporting. A survey of 244 companies in the 1960's disclosed that the common practice was to currently expense research and development expenditures.

Auditors who examined published financial statements supported the established practice of currently expensing research and development costs. The difficulty in measuring future benefits of the expenditures and the lack of tangible, physical evidence were the main reasons given for this support. Although extremely important to the long-term profit of a business firm, research and development expenditures are not physically tangible like plant and equipment. Thus, the capitalization of research and development costs is difficult to justify in the eyes of the public. Also, public distrust was warranted by cases in which these costs were capitalized when the available evidence did not support a future benefit. Subsequently, when it became apparent that the capitalized costs had no future benefit, a quick write-off caused a drastic reduction in current profit and a decline in stock prices.

The problem of profit distortion had to be solved. Relying on established practice and a limited amount of research, the Financial Accounting Standards Board authored Statement Two in 1974. Statement Two requires that private research and development expenditures be currently expensed.

The troublesome problem of whether to capitalize or to expense research and development costs was temporarily solved. At least no more quick write-offs of past capitalized research and development costs would cause drastic declines in current income and in the stock market.

Statement Two was pragmatically designed to temporarily handle a current problem. The decision is not supported by accounting theory. Uniformity in the accounting of research and development costs was established simply by requiring all firms to expense research and development in the year incurred. No research was apparently undertaken by the Financial Accounting Standards Board to consider what effect the established practice would have on the dollar amount and type of private research and development in the United States. No research was undertaken by the Financial Accounting Standards Board to determine, if possible, to what extent research and development is becoming a function of current profits as a result of the current expense treatment.

Statement Two went into effect in 1975 and the Securities Exchange Commission has required the disclosure of research and development expenditures since 1972. A unique opportunity exists to test the relationships between research and development costs and other accounting measurements. This analysis should be done since the current

expense treatment required by the Financial Accounting Standards Board may affect the level and type of research and development expenditures.

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CHAPTER III

THE MODEL, COMPANY SELECTION, DATA GATHERING AND THE MATERIALITY OF RESEARCH AND DEVELOPMENT EXPENDITURES IN THE COMPANIES ANALYZED

Introduction

As developed in Chapter II an unprecedented opportunity exists to analyze the effect of a financial accounting reporting method on research and development bedgeting within public corporations. Specifically, the proposition that Statement Two reduced the level of research and development expenditures in those firms affected will be investigated. First, however, a model must be constructed to analyze the variables that may affect research and development expenditures. This chapter presents the model, discloses the data gathering and includes computations on the materiality of research and development expenditures in relationship to the other accounting variables in the companies analyzed.

The Model of the Accounting Variables Influencing Research and Develop- ment Expenditures

A model is developed in this chapter to analyze the effects, if any, of Statement Two on research and development expenditures. In any model, variables by themselves

are of little importance until their inter-relationships have been studied so that the impact of a change in one variable on changes in the others can be understood. The model integrates the most important accounting variables that may affect budgeting decisions related to research and development. These variables are profit, sales, two concepts of liquidity, and research and development. Two concepts of liquidity are necessary because cash flow does not include the beginning liquidity of the business firm. Consequently, liquidity is measured as cash flow and as cash plus cash flow.

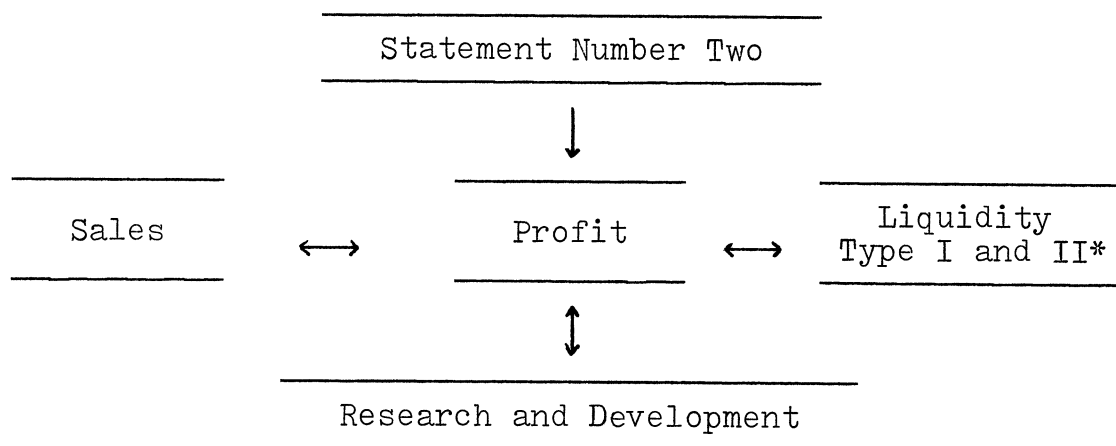
The variables are defined as follows: Income or Profit--net income before extraordinary items as shown in the published financial statements. Cash Flow--net income after tax before extraordinary items, plus depreciation and amortization and relevant operating account adjustments, such as current receivables and payables. Research and Development--the dollar amount of company sponsored funds spent on material research activities relating to the development of new products or services.

Operating net income was believed to be the best measure of profit; it is not distorted by unusual non-recurring events outside management's control. As already defined, a rather sophisticated measure of operating cash flow is used in this model. An additional measure of

liquidity, cash plus cash flow, is used to attempt to include the beginning current liquidity of the business firm. Research and development is defined in the requirements of the Security Exchange Commission (3) for filing the Annual 10-K Report.

Other variables such as new breakthroughs in technology and government research and development are excluded from the model. Some of these exogenous determinants of research and development expenditures are the productivity of past research, the current availability of research and development projects, the company's product diversification, the government's expenditures on research and development, the availability of research and development staff, the corporate management and control, the competitive environment, the state of technology, historical accident, and the state of the economy. Possibly the effect of these exogenous variables on the level of research and development expenditures will tend to cancel out. Whether or not these exogenous variables affected the model will be tested. However, in model building and testing, earlier researchers worked with fewer data, i.e., usually their data included only the number of company research and development employees or the number of business firm patents. Therefore, the unique opportunity to test actual research and development expenditure behavior during the period of the accounting

change is accepted. A diagram of the model is displayed in Figure 2.



*Type I = Cash flow
 Type II = Cash plus cash flow

Fig. 2--Model developed to analyze the effects, if any, of Statement Two on research and development expenditures.

Expected Relationships in the Model and the Expected Results from Testing these Relationships

First, interaction is expected among the variables within the model. Variables by themselves are of little importance until their interrelationships are studied so that the impact of a change in one variable on the other variables can be understood. One expects profit and sales to be usually directly related. Profit, however, may increase or decrease in relationship to sales; liquidity may also fluctuate directly or inversely with sales and profit. Consequently, a degree of interaction is expected, but the direction of this interaction is not predictable.

Second, because Statement Two has an effect on profit, the research and development expenditures variable may be indirectly decreased by this decision. The other variables; i.e., sales, cash flow, and cash plus cash flow, will be less affected over the short run by this decision. (See Model, page 50.) Sales are obviously unaffected over the short run because the determination of accounting profit, i.e., current expensing versus capitalization, has nothing to do with the demand for products or services. The liquidity variables are unaffected over the short run because of 1954 tax legislation. Previous research disclosed that post 1954 taxable and accounting incomes do not have to be computed in the same manner to take advantage of current expensing of research and development for tax purposes. Then, a logical assumption is that the firms included in this study were expensing research and development prior to Statement Two for the maximum tax advantage. Therefore, Statement Two has little or no effect on liquidity through a tax effect on cash flow. The independent variable--profit--is the only variable directly affected by the accounting change. The procedures required by Statement Two reduce profits over the short run. As a result, stockholder insistence for profit may exert pressure on management to maintain current profits. Management therefore may cut research and development expenditures to minimize the effect of currently expensing research and development in the year

incurred. After the effect of the other accounting variables on research and development expenditures is considered, the change in profit caused by Statement Two is expected to indirectly cause a change in the level of research and development expenditures between the two time periods; i.e., before and after the accounting change. A natural outgrowth of this type of treatment is that research and development expenditures are reduced even though they are essential for the long run growth of the business. As a result, technological progress is retarded in those firms affected by the decision.

Selection of Companies and the Data Gathering Procedure

The data gathering procedure is composed of three steps: the selection of the corporations to be included in the study group, the collection of the data, and computations on the materiality of research and development expenditures compared to the other accounting variables.

As previously disclosed in detail; i.e., Chapter I, Research Methodology, Fortune's top 500 industrial and top fifty each of transportation, retailing and utility corporations were selected. Four hundred of these 650 companies furnished the required information. The results of a thorough study of the 400 companies' financial statements show that twenty-one companies were forced to change to the current expense method mandated by Statement Two.

That is, twenty-one of the 400 companies changed from capitalizing research and development expenditures to expensing research and development expenditures in their financial statements.

Securities and Exchange Commission data, i.e., 10-K research and development expenditure report data (3), are utilized on these twenty-one companies to maintain definitional consistency throughout the four-year time period under study--1972 through 1975. The annual 10-K reports were requested and received from these twenty-one firms. Sales, profit, beginning cash, and cash flow data were obtained from the financial statements. Cash flow and cash plus cash flow was then computed.

The Materiality of Research and Development for the Twenty-One Companies

Following the collection of the data described above, research and development expenditures were compared to sales, profit, and cash flow to provide information about the significance of these variables in relationship to research and development expenditures and to one another. This information aids the understanding of the relationship of Statement Two to research and development expenditures and to the other variables in the theoretical model.

The materiality comparisons were accomplished by analyzing the data collected on the twenty-one major United States Corporations previously selected. The percentage of

research and development to profits, sales, and cash flow was computed for the year 1974. The 1974 year was selected because the Statement Two became effective in 1975. The corporations were divided into classes depending upon the materiality in the analysis of research and development expenditures.

Information regarding the materiality of research and development in the twenty-one firms is disclosed in Tables VI and VII (pp. 55-56). The National Science Foundation (2, p. 11) lists six research intensive industries that account for 70 percent of the research and development in the United States. Twelve of the twenty-one companies; i.e., 57 percent of those companies included in Table VI, are research intensive.

Total research and development expenditures of the twenty-one companies is \$1,265 million compared to sales of \$43,416 million; profits of \$1,680 million; and cash flow of \$1,627 million. (See Tables VI and VII, pp. 55-56.) The weighted average of research and development to sales is 3 percent, to profits 75 percent; and to cash from operations 78 percent. Consequently, the twenty-one companies did spend a significant dollar value on research and development expenditures. (See Table VII, p. 56.)

The materiality of research and development in comparison to profit, sales, and cash flow for each of the

TABLE VI
SALES, PROFIT AND CASH FLOW FOR TWENTY-ONE
UNITED STATES CORPORATIONS

Com- pany No.	Company Name	1974		
		Sales*	Profit*	Cash Flow**
1	Arvin	\$ 283,080	\$ 4,163	\$ (7,161)
2	Automation	240,373	4,832	12,476
3	AVCO	628,432	(20,687)	(17,193)
4	Bell & Howell	465,624	15,610	(4,155)
5	Control Data	1,101,142	(31,398)	(34,976)
6	General Dynamics	1,968,416	51,623	85,757
7	Goodrich, B.F.	1,975,244	55,867	61,794
8	Honeywell	2,628,606	72,170	228,397
9	Kiddie Walter	1,107,167	39,921	33,542
10	Lockheed	3,279,100	23,200	110,600
11	McDonnell Douglas	3,317,869	106,684	(7,086)
12	Rockwell Int'l.	4,453,800	130,300	(238,600)
13	Occidental	5,578,189	280,667	282,850
14	ROHR	419,915	3,234	(12,356)
15	Sundstrand	456,751	18,780	10,211
16	Textron	2,113,754	105,904	3,604
17	UOP	825,093	27,752	(23,668)
18	Western Electric	7,422,534	310,633	349,491
19	Western Union	551,982	34,064	131,873
20	White Consoli- dated	1,022,015	38,476	(20,057)
21	Xerox	3,576,442	408,302	681,704
Total		\$43,415,528	\$ 1,680,097	\$ 1,627,047

*Source: Annual financial reports, 1974.

**Source: Calculated from data in annual financial reports, 1974.

***\$--dollars in thousands.

TABLE VII

RESEARCH AND DEVELOPMENT AS A PERCENT OF
PROFIT, CASH FLOW AND SALES FOR TWENTY-
ONE UNITED STATES CORPORATIONS

Com- pany No.	Research and Development*	1974 Research & Development As a Percent of		
		Profit**	Cash Flow**	Sales**
1	\$*** 6,500	***156.137	(90.769)***	2.296
2	2,055	42.529	16.472	.855
3	15,091	(72.949)	(87.774)	2.401
4	21,171	135.625	(509.531)	4.547
5	64,200	(204.472)	(183.554)	5.830
6	20,649	40.000	24.079	1.049
7	39,599	70.881	64.082	2.005
8	170,156	235.771	74.500	6.473
9	8,199	20.538	24.444	.741
10	42,000	181.034	37.975	1.281
11	139,460	130.723	(1,968.106)	4.203
12	40,500	31.082	(16.974)	.909
13	18,596	6.626	6.757	.333
14	5,501	170.099	(44.521)	1.310
15	21,470	114.324	210.263	4.701
16	39,776	37.559	1,103.663	1.882
17	23,642	85.190	(99.890)	2.865
18	378,052	121.704	108.172	5.093
19	2,853	8.375	2.163	.517
20	8,599	22.349	(42.873)	.841
21	196,727	48.182	28.858	5.501
Total	\$1,264,796	1,381.307	(1,342.746)	55.633
M***	- - -	(138.71) 87.30	(355.53) 141.77	2.65
N***	- - -	75	78	3

*Source: Securities Exchange Commission, 10-K Report, 1974.

**Calculated from data in Table VI.

***"M"--unweighted mean; (--)--negative profit or cash flow; "N"--weighted mean; "\$"--dollars in thousands.

twenty-one companies was computed and the results were tabulated in these individual analyses. These individual analyses are essential because the theoretical model was tested on the basis of individual observations by covariance analysis as explained in Chapter IV.

First, the percentage of research and development compared to profit was computed for each of the twenty-one companies. These percentages were divided into six classes in Table VIII. The twenty-one corporations' research and development expenditures as a percent of profit in each class are as follows: 10 percent between a negative 200 and a negative 125 percent; 5 percent between

TABLE VIII
RESEARCH AND DEVELOPMENT AS A PERCENTAGE
OF PROFIT FOR TWENTY-ONE CORPORATIONS

Percentage Range of Each Class	Number of Companies in Each Class	Percentage of Companies in Each Class
(200)-(125)	2	10
(124)-(49)	1	5
(48)- 27	4	19
28 - 103	7	33
104 - 179	6	28
180 - 255	1	5
Total	21	100

*Source: Table VII, p. 56.

a negative 124 and a negative 49 percent; 19 percent between a negative 48 percent and 27 percent; 33 percent between 28 and 103 percent; 28 percent between 104 and 170 percent; and 5 percent between 180 and 225 percent.

Next, research and development was compared to sales for each of the twenty-one companies in 1974. These percentages were divided into five classes. The twenty-one corporations' research and development as a percent of sales in each class is as follows: 43 percent between .333 and 1.563 percent; 19 percent between 1.564 and 2.794 percent; 5 percent between 2.795 and 3.995 percent; 19 percent between 3.996 and 5.226 percent; and 14 percent between 5.227 and 6.457 percent. (See Table IX, below.)

TABLE IX
RESEARCH AND DEVELOPMENT AS A PERCENTAGE OF
SALES FOR TWENTY-ONE CORPORATIONS IN 1974

Percentage Range of Each Class	Number of Companies in Each Class	Percentage of Companies in Each Class
.333-1.563	9	43
1.564-2.794	4	19
2.795-3.995	1	5
3.996-5.226	4	19
5.337-6.457	3	14
Total	21	100

*Source: Table VII, p. 56.

The last step in the materiality tests of the twenty-one companies compares research and development with liquidity, i.e., cash flow from operations. Research and development expenditures as a percent of cash flow were computed for each of the twenty-one companies in 1974. The results of these companies were divided into six classes, and the relative frequency of each class was determined. (See Table X, below.)

TABLE X
RESEARCH AND DEVELOPMENT AS A PERCENTAGE
OF CASH FLOW FOR TWENTY-ONE
CORPORATIONS IN 1974

Percentage Range of Each Class	Number of Companies in Each Class	Percentage of Companies in Each Class
(1960) - (398)	2	10
(397) - (39)	13	62
40 - 180	5	24
181 - 1165	1	4
Total	21	100

*Source: Table VII, p. 56.

**(--)--negative cash flow

The twenty-one companies' research and development expenditures as a percent of cash flow in each class are as follows: 10 percent between 1960 and 398 negative percent; 62 percent between 397 negative percent and 39 positive

percent; 24 percent between 40 and 180 positive percent; and 4 percent between 181 and 1165 percent.

Summary

This chapter presented a model of the accounting variables influencing research and development expenditure decisions. The independent variables disclosed are Financial Accounting Standards Board Statement Number Two, profit, sales, and two measures of liquidity. The dependent variable is research and development.

The relationships of these variables in the model were discussed. Hypothesizing that after the effect of the accounting variables on research and development expenditures are considered, Statement Two indirectly caused a decrease in the level of research and development expenditures between the two time periods; i.e., before and after the accounting change.

The companies used to test this hypothesis were selected. As previously disclosed in detail; i.e., Chapter I, Research Methodology, Fortune's top 500 industrial and top fifty each of transportation, retailing and utility corporations were selected. In addition to financial reports, Securities Exchange Commission Form 10-K and Compustat data on research and development expenditures were utilized for these 400 companies. A search in the financial statements of the 400 companies was made to determine which companies

disclosed a change in accounting for research and development in 1974 and in 1975. As a result of Statement Two, twenty-one companies disclosed a change from capitalizing research and development costs to charging these costs to current expense.

The financial statements of these twenty-one companies were then examined in detail to determine the materiality of research and development in relationship to other variables in the model. The materiality tests are necessary to determine whether or not research and development expenditures in these companies was significant enough to justify analyses. The materiality of research and development in comparison to profits, sales and cash flow was analysed in 1974 for the twenty-one companies which changed accounting for research and development, and the results were tabulated. The conclusions are as follows:

1. Profit--over 81 percent spent 28 percent or more of profit for research and development;
2. Sales--over 57 percent spent 1.5 percent or more of sales for research and development;
3. Cash flow--over 50 percent spent 50 percent or more of cash flow for research and development.

Research and development was a material expenditure for the majority of the companies which changed accounting methods

as a result of Statement Two within the study group. Therefore, the proposition that Statement Two affected the level of research and development expenditures could be tested.

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CHAPTER IV

TEST RESULTS OF THE RELATIONSHIP OF STATEMENT TWO TO RESEARCH AND DEVELOPMENT EXPENDITURES

Introduction

The effects of Statement Two on the level of research and development expenditures is investigated in this chapter using statistical techniques. Coefficient of correlation and one-way covariance analyses are utilized to test the model. In addition to statistical testing, this chapter includes a rough estimate of the effects of Statement Two on the profits of the twenty-one companies. Finally, there is a brief discussion of the effects of the exogenous variables not included in the model.

Analysis of the Companies Which Changed Accounting Reporting of Research and Development

The proposition that Statement Two affects the level of research and development expenditures is investigated using statistical techniques. The previously selected twenty-one companies, which changed accounting reporting as a result of Statement Two, are included in this analysis. Fifteen of these companies changed accounting methods for research and development in 1974, and six companies changed accounting methods in 1975 as a result of Statement Two.

Consequently, forty-eight company years are observed before the required accounting change, and thirty-six company years are observed after the accounting change; i.e., a total of eighty-four company year observations over the four year time period are included in the statistical testing.

Research and development expenditures are statistically analyzed with the four independent variables, sales, profit, cash flow, and cash plus cash flow for coefficients of correlation. Research and development expenditures have a coefficient of correlation with sales of .76; profit of .69; cash flow of .62; and cash plus cash flow of .57. The relationship between research and development expenditures and the other variables is statistically significant at the 5 percent level.

Next, analyses of covariance are used to investigate the influence of Statement Two on the level of research and development expenditures. These analyses of covariance provide a technique by which the effect of the selected variables, sales, profit, cash flow, and cash plus cash flow, can be removed to some extent (or adjusted for their influence) on research and development expenditures. Thus the effect of each variable on the level of research and development expenditures is analyzed somewhat separately from the effect of the other variables.

A covariance analysis over the four-year time period gives the total regression coefficients for the independent

variables as follows: sales, .04; profit, .08; cash flow, .86; and cash plus cash flow, a negative .62 (Table XI, p. 67). Also, the variables sales, profit, and cash flow, vary directly with the level of research and development expenditures; but cash plus cash flow varies indirectly with the amount of research and development. This interpretation of cash flow and of cash plus cash flow regression coefficients was not accepted without further interpretation and analysis. Since the two variables, cash flow and cash plus cash flow, show a high correlation of .98, it is difficult to isolate the influence of the two variables upon research and development expenditures. Therefore, as quite often happens in multiple regression analysis with highly correlated variables, one variable shows an unusually high coefficient of regression of .86; i.e., cash flow with research and development expenditures, while the other variable, cash plus cash flow, compensates for this over-reaction by showing a negative regression coefficient of .62. To check this phenomena, two covariance analyses were done by alternately excluding each covariant; i.e., cash flow and cash plus cash flow, from the analysis. The results of these analyses indicate that the over-reaction interpretation is correct since the regression coefficient of cash flow dropped to .11 and cash plus cash flow shows a positive regression coefficient of .02 (Table XI, p. 67).

TABLE XI

MULTIPLE REGRESSION COEFFICIENTS FOR SALES,
 PROFIT, CASH FLOW, AND CASH PLUS CASH FLOW

Covariants	Four Covariant Analysis	Three Covariant Analysis Excluding Cash Flow	Three Covariant Analysis Excluding Cash Plus Cash Flow
Sales	.038	.028	.028
Profit	.084	.059	.202
Cash Flow	.856	.110	---
Cash Plus Cash Flow	-.622	---	.021

In conclusion, the results of the analyses show that all variables are significantly related at the 95 percent level to each other and that the independent variables have a positive correlation with the level of research and development expenditures. However, these results do not directly support the hypothesis that Statement Two affects the level of research and development expenditures.

Next, the group means for all the variables, both before and after the accounting change, were examined to infer the effects of the independent variables on the level of research and development expenditures. The mean for sales is 1703; profit, 69; cash flow, 116; cash plus cash flow, 178; and research and development expenditures, 60, in millions of dollars before the accounting change. After the accounting change the means are: sales, 2034; profit, 65; cash flow, 129; and cash plus cash flow, 199; and research and development expenditures, 52 (Table XII, p. 69). Thus, the means of sales, cash flow, and cash plus cash flow, increased after the accounting change; but both the profit and the research and development expenditure means decreased after the accounting change. After the accounting change, the percentage decline of the research and development expenditures compared to sales is 28; cash flow, 15; cash plus cash flow, 23; and profit, 5 (Table XIII, p. 70). Since research and development

TABLE XII

MEANS FOR SALES, PROFIT, CASH FLOW
 CASH PLUS CASH FLOW AND RE-
 SEARCH AND DEVELOPMENT

Variable	All Years	Years Before Accounting Change	Years After Accounting Change
Sales	1,845,160,000	1,703,494,000	2,034,048,000
Profit	67,354,000	69,188,000	64,908,000
Cash Flow	121,703,000	116,262,000	128,956,000
Cash Plus Cash Flow	186,732,000	177,678,000	198,803,000
Research and Development	56,600,000	60,007,000	52,057,000

TABLE XIII

RESEARCH AND DEVELOPMENT EXPENDITURES AS
AS PERCENT OF SALES, PROFIT, CASH
FLOW AND CASH PLUS CASH FLOW

Variable	Research and Development Expenditures				Percentage Change
	Percent for All Years	Percentage Before Accounting Change	Percent After Accounting Change	Percentage Change	
Sales	3.0	3.5	2.5	28	
Profit	83	86	81	5	
Cash Flow	46	52	40	15	
Cash Plus Cash Flow	30	34	26	23	

expenditures decline in both absolute dollar amounts and in percentage amounts, in relationship to the other variables, Statement Two may have, but not necessarily, resulted in a reduction in the level of research and development expenditures.

The proposition that Statement Two resulted in a reduction in the level of research and development expenditures was tested using covariance analysis. Covariance analysis was used to remove the effect of the following on research and development expenditures: sales, cash flow, and cash plus cash flow. The dollar amounts of sales, cash flow, and cash plus cash flow increased after the accounting change. The increase in these variables may have caused an increase in the level of research and development expenditures after the accounting decision. After removing the effect of these variables, the adjusted group means was calculated.

As adjusted, the research and development expenditure mean before the required accounting change is sixty-five million dollars, and the research and development mean after the required accounting change is forty-six million dollars; i.e., a decline of 29 percent.

The statistical significance of the decrease in research and development expenditures was measured by an F test. An F test is a statistical test used to determine if an unexpected variation is significant in relationship to

a total variation. The F test detected a difference between research and development expenditures before and after the accounting change required by Statement Two at a significance level of 5 percent. Consequently, if one accepts the model, one may be 95 percent confident that the accounting change required by Statement Two resulted in a decline in the level of research and development expenditures in the twenty-one companies.

In conclusion, the statistical testing indicates that the level of research and development expenditures may be affected by Statement Two. However, none of the results of the tests afford a sound statistical basis for such an inference; i.e., that Statement Two and/or profits affected research and development expenditures.

The Estimated Effect of Statement Two
on Profits as Disclosed in the
Financial Statements

Statement Two, as previously explained, does away with the management flexibility of either expensing research and development in the year incurred or capitalizing it and then amortizing the expenses over future time periods. Thus, the effect of the decision may decrease short-run profit in the year of the change and in subsequent years. Management of the firms effected may react to this decision by reducing research and development expenditures so that current profits are unaffected. However, Statement Two

contains a provision whereby previously capitalized research and development expenditures should be retroactively written off by a restatement of prior years' earnings. (See Critique of Statement Two, p. 32.) Such a write-off of previously capitalized research and development expenditures reduces research and development expenses over future time periods by the amount of the amortization that would have been expensed in those periods.

The net effect of the retroactive write-off plus the current expense treatment could have increased, left relatively unaffected, or decreased research and development expenses in the year of the change and in future amortization years. Furthermore, decreases in the amount of research and development expensed in one firm could have been offset by an increase in the amount expensed in another firm.

The actual dollar effect of the decision on research and development budgeting can only be inferred. However, management did state the amount of research and development expenditures expensed in the current years that previously would have been capitalized, in a number of the twenty-one companies' financial statements. Consequently, an individual company analysis based on the reported effect on earnings was made on these twenty-one companies. (See Table XIV, p. 74.)

TABLE XIV
 THE EFFECT ON PROFITS OF THE TWENTY-ONE
 COMPANIES INCLUDED IN THE STUDY

Company Number**	Year of Change	Intensive*	Percentage Effect on Profit			Percentage Effect on Retained Earnings	
			Years		Other	Year*	%
			1975*	1974*	%*		
1	1974	I	---	---	(7.44)	---	---
2	1974	-	---	---	---	---	---
3	1974	-	---	(28)	(12.6)	---	---
4	1975	-	(6)	(.34)	---	---	---
5	1975	I	---	(13.7)	---	---	(4)
6	-	-	---	---	---	---	(3.13)
7	1974	I	---	1.3	.21	---	(12)
8	1974	I	---	(3.2)	---	---	---
9	1975	I	---	(2.9)	(54)	---	---
10	1974	I	---	(28)	(117)	---	---
-	-	-	---	---	(355)	---	---
-	-	-	---	---	(144)	---	---
-	-	-	---	---	8.3	---	---
11	1974	I	---	7.19	3.17	---	---
12	1974	-	---	---	---	---	---
13	1974	-	---	(1.2)	(6.4)	---	---
14	1975	I	---	(6.3)	(7.8)	---	---
15	1974	I	---	---	4.5	---	---
-	-	-	---	---	(20.1)	---	---
-	-	-	---	---	(31.9)	---	---
-	-	-	---	---	(8.4)	---	---
16	1975	-	---	---	---	---	---
17	1974	-	(2.7)	---	(3.4)	(18)	1973
18	1975	I	(9)	(1.2)	---	.37	1974
19	1974	I	---	(1.08)	(2.4)	(1.04)	1974
20	1974	I	---	---	---	---	---
21	1975	I	(1.4)	(.7)	---	---	---

*I--Research intensive; ---=Not determinable; (-)=Negative.

**See Table XV for company name.

A similar analysis with the same budgeting assumption for the year 1975 was made on the fourteen firms which changed in 1974 (Table XIV, p. 74). The computed effect on earnings was as follows: 7 percent reported a decrease and 93 percent did not report either an increase or decrease. The computations were made to see if earnings would have decreased in the years under study, i.e., after the accounting change, if research and development budgeting was not adjusted to alleviate the current expense impact.

An examination of Table XIV, p. 74, discloses one company in particular whose profits were undoubtedly greatly affected by the accounting decision. Lockheed Aircraft Corporation, in compliance with the retroactive write-off requirement, reduced retained earnings as of December 31, 1972, by 281 million and reconciled net earnings (loss) with amounts previously reported for the four years ended December 30, 1973. (See Table XV, p. 76.) Table XV does not show an adjustment of approximately \$100 million to Lockheed's retained earnings prior to 1970. It does show a retroactive write-off of almost \$308 million of previously capitalized research and development over the years 1970 through 1973. The effect of this retroactive write-off on prior years' earnings was computed as follows: 1970--117 percent; 1971--355 percent; 1972--144 percent; and 1973--8.3 percent. Most of the research and development expenditures had been carried in current inventories,

although recovery of these costs was subject to much speculation. Such a retroactive write-off of research and development reduced expenses over a future time period and thus released a heavy burden from the management of Lockheed Aircraft Corporation.

TABLE XV

LOCKHEED AIRCRAFT CORPORATION
EARNINGS RECONCILIATION

	1973	1972	1971	1970
Net earnings (loss) as previously reported	\$ 16.8	\$ 16.2	\$ 15.4	\$ (86.3)
Development costs incurred	(20.7)*	(52.9)	(92.7)	(141.6)
Gross profit recognized	20.7	9.9	-	-
Related income tax effect	1.4	19.6	37.9	40.1
Totals	\$ 18.2	\$ (7.2)	\$ (39.4)	\$ (187.8)

*Source: Annual Financial Statements.

**(-)--negative.

The individual company analysis of the twenty-one firms, particularly Lockheed, disclosed that prior period adjustments specified by Statement Two reduced earnings in years previous to the accounting decision; but these same prior period adjustments caused an increase in earnings after the accounting decision. Statement Two also caused

a reduction in earnings after the accounting change because of the current expense treatment for research and development expenditures. The net effect of the prior period adjustments and the current expense treatment for research and development expenditures was to reduce profit after the accounting change. In 83 percent of the companies reporting the necessary financial data, Statement Two caused a decrease in profits.

The lack of statistical support that profit alone caused a change in the level of research and development expenditures in the twenty-one business firms has previously been disclosed. Because of this fact, one may also interpret the results of the statistical analyses as indicating that the level of research and development expenditures between the two time periods, before and after the accounting change, was also significantly affected by exogenous variables. This possibility is considered.

Determinants of Research and Development Expenditures Not Included in the Model

The effects of any variables not included in the model were assumed to cancel out. However, one may interpret the result of one of the covariance analyses as indicating that the level of research and development expenditures, before and after the accounting change, was also significantly affected by exogenous variables. (See Chapter IV, Analysis of the Companies, p. 64.)

In dollars, research and development expenditures declined 13 percent after the accounting change. In relationship to the other accounting variables--sales, profit and liquidity--research and development expenditures declined 29 percent after the accounting change. This decline in research and development expenditures may be explained by the influence of one or more determinants of research and development not included in the model.

A review of the literature disclosed other possible determinants of research and development. These determinants, as disclosed during the construction of the model, are the productivity of past research and the current availability of research and development projects, the companies' product diversification, the government's expenditures on research and development, the availability or research and development staff, corporate control and corporate management, historical accident and technological advancements, and the state of the economy.

The productivity of research and the current availability of research and development projects affect the level of research and development expenditures as indicated by capital budgeting (5; 3). Past research productivity and the availability of new research projects were studied for the twenty-one companies. This study included a search in the annual 10-K reports and in the financial statements.

Prior to and/or after the accounting change, no substantial qualitative evidence was found that available research projects either declined or increased.

The companies' product diversification was hypothesized by Nelson (4; 6, p. 362) to affect the level of research and development. Since research is so uncertain, especially the search for new knowledge, diversification aids in the application of the discovery for profitable results. Consequently, the breath of research projects in a diversified company reduces the element of overall risks. The twenty-one companies' financial statements and 10-K reports revealed that only two of the twenty-one companies became substantially more diversified during the four-year time period. Diversification in these two companies occurred because of pooling; i.e., a combination with other companies, in 1973 and 1974.

Government expenditures on research and development affect private research and development spending. The effect is greater when the money is a matching grant. Private research and development expenditures generally have a positive correlation with federal research and development expenditures. Federal and private research and development expenditures in dollars increased every year before and after the accounting change in the United States.

Seven of the twenty-one companies disclosed government sponsored research and development activities. Six of these

seven companies reported government sponsored research and development expenditures that were greater after the accounting change than before the accounting change. Thus, private research and development spending in the twenty-one companies that disclosed government sponsored research and development activities was favorably influenced by government expenditures.

The availability of loyal and capable research personnel influences research and development. The human assets of a corporation, particularly in a research intensive industry, are perhaps its most important asset (2). The majority of the twenty-one companies reduced their research and development staff after the accounting change as quantitatively disclosed in 10-K reports. This reduction probably occurred because of cut-backs in research and development expenditures rather than because of the unavailability of capable staff. There was a surplus of research personnel during the two periods. Thus, the availability of research personnel encouraged research and development.

The type of corporate control and corporate management in our large corporations may determine to a great extent the level of research and development expenditures. Stockholders of a firm with widely dispersed stock and no major stockholders may be unknowledgeable about profit and demand short-term results from management; but stockholders

of a firm with closely held stock may be more knowledgeable about profit and desire long-term results from management. Only two companies issued large blocks of stock; i.e., over 10 percent increase in outstanding common stock during the four years as disclosed in 10-K reports. These companies were the same two companies that became more diversified through pooling. Stock ownership and control in the twenty-one companies remained substantially the same before and after the accounting change.

The education of a corporate manager is important. As an example, the replacement of a research physicist by a short-run, profit-oriented manager can rapidly reduce research and development expenditures. The 10-K reports on the twenty-one companies revealed that Textron underwent major changes in management as a result of pooling and diversifying. Occidental Petroleum hired a new research and development director in 1975. The balance of the companies retained either the majority of their executive staff or promoted within their organization between the two time periods studied. Thus, changes in corporate control and management cannot account for the decrease in research and development expenditures after the required accounting change.

Historical accident, by its mere nature, can play a part in research and development expenditures. Technological advancements can occur unexpectedly and thrust a

business firm or industry forward (6, p. 352). No major business firm breakthroughs or barriers in technology were noted in an examination of the firms' 10-K reports.

The state of the economy is the last, perhaps the most important, determinant of research and development expenditures. Economic conditions were very unstable during the time period under study (7), as reflected in the sales, profit and cash flow of the twenty-one companies.

Research and development expenditures decreased 13 percent in the twenty-one companies after the required accounting change, but both federal and private United States expenditures for research and development increased every year over the four-year time period (1).

Summary

The effects of Statement Two on the level of research and development expenditures was investigated using statistical techniques in the twenty-one firms. The relationships between the variables were statistically examined. Research and development expenditures and the independent variables, sales, profit, cash flow and cash plus cash flow are significantly related; i.e., at a 5 percent level, and have a positive correlation with each other.

Next, the group means for all the variables, both before and after the accounting change, were examined to infer the effects of the independent variables on the level

of research and development expenditures. Before the accounting change the mean for sales was 1703; profit, 69; cash flow, 116; cash plus cash flow, 178; and research and development, 60 in millions of dollars. After the accounting change the mean for sales was 2034; profit, 65; cash flow, 129; cash plus cash flow, 199; and research and development, 52 in millions of dollars. Thus, the means of sales, cash flow, and cash plus cash flow increased after the accounting change; but the profit and the research and development expenditure mean decreased after the accounting change. The percentage decline after the accounting change of research and development expenditures compared to sales was 28; cash flow, 15; cash plus cash flow, 23; and profit, 5. Since research and development expenditures declined in both absolute dollar amounts and in percentage amounts, in relationship to the other variables, Statement Two may have, but not necessarily, resulted in reduction in the level of research and development expenditures. This proposition was investigated with covariance analysis.

Covariance analysis was used to remove the effect of the following on research and development expenditures: sales, cash flow, and cash plus cash flow. The dollar amounts of sales, cash flow, and cash plus cash flow increased after the accounting change. The increase in these variables may have caused an increase in the level of

research and development expenditures after the accounting decision. After removing the effect of these variables, the research and development expenditure mean before the required accounting change was sixty-five million dollars, and the research and development mean after the required accounting change was forty-six million dollars; i.e., a decline of 29 percent.

The difference between research and development expenditures before and after the accounting change required by Statement Two is statistically significant at a level of less than 5 percent. Consequently, within the model, one may be 95 percent confident that the accounting change required by Statement Two resulted in a decline in the level of research and development expenditures.

Next, since Statement Two caused a reduction in profits, the probability that profit alone caused a decline in the level of research and development expenditures was tested. The results of this test disclosed a probability of 73 percent that is not significant.

Since the variables, sales, cash flow, and cash plus cash flow, increased and the research and development expenditures and profit variables decreased after the accounting change, the cause of the profit decline was examined in relationship to Statement Two. The reduction in profits caused by Statement Two was estimated on the twenty-one companies. In 83 percent of the companies that reported the

necessary financial data, a decrease in profits occurred as a result of the accounting change required by Statement Two. Therefore, it is established that Statement Two caused a decline in profit in the firms included in the study group.

The lack of statistical support that profit alone caused a change in the level of research and development expenditures in the twenty-one business firms has previously been explained in this summary. However, because of this fact, one may also interpret the results of the statistical analyses as indicating that the level of research and development expenditures between the two time periods, before and after the accounting change, was also significantly affected by exogenous variables, this possibility was considered.

Possible exogenous determinants of research and development are the productivity of past research and the current availability of research and development projects, the companies' product diversification, the government's expenditures on research and development, the availability of research and development staff, the corporate control and corporate management, historical accident, technological advancements, and the state of the economy.

The study of the exogenous variables of research and development expenditures included a search in the annual 10-K reports and in the financial statements. The

investigation revealed that changes in the exogenous variables, product diversification, research and development staff, and government expenditures on research and development, may have supported an increase in company research and development expenditures over the four-year time period. A study of the exogenous variable, research productivity, yielded no evidence that as a group research productivity declined before the accounting change. Nor was any evidence found that after the accounting change available research and development projects decreased. However, the twenty-one firms, as a group, did face increasing competition in the recession of 1974.

In conclusion, the statistical testing and the study of exogenous variables indicated that the level of research and development expenditures may be affected by profits and/or Statement Two. However, none of the results of the tests afford a sound statistical basis for such an inference. Additional library research was undertaken and is discussed in Chapter V.

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CHAPTER V

ADDITIONAL RESEARCH ON THE RELATIONSHIP OF PRIVATE RESEARCH AND DEVELOPMENT EXPEN- DITURES TO ACCOUNTING MEASUREMENTS

Introduction

In this chapter the proposition that Statement Two affects the level and type of research and development expenditures is explored based on library research.

Library research involves the following. First, the process of innovation and the traditional accounting model and investigated for possible conflicts. Second, corporate and/or executive goals are explored in relationship to the traditional accounting model and to its accounting measurements; i.e., sales, profit and liquidity. The accounting measurement of profit is studied in considerable depth because of the impact of Statement Two; i.e., the requirement to currently expense research and development expenditures, on current profits.

The Process of Innovation

A problem of timing between the current expense treatment of research and development expenditures and the process of innovation is present. The process of innovation requires a long-term commitment of research and development funds. Table XVI from a 1973 Batelle Institute

Study (7, p. 12) of the ten most important recent innovations, shows a commitment required for research and development of 19.2 years. McLaughlin, Director of Technological Planning at Ling-Temco_Vought, Inc., (17, p. 17) in a 1970 American Management Study, estimates the average research and development period; i.e., from the original inception to the market place, to be slightly less, approximately fifteen years. As a result, under the current expense treatment required by Statement Two, profits may be affected negatively for approximately fifteen to twenty years.

TABLE XVI
RESEARCH AND DEVELOPMENT GESTATION
PERIOD FOR TEN MAJOR INVENTIONS

	Year of First Con- ception	Year of First Re- alization	Duration Years
Heart Pacemaker	1928	1960	32
Hybrid Corn	1908	1933	25
Hybrid Small Grains	1937	1955	19
Green Revolution Wheat	1950	1966	16
Electrophotography	1937	1959	22
Input-Out Economic Analysis	1936	1964	28
Organophosphorus Insecticides	1934	1947	13
Magnetic Ferrites	1933	1955	22
Video Tape Recorder	1950	1956	6
Average Duration	--	--	19.2

Source--(7, p. 12).

A clash exists between the time involved for the process of innovation and short-term profits. This clash is intensified if research and development expenditures are currently expensed rather than capitalized and amortized over the product market life.

Another conflict between innovation and short-term profits is that of incentives for people engaged in research and development. Seven hundred and ten inventors were questioned about their incentives to invent. The results of this questionnaire are in Table XVII, p. 91. Only 167 inventors out of 710 stated financial gain as their incentive for inventing. Not surprisingly, inventors find it difficult to work in the profit-oriented corporate organization. In a corporate atmosphere, inventors must be left relatively free from short-term profit constraints to do what they desire or the goals of the business firm are not compatible with invention.

The Traditional Accounting Model and Research and Development Expenditures

The accounting model is a short-term motivational model. "Accounting theory follows the concept of periodicity, that is, there is an arbitrary division of the resulting activity, behavior, into specified periods of time which is usually a fiscal year" (23, p. 25). Specifically, the

TABLE XVII
THE INCENTIVES OF
710 INVENTORS*

Motives	No. of Inventors
Love of Inventing	193
Desire to Improve	189
Financial Gain	167
Necessity or Need	118
Desire to Achieve	73
Part of Work	59
Prestige	27
Altruistic Reasons	22
Laziness	6
No Answers	33

*Source: (25, p. 152).

accounting model is used in an attempt to measure the outcome of managements' actions in terms of one year (23, p. 25).

Since the research and development commitment period is fifteen to twenty years, a clash exists between the accounting model and research and development. Under the current expense treatment required by Statement Two, the firm must show an expense for fifteen to twenty years before the product is ready for sale in the market.

The accounting model was originally designed for an agrarian economy. Annual reporting was accurate in an

agrarian economy characterized by manual labor and a static technology. Annual reporting is often inaccurate in an industrialized economy characterized by long-lived capital assets and a rapidly changing technology.

Accounting income is estimated by the matching of expenses and revenues over the appropriate time period. Cost allocation is essential in the matching process. Cost allocations of capital assets over future time periods often are so arbitrary that short-run profit is unreliable. In a rapidly changing technology, the useful lives of capital assets become more difficult to estimate. Technology may render a plant obsolete many years before it wears out. The lives of many assets are thus determined by technological change. The serious problem of cost allocation to determine annual profits becomes more difficult given a rapidly changing technology. Yet, if capital assets are currently expensed, the allocations distort present income even more than capitalization (30). Imagine expensing a multimillion dollar plant during construction. The same effect occurs when intangible assets arising from research and development are currently expensed.

The accounting model is not suited for a business that depends on innovation for its profits. Under the current expense treatment of research and development expenditures required by Statement Two, the problem is intensified. The

result of this conflict is that the level and type of research and development expenditures will be affected if management goals are influenced by the accounting model. The level of research and development may be affected by cutbacks to increase annual profits. The type of research and development expenditures may become short-run to fit the accounting model.

The Goals of the Business Firm and/or the
Corporate Executive and Research and
Development Expenditures

How closely do the goals of the corporation and/or the business executives coincide with the short-term accounting model? This study revealed a clash between the long-term commitment required for research and development and the accounting model. When a positive correlation between corporate objectives and the accounting model is present, the level and type of research and development expenditures will be affected. Consequently, research dollars when currently expensed as required by Statement Two generally may be directed to short-term research and development activities and/or reduced to increase short-term profit.

The goals of a firm and/or of its executives are difficult to determine. The direct executive interview is usually nonproductive. Executives will confirm multiple goals; i.e., maximize sales and profit and minimize costs at the same time. Usually these goals cannot be accomplished

together. The executive must choose between goals. Both short-term and long-term profits cannot be maximized (1, p. 319). For example, when currently expensed research and development expenditures are reduced, they increase short-term profits but decrease long-term profits.

Baumol (27, p. 234) argues that instead of maximizing profits, either short-run or long-run, firms with market power tend to maximize sales, subject only to the condition that profits do not fall below some specified minimum value.

Baumol hypothesizes several reasons for the maximum sales objective: bank loan officers look favorably on increasing sales in granting loans, personnel problems are decreased when sales are sufficient because of fewer manpower cutbacks, and firms with a greater share of the market can be more competitive. Most important, Baumol asserts that executive salaries and prestige are more associated with sales than with profits (27, p. 234). Baumol is more optimistic about management's long-term objectives than most researchers (7; 11; 14; 24), but he asserts that management turns to short-term profits in a profit squeeze.

Raby believed that when research and development is currently expensed, the incentive is present to improve current earnings during a recession by a cutback on research and development expenditures (24, p. 56). The reaction of corporate management to research and development expenditures

in a profit squeeze is vividly described by Laserson and Sperling in a 1972 American Management Association study.

Divisional management, faced with a short-term profit squeeze, cuts research and development and relies on the corporate effort to provide it with the new products needed when recovery comes. Corporate management similarly squeezed, decides that all research and development efforts that do not have short-term payoffs must be curtailed, and relies on the divisions to carry the ball (14, p. 13).

Consequently, research and development expenditures are left without support and are cut more than is intended.

Crystal, in a 1970 American Management Association study states, ". . . most companies incentive plans, unfortunately, are oriented toward the accomplishment of such short-range goals as current profits . . ." (6, p. 28).

Crystal reasons that short-term goals are dominate because of annual reporting to the shareholders, but planning based on the annual report was not valid because management decisions should pertain to more than one year (6, p. 30).

Dean, a former director of research of a major corporation and now head of a company that depends on innovation for its profits, states, "With the short-term horizon of contemporary U. S. management, stimulated by stock options, management is encouraged, nay forced, to look at short-term profits only" (7, p. 13). As noted by Dean,

. . . the sales department of a major manufacturer of heavy industrial equipment recently

oversold their production capacity. The Division Manager, under the gun of this year's profits, went on a cost-cutting binge. He laid off some 25% of the design engineering department, at a time when the design load was already excessive, in order to save enough expense to guarantee a profit this year (7, p. 13).

This type of tunnel vision is characteristic of a short-term profit oriented financial manager.

A few years ago, Anaconda Corporation sold timber resources valued at hundreds of millions of dollars for a fraction of what the resources were worth to boost short-term profits and cash flow. The timber lands were valued on the balance sheet at historical cost. Sales price greatly exceeded historical costs. Thus, short-term profit was increased. Three years ago, Anaconda Corporation expended six million to seven million dollars for research and development and other capital expenditures on the Butte, Montana copper deposits when copper prices were favorable and short-run profitability was high. Now, with the profitability down due to low copper prices, the whole facility may be shut down. Little research and development is presently being undertaken.

Other articles on budgeting relating research and development expenditures to profitability are available. Nieman considers short-run profit an important variable in research and development expenditure decisions. He calls the clash between long-term research and development

expenditure decisions and short-term profits, "managerial myopia" (21, p. 50). Managerial myopia is, ". . . perhaps the most common pitfall in research and development administration . . ." and results in the ". . . trading off of long-range goals for short-term gains" (21, p. 50). The demand for immediate results is a constant pressure and frequently conflicts with long-run objectives. Thus, short-run profits do have an impact on research and development expenditures.

Merrifield, Usry, Hess, Raby and Dean (18; 31; 24; 7) all note the clash between short-term profit and research and development expenditures. Merrifield, Vice President of research development in Hooker Chemical Corporation, states ". . . in the interest of bottom line press and short-term results . . . there is a failure . . . to maintain personal growth and development of our present technical people . . ." (18, p. 33).

Executive short-run incentive plans have an effect on the cost allocations within companies. An example is a large conglomerate that was experiencing low profits with one of its subsidiaries. "By tying managers' incentives to their current return on gross assets, the firm may have inadvertently discouraged them from spending enough on research and development" (6, p. 27).

Gee of the Dupont Chemical Company says,

All too often there are only two criteria that govern what a corporate research organization spends next year: what was spent last year and what was the general level of corporate profitability. If it was highly profitable, the tendency is to increase the research organization. If it was not so profitable, we have a holding period and try to have only minimum increases in staff (11, p. 220).

These criteria, the general level of corporate profitability and what was spent last year, are extremely poor guides for research and development decision making. The gestation period of research and development is long-run. Consequently, short-term results should not be used to make long-run decisions. The high profitability of a past decision on a product line should not be used as a basis for current decisions. Products and product lines change over time and so does the make-up of the research and development staff (11, p. 220).

The corporate financial manager must also consider the effect of a drop in short-term profits on floating new equity capital. A reduction in short-term profits may cause a decline in stock prices. This decline in stock prices may result in a loss of investor interest in new issues of securities.

The type of research and development, as well as the level of the expenditures, is affected by short-term profits. Dean emphasizes what he calls a "temporal mismatch . . . between . . . innovations pace versus managements time horizon" (7, p. 12). Top management view is short-run, generally one year, sometimes three years, and seldom five years. This

short-run management view exists because, ". . . boards of directors have become minions of the stock market and . . . because our business schools have taught that profit is all . . . and because profit has been read as short term profit (i.e., this year's profit)" (7, p. 12). The "temporal mismatch" noted by Dean affected the type of research and development in an electronics firms. "Since each manager was evaluated on the basis of the profitability of his plant, the managers chose the products that were easiest to make--those already in production with high yields. Only reluctantly would the managers start new products (6, p. 27).

The impact of this "mismatch" has been increased through capital budgeting. Capital budgeting has rapidly grown in importance during the last fifteen years. Most management journals now include articles on capital budgeting for research and development. Mullins criticizes the capital budgeting approach because the estimated rate of return is very arbitrary. As a result, other things being equal, a short-term project will almost always appear more attractive than a longer range research and development program. Mullins states that scientists and engineers have long opposed capital budgeting for research and development for this reason.

Scientists and engineers argue that R & D expenditures cannot be handled as part of the conventional capital budgeting process because economic evaluation of R & D project proposals is impractical . . . but . . . most financial managers, on the other hand, resist allocation of funds without substantial justification (19, p. 45).

Furthermore, long-term research and development commitments can be replaced by low risk priority projects to assure self protection and survival of corporate management; but this short-run emphasis on research and development has a disastrous effect on the lives and loyalties of creative people, making it difficult to obtain a good new research and development staff when the business has a history of research and development fluctuations (19, p. 45).

Raby gives further support that capital budgeting is so arbitrary that short-run projects appear more profitable than long-term commitments.

We find a wide range of rates, and very frequently the only reason a particular rate of return seems to have been chosen by a particular company is that the financial data available to it indicates that this is an average rate of return on investment for the industry. This doesn't necessarily mean anything, because the rate of return achieved and the rate of return sought for are never going to be the same, anyway (24, p. 56).

Again, the impact of various types of research is apparent. The short-term project will almost always appear more profitable under these circumstances, assuming other factors balance out.

Four primary determinants of research and development expenditures are listed in an editorial in Managerial Accounting (3, p. 375). These determinants are a percentage of present or expected profits for the next year, a

percentage of sales, cash resources available, and an amount determined by past experience.

Concerning the sales criterion, Dearden (8) describes a typical research budgeting system. This total system includes a research committee composed of the president, executive vice president, marketing vice president and research director. Within this group the total amount of research and development is determined by using percent of sales criteria. Dearden believes this to be the ". . . worst possible arrangement . . ." that is, ". . . to relate research expenditures to annual sales volume" (8, p. 23).

Sandretto (26, p. 30), Past Vice President and Technical Director of the International Telephone and Telegraph Company, used a variation of the percent of sales technique. However, he modified this technique by considering the desirability of available research and development projects.

Mansfield (15, p. 62) believes firms are prone to maintain an unfluctuating ratio between research and development expenditures and sales, but over the long-run an attempt to modify this ratio is based on the profitability of research and development.

Interviews conducted with executives support the notion that sales is a major determinant of research and development expenditures. Many business managers suggest using a percent of sales as a determinant of the total

research and development budget, as revealed in a 1956 National Science Foundation Study (13).

Liquidity is another important accounting variable that affects the level of research and development expenditures. A National Science Foundation study disclosed that small businesses are forced to emphasize short-term research and development because of liquidity. Small firms, because of capital limitations, concentrate more on development and short-term payoff and less on basic research (28). Also, a 1972 study (14) of 242 companies disclosed that 113 of these companies reduced research and development expenditures in relationship to other activities over a three year time period. One of the primary reasons given for the cutbacks was liquidity. Additional support for liquidity as a determinant of research and development expenditures is given in a 1975 report (28, p. 22) from the Commerce Department. The report lists liquidity as one of the main reasons for reductions in private research and development.

Peters, in an American Management Association Study, states,

Even in boom periods, the different portions of the organization will be competing for a limited amount of funds. In periods when the organization is cutting back, those units with quantifiable outputs will certainly win out over any creative group when it comes to a contest for funds (22, p. 71).

The creative group to which Peters refers is the research

and development group. Complicating the problem, liquidity has decreased in recent years. The average corporate debt to equity ratio doubled from 1964 to 1971 (4, p. 19).

From the preceding research, short-term profit, sales, and liquidity influence the level and type of research and development expenditures. Research and development expenditures may decrease as these variables decline, particularly profits. However, some very profitable companies do increase research and development in profitable years to provide a hidden reserve of new products and processes. Texas Instruments has done this in the past.

The type of research and development is becoming a function of short-term objectives. A survey by McGraw-Hill revealed that the major objective of private industry in research and development is product improvement and the development of new products. Forty-five percent of the respondents of the survey list their major research and development objective as new products, 41 percent list the improvement of old products, and only 14 percent list the development of new processes (27, p. 349).

Summary

Using library research, this chapter explored the proposition that Statement Two affects the level and type of research and development expenditures. The research and

development process and the accounting model were investigated for possible conflicts.

A strong clash exists between the research and development process and the accounting model. The average commitment period for research and development is fifteen to twenty years; but the accounting model is designed for one year.

The accounting model is used in an attempt to measure the outcome of management actions annually. Annual results of management activities are evaluated by the matching of expenses and revenues. In the matching process, cost allocation is essential. Cost allocations of capital assets such as research and development and/or plant and equipment in a rapidly changing technology are often so arbitrary that annual reporting becomes distorted. When research and development expenditures are capitalized, the allocations over future time periods are difficult; but when currently expensed, the allocations distort annual income even more than capitalization.

The result of the conflict between research and development and the accounting model is that the level and type of research and development will be affected if management objectives are influenced by the accounting model. The level of research and development will be affected by cut-backs to increase annual profits. The type of research and

development will become short-run to fit the accounting model.

American Management Association and other research studies support the proposition that most company incentive plans and/or corporate objectives emphasize annual or short-term profits. Even the most optimistic of studies place management objectives somewhere between short-term and long-term profit, providing a minimum profit level is maintained. Management objectives relate very closely to short-term profits, particularly during a profit squeeze. Consequently, research and development tends to become a function of short-term profits.

This phenomena is intensified by the current expense treatment of research and development expenditures as required by Statement Two. When research and development expenditures are capitalized, the effect on current profits is removed to some extent. The majority of private research and development in the United States is for new product development and product improvement. Only ten large corporations carry on the bulk of all private basic research.

The budgeting of research and development was then specifically examined. It was found that budgeting techniques involve the variables included in the model of this study.

Library research supports the proposition that the level and type of research and development is affected by Statement Two. Research and development expenditures may have been reduced to offset the effect of Statement Two and the economic recession on annual profits. Furthermore, over time, the type of research and development may tend to become short-run to minimize the negative effect on short-term profit.

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CHAPTER VI

SUMMARY

Research and development is the most important asset in the economy. Solow estimates that 90 percent of the per capita increase between 1909 and 1949 was caused by technological change. Only a low percentage was caused by an increase in capital. The Committee for Economic Development did a similar study for the period 1929 to 1957. Approximately 36 percent of the increase in output per worker in the United States is caused by research and development; 42 percent, by increased education; and only 9 percent, by capital intensiveness.

The total national expenditure for research and development in 1974 is estimated at 32.1 billion dollars. Of this amount, 13.2 billion dollars was provided by private industry. Due to the large expenditures on private research and development and the diversity in financial reporting for this important cost, Statement Two of the Financial Accounting Standards Board was promulgated. Yet, no significant research was undertaken by the Financial Accounting Standards Board prior to its decision. Statement Two requires the treatment of research and development

expenditures as a current expense. Prior to Statement Two, business firms had the option of either currently expensing or capitalizing research and development expenditures.

Short-term profit is one of the objectives of the corporation; i.e., at least annual profits must be maintained at an acceptable level. Thus, management may cut certain expenditures that have a short-run negative effect on profits. However, capitalization and future amortization of these costs reduces this negative impact on current profits. Research and development expenditures are an example of a cost wherein the accounting method adopted affects current profits. If research and development expenditures are currently expenses, current profits are reduced; but if research and development expenditures are capitalized and amortized over future time periods, current profit is unaffected.

The effect of cutting back on research and development expenditures during a recession may be detrimental to the growth of the business firm and to the economy as a whole. The recent Financial Accounting Standards Board decision on research and development expenditures offers a unique opportunity to study this problem. Furthermore, only recently has research and expenditure data been available. Starting in 1972 the Securities Exchange Commission and the Accounting Principles Board require the disclosure of the

dollar value of research and development expenditures in published reports.

The promulgation of Statement Two in 1975 does away with the flexibility to expense or capitalize research and development expenditures. The effect of the decision by the Financial Accounting Standards Board may decrease short-run profits for some firms in the year of the accounting change and in future years. These firms may react to this decision by reducing research and development expenditures so that present profit is unaffected. Thus, technological progress may be retarded in these firms in the year of the accounting change and in later years because of the immediate impact on short-run profits.

The primary objective of this study was to gain a greater understanding of how the level and type of research and development expenditures are influenced by accounting measurement, if at all. To accomplish this primary objective, the following proposition was considered: The level of research and development expenditures fluctuates directly with the accounting measurements of profit and cash flow from operations. If this relationship exists, research and development expenditures will fluctuate in the short-run with these accounting measurements. Budgeting of research and development expenditures, therefore, will be on a short-term basis and may lead to undue emphasis

on products and processes as opposed to projects requiring a long-run budgetary commitment. To test the existence of the proposed relationship the following steps were taken:

1. to establish that research and development expenditures are material items among a large segment of the business firms;
2. to study the effect of the accounting change required by Statement Two of the Financial Accounting Standards Board on the level of research and development expenditures in the firms included in the study; and
3. to study the economic and accounting literature regarding the budgeting of research and development expenditures.

Overview of the Study

The study involves a review of the literature on research and development cost behavior and the accounting treatment of these costs for financial reporting purposes. A model consolidating research and development expenditures and the most important accounting variables is developed. The model provides a framework to analyze the relationship of Statement Two of the Financial Accounting Standards Board to the level of research and development expenditures. The model includes the accounting change required by Statement Two, profit, sales, liquidity, and research and development expenditures.

Following the development of the model, the companies to be studied are selected. Annual financial reports were requested from 650 of the largest non-financial corporations

in the United States in a previous study. These 650 corporations consisted of Fortune's top 500 industrials and top fifty transportation, retailing and utilities corporations. Four hundred of these 650 companies furnished the required information. In addition to these financial reports, Securities Exchange Commission Form 10-K and Compustat data on research and development expenditures are utilized for these 400 companies. One hundred and eighty-two of the 400 companies satisfied established criteria.

A comparison of research and development with profit, sales and cash flow for 1974 in these 182 companies is done to determine the materiality of research and development expenditures. Then a search in the financial statements of the 400 companies is made to determine which companies disclosed a change in accounting for research and development in 1974 and 1975. Twenty-one companies disclosed a change from capitalizing research and development costs to current expensing of these costs, as a result of Statement Two.

Research and development was found to be a material expenditure in the twenty-one companies that changed accounting methods as a result of Statement Two.

The proposition that the accounting change required by Statement Two resulted in a decline in the level of research and development expenditures in the twenty-one companies is

tested. Coefficient of correlation and one-way covariance analyses are utilized to analyze the model. After statistical testing, the effect of Statement Two on profits is estimated and exogenous variables were discussed. Then the proposition that Statement Two affects the level and type of research and development expenditures is explored in greater depth with library research.

Results of the Study

Individual business firms' information on the materiality of research and development expenditures in relationship to accounting measurements was available only after some involved computations. Results of these computations disclose the materiality of research and development compared to sales, profit, and cash flow for 182 corporations in 1974. These companies account for approximately 68 percent of all private research in the United States. Research and development expenditures in the 182 corporations are approximately 1.7 percent of sales, 32 percent of profit, and 23 percent of cash flow.

The materiality of research and development in comparison to sales, profit, and cash flow in each of the 182 corporations was computed for the year 1974. Over 80 percent of the business firms spent a material dollar amount on research and development; i.e., 9 percent or more of profit. Furthermore, 61 business firms spent 50 percent or more of

profit, and 91 business firms spent 100 percent or more of profit for research and development. Seventy-three business firms spent more than 1 percent of sales, and 98 business firms spent more than 12 percent of cash flow for research and development. Therefore, expenditures for research and development are material in relationship to accounting measurements when a 5 percent criterion is utilized.

Since research and development expenditures are significant in financial reporting, the historical accounting treatment of this important cost was investigated. Historical research revealed that early accounting organizations, the Internal Revenue Service and accounting practice, supported capitalization and future amortization of research and development expenditures. However, economic and social forces pressured for immediate write-off of research and development for income tax advantages.

The Internal Revenue Service yielded to these forces but required that research and development costs be currently expensed in published financial statements when immediate write-off for tax purposes was to be allowed. This tax law was reversed in 1954, but the current expensing technique had already become institutionalized into accounting thought because of the impact of tax policy on public reporting. A survey of 244 companies in the 1960's

disclosed that the common practice was to currently expense research and development expenditures.

Auditors who examined published financial statements supported the established practice of currently expensing research and development costs. The difficulty in measuring future benefits of the expenditures and the lack of tangible, physical evidence were the main reasons given for this support. Although extremely important to the long-term profit of a business firm, research and development expenditures are not tangible assets like plant and equipment. Thus, the capitalization of research and development costs is difficult to justify in the eyes of the public. Also, public distrust was warranted by cases in which these costs were capitalized when the available evidence did not support a future benefit. Subsequently, when it became apparent that the capitalized costs had no future benefit, a quick write-off caused a drastic reduction in current profit and a decline in stock prices.

The problem of profit distortion had to be solved. Relying on established practice and a limited amount of research, the Financial Accounting Standards Board authored Statement Two in 1974. Statement Two requires that private research and development expenditures be currently expensed.

The troublesome problem of whether to capitalize or to expense research and development costs was temporarily solved. At least no more quick write-offs of past

capitalized research and development costs would cause drastic declines in current income and in the stock market.

Statement Two was pragmatically designed to temporarily handle a current problem. The decision is not supported by accounting theory. Uniformity in the accounting of research and development costs was established simply by requiring all firms to expense research and development in the year incurred. No research was apparently undertaken by the Financial Accounting Standards Board to consider what effect the established practice would have on the dollar amount and type of private research and development in the United States. No research was undertaken by the Financial Accounting Standards Board to determine, if possible, to what extent research and development is becoming a function of current profits as a result of the current expense treatment.

Statement Two became effective in 1975 and the Securities Exchange Commission has required the disclosure of research and development expenditures since 1972. The unique opportunity existed to test the relationships between research and development costs and other accounting measurements over the four-year time period. A statistical analysis was done because the current expense treatment required by the Financial Accounting Standards Board may affect the level and type of research and development expenditures.

The variables, sales, profit, and liquidity, in the theoretical model are significantly related to and have a positive correlation with research and development expenditures over the four years. Within the model one may be 95 percent confident that the accounting change required by Statement Two resulted in a decline in the level of research and development expenditures in the twenty-one companies. In dollars, research and development expenditures declined 13 percent after the accounting change. In relationship to the other variables, sales, profit, and liquidity, research and development declined 29 percent after the accounting change.

The means of sales, cash flow, and cash plus cash flow increased after the accounting change; but both the profit and the research and development expenditure mean decreased after the accounting change. Since Statement Two caused a reduction in profits, the probability that profit alone caused a decline in the level of research and development expenditures was tested. The results of this test disclose a probability of 73 percent at the 5 percent level which is not significant.

In conclusion, the statistical testing indicates that the level of research and development expenditures may be effected by Statement Two. However, none of the results of such tests afford a sound statistical basis for such an

inference; i.e., that Statement Two and/or profits affected research and development expenditures.

One may interpret the result of this analysis as indicating that the level of research and development expenditures between the two time periods; i.e., before and after the accounting change, was also significantly affected by exogenous variables. The study of the exogenous variables affect of the level of research and development expenditures included a search in the annual 10-K reports and in the financial statements. The investigation revealed that changes in the exogenous variables, product diversification, research and development staff, government expenditures on research and development, may have supported an increase in company research and development expenditures over the four-year period. Also, no evidence was found that changes in research productivity or available research projects occurred over the four year time period. The twenty-one firms, as a group, did face increasing competition in the recession of 1974.

A reasonable conclusion is that a reduction in profit caused by both Statement Two and the business recession resulted in a decline in the level of research and development expenditures after the required accounting change. Since it could not be statistically established that profit alone caused a decline in the level of research and

development expenditures after the required accounting change, additional library research was undertaken.

The process of innovation and the accounting model were investigated through library research for possible conflicts. A strong clash exists between the accounting model and the research and development commitment. The average commitment period for research and development is 15 to 20 years, but the accounting model is designed for annual reporting. Specifically, the accounting model is used in an attempt to measure the outcome of management actions in terms of one year. Management activities are evaluated by the matching of expenses and revenues over the appropriate time period. Cost allocation is essential in the matching process. Cost allocations of capital assets such as research and development and/or plant and equipment in a rapidly changing technology are often so arbitrary that annual reporting becomes difficult. When research and development expenditures are capitalized, the allocations over future time periods are difficult; but when currently expensed, the allocations distort annual income even more than capitalization.

The result of the conflict between research and development and the accounting model is that the level and type of research and development will be affected if management goals are influenced by the accounting model. The level

of research and development may be affected by cutbacks to increase annual profits. The type of research and development may be affected by cutbacks to increase annual profits. The type of research and development will become short-run to fit the accounting model.

The American Management Association and other research studies support the proposition that most company incentive plans and/or corporate goals emphasize annual or short-term profits. Even the most optimistic of studies places management objectives somewhere between short-term and long-term profit, providing a minimum profit level is maintained. Thus, management goals relate very closely the accounting model, particularly during a profit squeeze. Consequently, research and development tends to become a function of short-term profits.

This phenomena is intensified by the current expense treatment of research and development expenditures as required by Statement Two. If research and development expenditures are capitalized, the effect on current profits is removed to some extent. Eighty-six percent of private research and development in the United States is for new product development and product improvement. Only ten large corporations conduct the bulk of all private basic research.

The budgeting of research and development was then specifically examined. Budgeting techniques involve the variables included in the model of this study. These variables are sales, profit, and liquidity.

Library research supports the proposition that the level and type of research and development is effected by Statement Two. The effects of Statement Two and the economic recession on annual profits may have resulted in a reduction of research and development expenditures. Furthermore, over time, the type of research and development may tend to become short-run to minimize the negative effect on short-term profit.

Recommendations

The Financial Accounting Standards Board should reconsider its decision to currently expense private research and development expenditures. Because research and development is most important for the growth of the United States' economy and because of the need for a long-term commitment of funds, research and development expenditures should not be a function of current profitability during business recessions and/or during times of prosperity.

Research should be **undertaken to** establish criteria for capitalizing research and development expenditures. The life of research and development expenditures should either be estimated or a reasonable alternative be developed.

Research and development is an expensive and difficult undertaking. An acceptable accounting treatment for research and development expenditures will occur only after an in-depth understanding of possible alternatives.

APPENDIX A

RESEARCH AND DEVELOPMENT, SALES, PROFIT,
AND CASH FLOW ANALYSIS FOR 182 UNITED
STATES CORPORATIONS IN 1974

TABLE XVIII
SALES, PROFITS AND CASH FLOW FOR 182
UNITED STATES CORPORATIONS

Company #	Industry Code*	1974 (000) thousands omitted		
		Sales **	Profit**	Cash Flow***
1	3740	\$ 539294	\$ 28776	\$ 25583
2	3670	482107	46226	16053
3	2835	765414	55009	(16214)***
4	2803	568471	39772	101031
5	2803	762703	32820	89255
6	2803	757504	33417	14339
7	5411	1027598	104	(533)
8	3334	2750440	173110	357650
9	3221	2657948	100137	118516
10	2801	1779872	146468	158161
11	3711	2023069	27546	89357
12	4811	26174412	3169946	7957791
13	3679	281358	4106	(2457)
14	2062	1046890	31411	59367
15	3331	1672724	106757	138473
16	3221	410980	16304	16404
17	2290	887166	377809	4521
18	3714	283080	4163	(7161)
19	7392	240373	4832	12476
20	9997	628432	(20687)	(17193)
21	2844	1260292	111755	100413
22	2837	466284	362288	26296
23	2837	411440	28548	(4964)
24	3861	465624	15610	(4155)
25	3714	2487800	75800	111000
26	3310	5448709	342034	772499
27	3550	641971	44569	(43776)
28	2020	3264502	83845	63440
29	3560	317852	25873	10349
30	2836	1590949	120403	39161
31	3948	785569	36934	(37820)
32	2200	23279971	99541	153472
33	2030	1468199	85365	50301
34	2020	1899353	79661	(7681)
35	3531	4082100	229200	80300

TABLE XVIII--Continued

Company #	Industry Code*	1974		
		(000) thousands omitted		
		Sales**	Profits**	Cash Flow***
36	2070	1749304	31572	(16391)
37	2844	561257	43611	(7827)
38	2912	2846600	203800	420700
39	3531	1421315	50064	(68584)
40	2086	2522150	195972	167809
41	2841	2615448	104160	(23277)
42	3511	1428028	40184	49600
43	2200	435337	15347	33943
44	2912	7365189	327609	603492
45	3570	1101142	(31398)	(34976)
46	3560	402911	23550	5028
47	3210	1050962	48125	80607
48	2600	1797353	124791	118656
49	1000	423958	54038	80851
50	2200	58050	7043	21817
51	2801	4938483	587386	51911
52	2801	6972200	403500	387300
53	4922	1251363	73009	272766
54	2899	1027617	74297	51154
55	3550	398428	18789	18534
56	3531	2105196	80887	46827
57	3670	395552	27032	37615
58	3430	336752	(10765)	(32651)
59	3000	3705052	154025	259532
60	2950	484858	14725	26653
61	3711	23620600	360900	599800
62	3999	948809	32493	(6491)
63	3721	1968416	51623	85757
64	2000	3001829	119480	55360
65	2000	2000103	75137	(6806)
66	3711	31670637	950069	1708563
67	4811	2841850	309206	655284
68	2000	286839	11122	14766
69	2844	1246422	87739	(20175)
70	3000	1975244	55867	61794
71	3000	5292934	157461	155670
72	2801	3497644	130558	80811
73	3721	1129796	29329	(51702)
74	2913	18216000	1065000	2261000
75	3311	505418	25398	26165
76	2801	1525489	93654	56891

TABLE XVIII--Continued

Company #	Industry Code	1974		
		(000) thousands omitted		
		Sales**	Profit**	Cash Flow***
77	3825	892785	84022	151849
78	3560	367236	19055	(18023)
79	3573	2628606	72170	228397
80	3714	320180	18184	14172
81	3560	1415076	101112	32416
82	3570	13016081	1837639	3661437
83	3713	5012753	117929	(50400)
84	2600	3095000	262600	393300
85	9997	11154401	451070	634567
86	3270	245040	9059	(5273)
87	2950	1117867	50613	47970
88	3550	400343	18330	(14755)
89	3332	1768084	104348	158871
90	2000	1020647	72031	56331
91	9997	1107167	39921	33542
92	2600	1463975	95252	85265
93	3531	380124	5373	(39446)
94	2803	914184	47781	26120
95	3679	658091	20055	23020
96	2111	761774	28495	23290
97	9997	4800329	85692	(75416)
98	9997	3029873	(14715)	15430
99	3721	3279100	23200	110600
100	2200	551618	10600	5600
101	3310	1826106	120954	221196
102	3714	256336	3968	9153
103	3721	1220650	80801	173409
104	3721	3317869	106684	(7036)
105	3610	909598	17137	(22464)
106	2835	1329550	210492	157378
107	2836	386167	9300	(3538)
108	3861	2965716	301739	33363
109	2510	551038	6161	6322
110	2801	3497900	323200	325200
111	3350	1497900	77921	77659
112	2052	1793049	45458	5984
113	2899	282799	27106	17914
114	3570	1979003	87165	(3234)
115	2085	1430103	89677	83809
116	2950	589345	27601	20755

TABLE XVIII--Continued

Company #	Industry Code	1974		
		(000) thousands omitted		
		Sales**	Profit**	Cash Flow***
117	3430	393025	11518	20863
118	3721	4453800	130300	(238600)
119	3721	861897	18136	87921
120	3291	565710	25118	(10048)
121	1311	5578189	280667	282850
122	2802	1260000	59480	53177
123	2010	972438	29791	44711
124	3550	480142	16704	(7786)
125	3430	840290	34671	49747
126	3221	2164181	83472	180964
127	3210	1776715	93728	110781
128	2082	562295	18330	281955
129	2835	1571887	135267	53479
130	2912	5105720	402138	767457
131	2000	1008176	28309	88823
132	3570	446644	25131	56667
133	3861	757296	28387	(39489)
134	3740	1425587	41332	(29082)
135	2899	409412	16453	8770
136	2000	1229852	39878	(19700)
137	3600	4626900	113300	463300
138	3670	1928854	57751	15905
139	2802	483724	24708	43368
140	3350	520356	17151	13747
141	3531	492739	17741	41075
142	3334	2045852	111132	133846
143	3725	419915	3234	(12356)
144	3550	336112	(5616)	(18149)
145	2600	1503425	105020	118596
146	2082	1023991	49982	46491
147	2600	1125553	69435	71986
148	3630	655283	14878	21312
149	2912	8492967	620539	1157918
150	3714	289860	7601	(36003)
151	2850	804259	29279	22410
152	9997	1679889	64419	62952
153	3714	567741	482	6730
154	2046	624932	15048	36589
155	2000	1775622	55932	22904
156	2913	18775207	970018	1483578
157	2912	10156428	970266	1472474

TABLE XVIII--Continued

Company #	Industry Code	1974 (000) thousands omitted		
		Sales**	Profit**	Cash Flow***
158	2913	45821124	3142192	4354350
159	3429	491869	17411	17789
160	3630	739879	31365	(439)
161	3540	456751	18780	10211
162	2837	495674	22436	(9565)
163	3714	2506019	100930	64178
164	3430	579542	28738	28790
165	2913	23993781	1586441	1804002
166	3679	1572487	89621	102803
167	9997	2113754	105904	3604
168	3721	313358	18033	26960
169	2912	4786988	288003	732806
170	3000	2309333	48630	143368
171	3350	825093	27752	(23668)
172	2835	805744	69105	18656
173	3825	293005	7272	(2081)
174	3295	438216	29972	43476
175	2300	323366	9089	1522
176	3661	7422534	310633	349491
177	3600	5838118	99132	614644
178	3630	1627693	24946	62644
179	3630	1022015	38476	(20057)
180	3713	1402977	22564	(46026)
181	2803	561757	23694	22292
182	3651	914496	11955	(55973)
Total	----	\$518570510	\$28389507	\$40473976

*SIC Industry Guide.

**Annual Financial Reports.

***Computed from data in Annual Financial Reports.

****Annual 10-K Reports.

*****"--" indicates negative.

TABLE XIX
RESEARCH AND DEVELOPMENT AS A PERCENT
OF PROFIT, CASH FLOW, AND SALES
FOR 182 UNITED STATES
CORPORATIONS

Company #	Research and Development*	1974 Research and Development as a Percent of		
		Profit**	Cash Flow**	Sales**
1	\$ 3,273	11.374	12.794	.607
2	46,000	99.511	286.551	9.541
3	42,199	76.704	260.263	5.513
4	11,218	28.206	11.104	1.973
5	10,943	33.342	12.260	1.435
6	15,714	47.024	109.589	2.074
7	299	287.500	(56.098)	.029
8	43,023	24.853	12.029	1.564
9	33,336	33,290	28.128	1.254
10	58,806	40.149	37.181	3.304
11	35,299	128.146	39.503	1.745
12	189,882	5.990	2.386	.725
13	16,405	399.537	(667.684)	5.831
14	1,373	4.371	2.312	.131
15	3,799	3.559	2.743	.227
16	5,280	32.385	32.187	1.285
17	20,220	5.351	447.246	2.279
18	6,500	156.137	(90.769)	2.296
19	2,055	42.529	16.472	.855
20	15,091	(72.949)	(87.774)	2.401
21	14,591	13.056	14.531	1.158
22	21,384	58.929	81.320	4.586
23	15,748	55.163	(317.244)	3.828
24	21,171	135.625	(509.531)	4.547

TABLE XIX--Continued

Company #	Research and Development	1974 Research and Development as a Percent of		
		Profit	Cash Flow	Sales
25	\$ 76,299	100.658	68.738	3.067
26	32,259	9.432	4.176	.592
27	12,482	28.006	(28.513)	1.944
28	11,830	14.109	18.648	.362
29	2,500	9.663	24.157	.787
30	54,603	45.350	139.436	3.432
31	22,108	59.858	(58.456)	2.814
32	6,000	6.028	3.910	.258
33	12,779	14.970	25.445	.870
34	5,599	7.029	(72.894)	.295
35	143,899	62.783	179.202	3.525
36	2,500	7.918	(15.252)	.143
37	4,152	9.521	(53.047)	.740
38	12,299	6.035	2.923	.432
39	21,005	41.956	(30.627)	1.478
40	6,701	3.419	3.993	.266
41	28,869	27.716	(124.024)	1.104
42	26,808	66.713	54.048	1.877
43	1,134	7.389	3.341	.260
44	35,299	10.775	5.849	.479
45	64,200	(204.472)	(183.554)	5.830
46	3,119	13.244	62.033	.774
47	37,627	78.186	46.680	3.580
48	6,930	5.553	5.840	.386
49	7,922	14.660	9.798	1.869
50	784	11.132	3.594	1.351
51	148,664	25.309	286.382	3.010

TABLE XIX--Continued

Company #	Research and Development	1974 Research and Development as a Percent of		
		Profit	Cash Flow	Sales
52	\$ 344,099	85.279	88.846	4.935
53	6,356	8.706	2.330	.508
54	25,245	33.978	49.351	2.456
55	6,896	36.702	37.207	1.731
56	52,433	64.823	111.972	2.491
57	36,441	134.807	96.879	9.231
58	4,607	(42.796)	(14.110)	1.368
59	50,839	33.007	19.589	1.372
60	799	5.426	2.998	.165
61	824,899	228.567	137.529	3.492
62	15,577	47.940	(239.978)	1.642
63	20,649	40.000	24.079	1.049
64	31,276	26.177	56.496	1.042
65	22,903	30.482	(336.512)	1.145
66	1,369,564	144.154	80.159	4.324
67	95,426	30.862	14.563	3.358
68	2,796	25.139	18.935	.975
69	29,304	33.399	(145.249)	2.351
70	39,599	70.881	64.082	2.005
71	114,962	73.010	73.850	2.172
72	31,406	24.055	38.864	.898
73	12,685	43.251	(24.535)	1.123
74	54,000	5.070	2.388	.296
75	1,342	5.284	5.129	.266
76	30,020	32.054	52.768	1.968
77	70,684	84.126	46.549	7.917
78	4,964	26.051	(27.543)	1.352

TABLE XIX--Continued

Company #	Research and Development	1974 Research and Development as a Percent of		
		Profit	Cash Flow	Sales
79	170,156	235.771	74.500	6.473
80	4,799	26.391	33.863	1.499
81	45,401	44.902	140.057	3.208
82	889,792	48.420	24.302	6.836
83	119,706	101.507	(237.512)	2.388
84	15,699	5.978	3.992	.507
85	195,000	43.231	30.730	1.748
86	1,375	15.178	(26.076)	.561
87	18,806	37.156	39.204	1.682
88	10,822	59.040	(73.345)	2.703
89	10,918	10.463	6.872	.618
90	4,828	6.703	8.571	.473
91	8,199	20.538	24.444)	.741
92	17,608	18.486	20.651	1.203
93	8,199	152.596	(20.785)	2.157
94	6,718	14.060	25.720	.735
95	11,188	55.787	48.601	1.700
96	3,149	11.051	13.521	.413
97	21,599	25.205	(28.640)	.450
98	46,734	(317.594)	302.878	1.542
99	42,000	181.034	37.975	1.281
100	1,069	10.085	19.089	.194
101	3,491	2.886	1.578	.191
102	4,200	105.847	45.887	1.638
103	4,000	4.950	2.307	.328
104	139,460	130.723	(1,982.092)	4.203

TABLE XIX--Continued

Company #	Research and Development	1974 Research and Development as a Percent of		
		Profit	Cash Flow	Sales
105	\$ 19,195	112.009	(85.448)	2.110
106	103,455	49.149	65.737	7.781
107	18,123	194.871	(512.239)	4.693
108	132,356	43.864	366.715	4.463
109	4,758	77.228	75.261	.863
110	105,299	32.580	32.380	3.010
111	19,280	24.743	24.826	1.207
112	7,299	16.057	121.975	.407
113	9,401	34.682	52.479	3.324
114	74,199	85.125	(2,294.341)	3.749
115	5,299	5.909	6.323	.371
116	1,288	4.666	6.206	.219
117	1,812	15.732	8.685	.461
118	40,500	31.082	(16.974)	.909
119	20,412	112.550	23.216	2.368
120	7,810	31.093	(77.727)	1.381
121	18,596	6.626	6.575	.333
122	19,331	32.500	36.352	1.534
123	2,630	8.892	5.905	.271
124	17,070	102.191	(219.240)	3.555
125	22,021	63.514	44.266	2.621
126	32,088	38.442	17.732	1.483
127	47,185	50.342	42.593	2.656
128	500	2.728	.177	.089
129	67,729	50.071	129.646	4.309
130	31,365	7.800	4.087	.614
131	7,399	26.137	8.330	.734

TABLE XIX--Continued

Company #	Research and Development	1974 Research and Development as a Percent of		
		Profit	Cash Flow	Sales
132	\$ 9,441	37.567	16.660	2.114
133	76,788	270.504	(194.454)	10.140
134	5,299	12.821	(18.221)	.372
135	1,883	11.445	21.471	.460
136	15,357	38.510	(77.954)	1.249
137	110,099	97.175	23.764	2.380
138	41,594	72.023	261.515	2.156
139	1,899	7.686	4.379	.393
140	1,709	9.964	12.432	.328
141	5,122	28.871	12.470	1.039
142	13,699	12.327	10.235	.670
143	5,501	170.099	(44.521)	1.310
144	4,917	(87.553)	(27.092)	1.463
145	5,064	4.822	4.270	.337
146	1,500	3.001	3.226	.146
147	22,982	33.099	31.926	2.042
148	6,469	43.480	30.354	.987
149	77,739	12.528	6.714	.915
150	1,915	25.194	(5.319)	.661
151	23,043	78.701	102.825	2.865
152	36,320	56.381	57.695	2.162
153	11,599	2,406.432	172.348	2.043
154	5,080	33.759	13.884	.813
155	7,596	13.581	33.165	.428
156	62,282	6.421	4.198	.332
157	47,854	4.932	3.250	.471
158	174,000	5.538	3.996	.380

TABLE XIX--Continued

Company #	Research and Development	1974 Research and Development as a Percent of		
		Profit	Cash Flow	Sales
159	\$ 5,797	33.295	32.588	1.179
160	11,011	35.106	(2,508.200)	1.488
161	21,470	114.324	210.263	4.701
162	16,006	71.341	(167.339)	3.229
163	29,578	29.305	46.087	1.180
164	3,500	12.179	12.157	.604
165	39,000	2.458	2.162	.163
166	198,000	220.930	192.601	12.592
167	39,776	37.559	1,103.663	1.882
168	5,502	28.015	18.739	1.612
169	16,699	5.798	2.279	.349
170	58,000	119.268	40.455	2.512
171	23,642	85.190	(99.890)	2.865
172	67,656	97.903	362.650	8.397
173	18,214	250.468	(875.252)	6.216
174	1,772	5.912	4.076	.404
175	2,921	32.138	191.919	.903
176	378,052	121.704	108.172	5.093
177	148,000	149.296	24.079	2.535
178	28,479	114.163	45.447	1.750
179	8,599	22.349	(42.873)	.841
180	18,199	80.065	(39.541)	1.297
181	7,363	31.075	33.030	1.311
182	29,509	246.834	(52.720)	3.226
Total	9,293,913	- - -	- - -	- - -
M***		(144) 53	(262) 49	2.12

TABLE XIX--Continued

Company #	Research and Development	1974 Research and Development as a Percent of		
		Profit	Cash Flow	Sales
M'***		32	23	1.8

*Source: Compustat Data Tape, Standard and Poors, Englewood, Colorado, 1976; (000)--thousands omitted.

**Calculated from data in Table XXII.

***M--unweighted mean; M'--weighted mean; (-)--negative profit.

APPENDIX B

RESEARCH AND DEVELOPMENT EXPENDITURES, SALES,
PROFIT, CASH FLOW, AND CASH PLUS CASH FLOW
FOR TWENTY-ONE MAJOR UNITED STATES
CORPORATIONS FOR THE PERIOD
1972 THROUGH 1974

TABLE XX

SALES, PROFIT, CASH FLOW, CASH PLUS CASH FLOW,
AND RESEARCH AND DEVELOPMENT FOR TWENTY-
ONE UNITED STATES CORPORATIONS:
1972 THROUGH 1974

Company #	Industry Code	1972 (000) thousands omitted					
		Sales**	Profit**	Cash Flow**	Cash Plus Cash Flow**	Research and Development***	
1	3714	\$ 205,483	\$ 7,484	\$ 19,293	\$ 30,551	\$ 3,811	
2	7392	184,660	4,710	4,669	19,940	1,515	
3	9997	607,009	43,188	1,144	67,604	9,149	
4	3861	373,180	16,355	40,229	53,238	22,377	
5	3570	683,796	2,321	132,181	156,947	29,596	
6	3721	1,539,390	26,040	165,695	194,986	17,735	
7	3000	1,511,142	48,966	116,090	159,151	34,119	
8	3573	2,133,699	76,594	332,803	497,932	148,000	
9	9997	832,375	32,373	1,066	37,706	6,328	
10	3721	2,479,430	13,034	(80,081)**	21,662	33,563	
11	3721	2,757,170	111,675	144,539	202,709	147,491	
12	3721	2,385,234	77,919	143,833	234,209	55,899	
13	1311	2,743,277	19,675	74,116	312,403	14,000	
14	3725	285,053	5,019	(1,279)	11,775	2,849	

TABLE XX--Continued

Company #	Industry Code	1972 (000) thousands omitted					Research and Development
		Sales	Profit	Cash Flow	Cash Plus Cash Flow		
15	3540	\$ 304,130	\$ 8,855	\$ (3,828)	\$ 9,391	\$ 15,398	
16	9997	1,678,422	82,141	55,001	122,791	36,402	
17	3350	498,707	12,567	26,112	69,777	18,550	
18	3661	6,577,102	282,941	382,326	559,872	308,665	
19	4811	444,906	33,974	104,591	172,333	3,761	
20	3630	728,124	30,177	60,338	105,436	6,899	
21	3570	2,419,103	249,507	662,390	860,310	131,872	
		1973 (000) thousands omitted					
1	3714	233,883	6,863	(396)	10,963	4,439	
2	7392	214,339	1,738	(4,802)	9,095	2,048	
3	9997	670,461	29,652	55,257	123,160	14,435	
4	3861	407,567	19,190	1,523	16,345	23,688	
5	3570	948,191	16,635	71,080	71,080	57,200	
6	3721	1,641,799	40,302	105,230	123,110	18,858	
7	3000	1,661,072	56,057	151,882	203,375	35,191	
8	3573	2,408,436	7,335	352,874	352,874	159,837	

TABLE XX--Continued

Company #	Industry Code	1973 (000) thousands omitted					
		Sales	Profit	Cash Flow	Cash Plus Cash Flow	Research and Development	
9	9997	\$ 977,788	\$ 37,739	\$ 5,907	\$ 59,573	\$ 7,106	
10	3721	2,756,791	14,081	(91,040)	(2,077)	33,563	
11	3721	3,035,827	129,529	149,636	161,274	142,824	
12	3721	3,219,400	125,800	12,800	123,107	30,400	
13	1311	3,479,696	79,763	281,081	465,086	14,743	
14	3725	373,240	6,424	(2,374)	5,150	3,729	
15	3540	383,624	14,812	19,179	28,366	16,091	
16	9997	1,858,402	100,837	35,675	108,385	37,539	
17	3350	635,958	18,792	9,174	63,397	22,225	
18	3661	7,075,061	315,305	270,387	376,854	349,427	
19	4811	492,342	28,115	117,340	172,333	3,761	
20	3630	825,626	34,844	50,701	68,118	7,799	
21	3570	2,989,694	300,484	651,581	886,415	167,411	
		1974 (000) thousands omitted					
1	3714	283,080	4,163	(7,161)	3,550	6,500	
2	7392	240,373	4,832	12,476	15,656	2,055	

TABLE XX--Continued

# Company	Industry Code	1974 (000) thousands omitted				
		Sales	Profit	Cash Flow	Cash Plus Cash Flow	Research and Development
3	9997	\$ 628,432	\$ (20,687)	\$ (17,193)	\$ 79,660	\$ 15,081
4	3861	465,624	15,610	(4,155)	8,879	21,171
5	3570	1,101,142	(31,398)	(34,976)	40,841	64,200
6	3721	1,968,416	51,623	85,757	103,047	20,649
7	3000	1,975,244	55,867	61,794	109,852	39,599
8	3573	2,628,606	72,170	228,397	309,000	170,156
9	9997	1,107,167	39,921	33,542	38,785	8,199
10	3721	3,279,100	23,200	110,600	186,712	42,000
11	3721	3,317,869	106,684	(7,086)	(62)	139,460
12	3721	4,453,800	130,300	(238,600)	116,655	40,500
13	1311	5,578,189	280,667	282,850	594,291	18,596
14	3725	419,915	3,234	(12,356)	9,750	5,501
15	3540	456,751	18,780	10,211	24,015	21,470
16	9997	2,113,754	105,904	3,604	44,745	39,776
17	3550	825,093	27,752	(23,668)	13,092	23,642
18	3661	7,422,534	310,633	349,491	455,045	378,052
19	4811	551,982	34,064	131,873	131,412	2,853

TABLE XX--Continued

Company #	Industry Code	1974 (000) thousands omitted				
		Sales	Profit	Cash Flow	Cash Plus Cash Flow	Research and Development
20	3630	\$1,022,015	\$ 38,476	\$ (20,057)	\$ 8,091	\$ 8,599
21	3570	3,576,442	408,302	681,704	906,591	196,727
		1975 (000) thousands omitted				
1	3714	341,969	4,773	53,903	69,708	4,603
2	7392	245,618	6,416	13,204	17,396	1,665
3	9997	659,503	51,030	30,426	79,053	12,046
4	3861	409,030	12,607	21,321	31,804	21,599
5	3570	1,246,369	12,299	185,643	191,911	49,300
6	3721	2,160,038	81,088	146,219	164,714	20,925
7	3000	1,916,320	25,555	170,133	202,177	41,784
8	3573	2,777,930	76,477	511,367	584,021	164,177
9	9997	1,115,876	43,181	59,854	82,403	8,199
10	3721	3,387,000	45,000	(57,900)	64,299	52,000
11	3721	3,310,860	85,650	103,062	110,272	132,207
12	3721	4,985,100	101,600	457,100	622,699	31,000
13	1311	5,345,938	174,608	458,937	715,670	25,230

TABLE XX--Continued

# Company #	Industry Code	1975 (000) thousands omitted					
		Sales	Profit	Cash Flow	Cash Plus Cash Flow	Research and Development	
14	3725	\$ 465,265	\$ 5,460	\$ 20,353	\$ (7,531)	\$ 5,455	
15	3540	508,698	21,970	36,817	59,456	22,532	
16	9997	2,459,060	95,955	129,182	168,872	50,357	
17	3350	615,040	31,360	43,173	68,401	27,487	
18	3661	6,094,823	107,308	499,500	601,456	400,214	
19	4811	569,272	32,050	120,499	201,171	3,776	
20	3630	1,235,561	46,878	62,799	96,911	10,000	
21	3570	4,053,760	341,632	969,317	1,195,939	198,549	

*SIC Industry Guide.

**Annual Financial Reports.

***Computed from Data in Annual Financial Reports.

****10-K Report.

***** (--) indicates negative.

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