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The Allocation of Research and Development Costs Over Fiscal Periods

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THE ALLOCATION OF RESEARCH AND DEVELOPMENT COSTS OVER FISCAL PERIODS

BY

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ABSTRACT OF THESIS

Along with the significant increase in research and development programs and expenditures over the past few decades, various benefits and problems have been created. A major accounting problem related to R & D expenditures is the determination of a proper method of allocating R & D costs over fiscal periods. Three methods of allocating such costs are: (1) charging the costs against income for the period incurred, (2) capitalizing the costs and amortizing against future income, and (3) providing for the costs before they are incurred through the use of an accrual account.

The primary purpose of the study is to discuss the validity of the methods presented above, in line with such accounting principles as the proper matching of revenue and expense and conservatism in stating asset values, and to indicate the method that should be generally preferred in practice.

The major limitation of the study is that it excludes the costs of exploration and development of natural resources and research performed by any governmental agency, university, or non-profit organization.

The primary sources of data used include various publications found in college and public libraries, technical reports, and a questionnaire created by the author and mailed to various business firms throughout the nation. Also, several oral discussions with persons associated with R & D programs or accounting for related expenditures provided additional information for the study.

In developing the study, the background of the broad area of R & D growth worldwide, and in the United States, is presented in the first section, along with the causal reasons for such growth.

The methods of allocating R & D costs over fiscal periods and the supporting reasons for each method are presented in the second section. Also, the results of a national survey conducted by the author to obtain up-to-date information relating to the types of applied research performed and allocation methods used in private industry are presented.

In the third section, some methods of planning and controlling R & D costs, vital in aiding the proper allocation of such costs, are reviewed.

In the fourth section, conclusions and implications are presented. The basic conclusion drawn from the findings of the study is that most industrial firms performing research and development, whether it be pure, applied, or a combination of both, tend to charge such costs against the current income of a given period. Only under certain situations was capitalizing of R & D costs advocated, while the use of the accrual method was found to be rather rare.

Some of the reasons supporting the usage of the expensing method are: (1) conservatism in stating values is necessary when dealing with elements such as R & D, (2) research is normally regarded as a continuing function, and expenditures thereon are regarded as annual recurring costs similar to other operating expenses, (3) benefits derived from specific research project expenditures are generally uncertain in nature, and several accounting periods may pass before the success or failure of a

given project becomes apparent. To defer costs of a project until the results are known could cause an overstatement of a firm's asset values. The overall study leads the author to recommend the use of the expensing method by industry for allocating research and development costs over fiscal periods.

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I

INTRODUCTION TO RESEARCH AND DEVELOPMENT

The purpose of this chapter is to give the reader a brief background regarding the growth of research and development in the United States, its significance to government and private industry, and the accounting problem involved in allocating research and development expenditures over fiscal periods.

Also, a discussion of the different phases of research will be presented in a section relating to the meaning of research and development as presented in this study. From this point on in the study, the abbreviation commonly used for research and development, namely "R & D," will be frequently substituted in place of the complete terminology.

I. THE GROWTH OF R & D

Whether through conversation or through reading various magazines and newspapers, one may become aware of the tremendous increase in annual research and development expenditures on the part of industry and government.

In 1931, less than $210 million was spent on research and development. In 1951, the amount expended on R & D was $2.2 billion.[1] For the year 1966, approximately $15.5 billion was spent on R & D, and the annual figure to be spent on R & D

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[1] Daniel Hamberg, R & D Essays on the Economics of Research and Development (New York: Random House, 1963), p. 5.

for 1970 is estimated to reach $20.8 billion.[2] Thus, between 1931 and 1966, industrial R & D programs increased more than seventyfold (that is, more than 7,000 per cent).

One may very well wonder how much of the above-mentioned growth in R & D expenditures is due to inflation and changes in the definition of research and development over the decades.

Due to rising research costs, including the cost of laboratory equipment and salaries of scientists, and to broader classifications and definitions as to just what constitutes research, data in current dollars definitely overstate the increase in real R & D outlays. Various studies have been made that have generally found the true increase to be roughly half that of the current figures.[3] However, even a thirtyfold increase would still be considered as quite significant.

The increased expenditures for research and development in the United States have been such that, ever since World War II, Europe's reputation as the greatest repository of research for world-wide industry has steadily shifted to the United States.

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[2] "R & D Looms Big in Fiscal Budgets," Business Week, (May 13, 1967), 68.

[3] Leonard S. Silk, The Research Revolution (New York: McGraw-Hill Book Company, Inc., 1960), p. 160.

For instance, in 1962, the United States spent $14.7 billion, or 2.8 per cent of its Gross National Product, on research and development. During the same period, only Britain came close to that, with 2.7 per cent of its Gross National Product used for R & D. Germany, France, and Italy spent less than 1.5 per cent of their respective Gross National Product's on R & D.[4]

Research and development expenditures by the United States and Western Europe have not changed significantly since then in proportion. Table I, page 4, provides more detailed data regarding comparison of national R & D expenditures.

Why don't European industries spend more on R & D? Part of the answer lies in the lack of support of R & D ventures by the various European governments. For example, until recently, Italy taxed private industry's R & D budgets as hidden profits.[5] Thus, until the recent awareness of a definite technological gap embraced the ruling bodies of Europe, some European governments appeared to even discourage R & D expansion at times.

On the other hand, American industries have generally come to emphasize the need for R & D programs, particularly in the chemical, electronics, and aero-space fields, which

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[4] "The Research Gap," Time, 82:103, November 1, 1963.

[5] Ibid., p. 104.

TABLE I

COMPARISON OF NATIONAL R & D EXPENDITURES*

Nation	Gross R & D as percentage of GNP	Gross R & D per capita
United States	3.1	$93.7
United Kingdom	2.2	33.5
The Netherlands	1.8	20.3
France	1.5	23.6
Germany	1.3	20.1
Belgium	1.0	14.8

*This table is reproduced from an article by James Brian Quinn, "Technological Competition: U.S. vs. Europe," Harvard Business Review, 44: 113, July, 1966.

have a scientific base. The Federal government heartily supports the research efforts by private industry. What are some of the factors influencing the R & D explosion in the United States? There are several factors, and these will be discussed in the next section.

II. THE SIGNIFICANCE OF R & D

On the international level, the existence of the "Cold War" since the end of World War II has forged an economic and political weapon of research and development for use by the two super-powers, Russia and the United States. The Russians spend an almost equal percentage of their Gross National Product as the United States for R & D.[6]

An article in Business Week indicates that the Russians are seeking, through a profit incentive, to create a closer link between their research laboratories, which operate independently from the manufacturing facilities, and their production plants. According to the article, Russian research institutes receive a 75 per cent rebate on profits from any developments they supply to production plants.[7]

Economic and political competition have thus motivated the U.S. government to stimulate R & D by private industry, federal agencies, and universities. How important government stimulation has been is observed in the following comment:

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[6]"Profitable Researchers," Financial World, 125:7, January 12, 1966.

[7]"Soviets' New Profit Lure: Overhaul of Russia's R & D Establishment," Business Week, September 17, 1966, p. 115.

> The U.S. government is the most important single force in Western scientific and technological competition. European businessmen are quick to point out that the U.S. dominance of the electronics, computer, commercial aircraft, nuclear power, and space technologies results from government R & D stimulation and purchases.[8]

Even without government stimulation through contracts and tax legislation, private industry would have sufficient motivation to perform research and development.

There is the saying about change being inevitable, a proposition that is almost universally accepted. Change in industry comes about largely due to each business trying to meet, and if possible, beat its competitors in terms of maintaining or bettering its position in the field.

The ability to meet competition is usually enhanced by R & D, especially in the science-based industries, such as chemicals and drugs, and it can often mean the difference between success and failure. An oft-cited reason for a firm's engaging in R & D is the existence of a competitor's research and development program.[9] "Competition in research and development is a force affecting the day after tomorrow's efficiency, for the purpose of maximizing tomorrow's investment."[10]

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[8]James Brian Quinn, "Technological Competition: Europe vs. U.S.," Harvard Business Review, 44:120, July, 1966.

[9]Martin J. Davidson, "Some Thoughts Concerning Research and Development in Economic Theory," The American Economist, 10:11-12, Fall, 1966.

[10]Ibid., p. 12.

Evidence of the correlation between research expenditures and sales is shown in the results of work done by the University of Chicago. At the Sixth Conference on Scientific Manpower in 1957, Professor Yale Brozen reported on a study of eight chemical companies. It was found that one dollar spent on research in those companies, without any increased use of capital or labor, produced such an increase in productivity that they were able to increase annual output by $40 and more.[11] The illustration (Figure 1) on page 8 shows the long-range affect of research and development upon a firm's sales goals.

Research and development has played an important role in increasing productive efficiency. In a study by Moses Abramovitz of the National Bureau of Economic Research covering the period 1871- 1951, technological advance was found to account for approximately 90 per cent of the rise in output per manhour, compared to 10 per cent for capital formation.[12] In other words, productive efficiency was not just a matter of adding more machinery but one of introducing better machinery. Other studies on manpower have reached similar conclusions.

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[11]Carl Heyel (ed.), Handbook of Industrial Research Management (New York: Reinhold Publishing Corporation, 1959), p. 10.

[12]Leonard S. Silk, The Research Revolution, (New York: McGraw-Hill Book Company, Inc. 1960), p. 154.

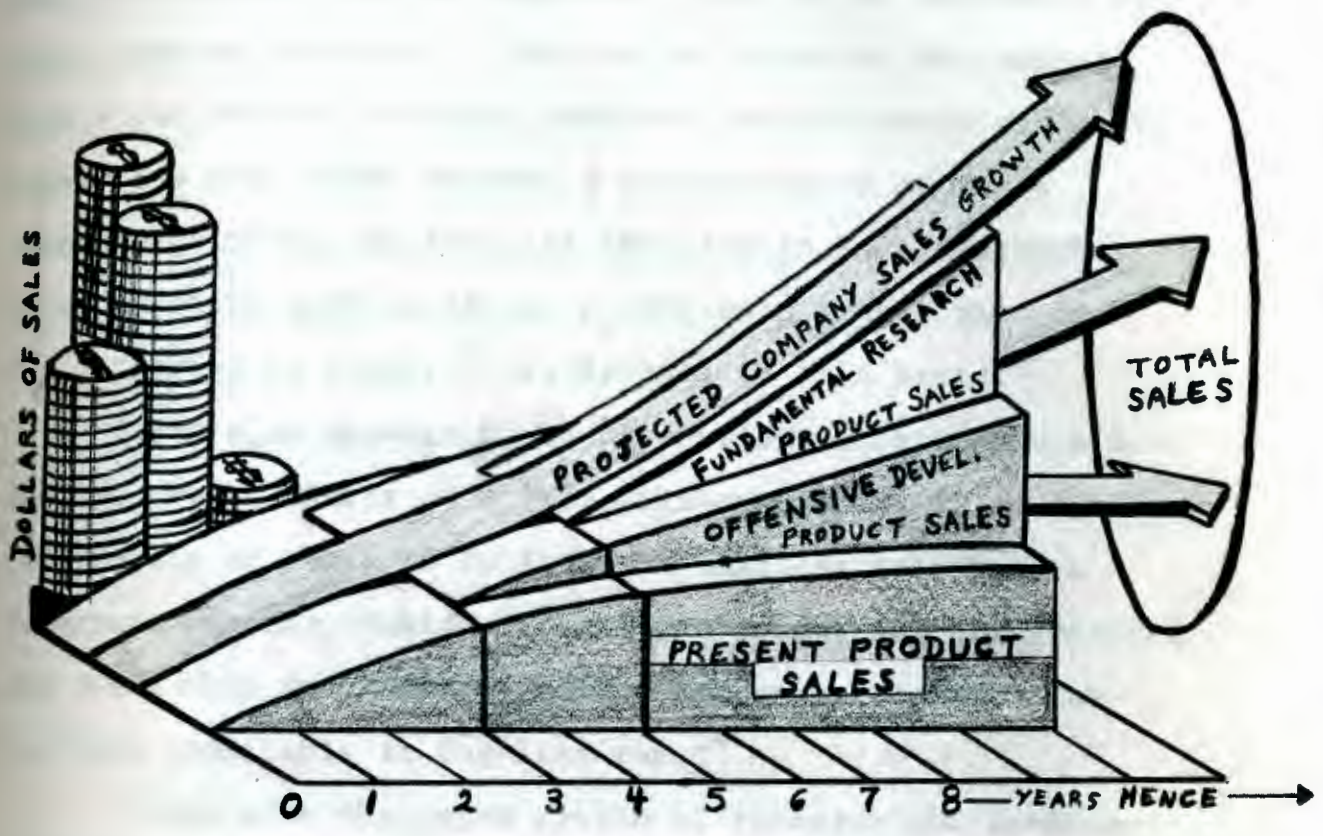

FIGURE 1

HOW PLANNED RESEARCH HELPS A COMPANY ACHIEVE TOTAL SALES GOALS (FROM: QUINN, JAMES BRIAN, "LONG-RANGE PLANNING OF INDUSTRIAL RESEARCH," HARVARD BUSINESS REVIEW, 39:98, JULY, 1961)

A firm's engaging in an effective research and development program can play an important part in the obtaining of bank loans or the sale of its capital stock on the market. Interviews between security analysts and corporate officials rarely are terminated without a discussion of a firm's research policies. In fact, if the firm is in a research-oriented field such as drugs, a very substantial part of the interview is likely to be devoted to this topic.[13]

There also appears to be a correlation between R & D and the profitability of a firm, although there is no clear-cut formula or route to follow. The American Telephone & Telegraph Company studied fifty large industrial corporations and found that the research-minded companies tended to be the most profitable in the long run.[14]

Along with the rapid growth of research and development and the related benefits, there arose various related problems, two of which are the accounting presentation of research and development costs over fiscal periods and efficient accounting control over R & D expenditures.

III. THE ACCOUNTING PROBLEM

The accounting problem lies in determining in what manner research and development costs should be distributed

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[13]"Profitable Researchers," Financial World, 125:7, January 12, 1966.

[14]Martin J. Davidson, "Some Thoughts Concerning Research and Development in Economic Theory," The American Economist, 10:12, Fall, 1966.

over fiscal periods by private industrial concerns. At present, there are three possible methods that can be used, the choice of one depending upon what management personnel decide best fits their situation. The three methods are: (1) charge the costs against income for the period incurred, (2) capitalize the costs and amortize against future income, and (3) provide for the costs before they are incurred by a charge against income.

The first two methods presented above are deemed to be generally accepted by the American Institute of Certified Public Accountants.[15]

IV. OBJECTIVES, LIMITATIONS, AND SIGNIFICANCE OF THE STUDY

The primary purpose of the study is to discuss the validity of the existing methods of allocating research and development expenditures over fiscal periods, in conjunction with such accounting principles as conservatism and the proper matching of the revenues of a given accounting period with the expenses of the same period, and to present what the author believes to be the most preferable accounting method to use in allocating R & D costs over fiscal periods.

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[15] Paul Grady, "Inventory of Generally Accepted Accounting Principles for Business Enterprises," Accounting Research Study No. 7 (New York: American Institute of Certified Public Accountants, Inc.), p. 390.

The major limitation of the study is that it will exclude the costs of exploration and development of natural resources, and it will exclude research performed by any governmental agency, university, or non-profit organization.

The significance of the study is based upon the lack of uniformity existent in having three different methods available for presenting the results, accounting-wise, of a single business function; that is, research and development performance.

Since increased uniformity, without undue rigidity, of accounting data improves the value of comparison of the operations of various firms as presented in financial statements, there is the need for continued study of this problem area.

The problem of research and development cost allocation is discussed briefly in a booklet published by the public accounting firm of Arthur Andersen Co., which supports the fact of lack of uniformity and the difficulty in applying accounting theory to practice.

V. DEFINITIONS OF MAJOR TERMS USED IN THE STUDY

There is the need, in every study, to establish a foundation for the key terms used in the discussion of

the subject matter, and this fact is especially true when dealing with a topic such as R & D, since the term itself varies in operational scope between industries. Since this study deals with the subject of research and development, these two separate, but interdependent, terms will be defined regarding their usage in this study.

Research. Research is the search for new knowledge, principles, products, applications, and processes, and the investigation of the merits and commercial application of any new discoveries. Research is usually divided into two major catagories; one is basic or fundamental research, and the other is applied research.

Basic research. Basic research is the search for new knowledge in a broad but definite scientific field without direct concern regarding any specific product or process applications. It is performed with the object of increasing the over-all scientific background of a firm, in line with a company's particular long-range goals.

The definition of basic research presented above is admittedly oriented upon the purpose of basic research operating in a commercial environment, a fact that is naturally appropriate for the objectives of this study. Basic or pure research in a non-commercial environment could be said to be "that which is carried out by a scientist

who hopes his findings will be primarily of interest to his scientific colleagues."[16]

Applied research. Applied research is the conversion of knowledge and principles revealed in pure research to commercially marketable products or processes. It may also include major changes made in improving an existing product or process.

Pure research becomes applied only when a narrowly (relatively) defined commercial application constrains research into a few preselected approaches.

> Applied research and developmental projects- if they are successful- also include some searching for new knowledge, but in such projects the search for knowledge is ancillary to their main purpose; i.e., solving a particular technical problem to utilize its solution directly in a practical application.[17]

Development. Development, sometimes called product engineering, relates to the final stages of applied research, which is usually a matter of "ironing out the bugs" in a proto-type model of the desired product or process. It may

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[16] Michael D. Reagan, "Basic and Applied Research: A Meaningful Distinction," Science, 155:1384, March 7, 1967.

[17] James Brian Quinn, Robert M. Cavanaugh, "Fundamental Research Can Be Planned," Harvard Business Review, 42:113, January, 1964.

also include minor revisions of an existing product or process.

II

THE ALLOCATION METHODS AND THEIR SUPPORTING REASONS

The purpose of this chapter is to present the bases behind each of the methods of allocating R & D expenditures over fiscal periods and to illustrate the influence the choice of a particular method can have upon the profit or loss as shown in a firm's income statement. Also, the results of a national survey covering numerous firms in various industries, regarding types of research performed and allocation methods used, will be presented.

I. METHODS OF ALLOCATION

The methods of allocating research and development expenditures over fiscal periods are: (1) charge the costs against income for the period incurred, (2) capitalize the costs and amortize against future income, and (3) provide for the costs before they are incurred by a charge against income.

Of the three methods presented above, the first two are the ones most commonly utilized in private industry.

II. THE REASONS SUPPORTING EACH OF THE ALLOCATION METHODS

The discussion of the supporting reasons is centered about two ideas in accounting; these ideas are: (1) costs should be matched with related revenues, and (2) costs should not be deferred to future periods unless there is a reasonable expectation that they will be recovered.[1]

With few exceptions, industrial concerns tend to favor the expensing of R & D costs against current income. This fact is acknowledged in a study conducted by the National Association of Accountants.[2] There are several reasons for the popularity of this method. One primary reason is conservatism in stating values when dealing with intangible elements, especially when concerned with an uncertain element such as research and development. The highly speculative and uncertain nature of R & D is supported in the following comment.

> Research is a cost or an investment; far from delivering guaranteed results, it is a highly speculative, highly uncertain effort that requires the greatest managerial competence to produce results.[3]

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[1] Accounting and Reporting Problems of the Accounting Profession (Second Edition. New York: Arthur Andersen & Co., October, 1962), p. 93.

[2] "Accounting for Research and Development Costs," N.A.A. Research Report No. 29 (New York: National Association of Accountants, 1955), p. 43.

[3] Peter F. Drucker, "Twelve Fables of Research Management," Harvard Business Review, 41:103, January, 1963.

There is no certainty that the investment in research will yield a positive return, whether the project goals be deemed short or long-term in the creative and applied process. Many projects involving substantial expenditures have been abandoned because the desired results have proven to be unfeasible at some point in the research process.

Even if a project is considered a technical success, there are other uncertainties that affect a product or process's ultimate value. Competing firms may have been working on a similar product or process that may be patented and marketed first, or perhaps a competitor may discover a better product or process that will render research results practically worthless regardless of patent protection.

Another important element affecting the ultimate success of a new product or process is consumer acceptance. Even after a research project has proven to be a technical success and patent protection obtained, an adequate market for the fruits of research must be established in order that the research investment bring a satisfactory return in revenue. Marketing is too often under-stressed in the management of R & D, and a management that regards R & D and marketing functions as independent elements may easily find itself in trouble. Early consideration of the marketing element may even indicate whether or not a new product should be developed, aside from engineering considerations.

"Marketing should be brought into the new product development picture as soon as possible- that is to say- at the beginning."[4]

Sometimes the success or failure of an R & D project may not become apparent for years, and many firms thus feel that by expensing R & D expenditures to current periods, they avoid introducing an asset of uncertain value into the balance sheet.[5]

Another reason that companies give for using the expensing method in allocating R & D expenditures is that research is normally a continuing operation, and that expenditures are related "to the size of the research organization and to the scope of the general research program."[6] Research costs are thereby regarded as annual recurring costs similar to other operating expenses.

The importance of the continuity element in research is emphasized by many industrial concerns. Research programs, even more so than other kinds, should not be, for best results, turned off and on as sales fluctuate. When the time cycles, the kinds of personnel involved, morale, etc., are considered,

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[4]Russ W. Henke, Effective Research and Development for the Smaller Company (Houston: Gulf Publishing Company, 1963), p. 18

[5]"Accounting for Research and Development Costs," op. cit., p. 45.

[6]Ibid.

it is obvious that stop and go research is injurious to a firm's well-being, especially in a highly competitive field.[7]

> It is common practice for large, well-established companies to expense such R & D outlays as they are incurred on the theory that this is a regularly recurring cost of maintaining the position of the company in its industry.[8]

As mentioned in the first chapter, the existence of an effective research and development program can mean the difference between success and failure in some industries.

The capitalization of R & D costs is advocated on the grounds that the current period, during which the costs of a given R & D project are incurred, does not benefit normally from the revenue generated by the fruits of research, and that the future periods which do benefit, if the research project is successful, should thus be charged with the costs incurred, not the current period.

In other words, capitalization of R & D expenditures results in a better matching of costs with related revenues, which is a major objective in accounting.[9]

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[7]Delmar W. Karger, The New Product (New York: The Industrial Press, 1960), p. 93.

[8]Paul Grady, "Inventory of Generally Accepted Accounting Principles for Business Enterprises," Accounting Research Study No. 7 (New York: American Institute of Certified Public Accountants, Inc.), p. 390.

[9]David F. Hawkins, "The Case of the Dubious Deferral," Harvard Business Review, 41:162, May, 1963.

However, due to the reasons presented regarding the expensing of R & D costs, few companies tend to defer R & D costs in practice. Even if much of the uncertainty relating to the technical success and marketing acceptance of a new product or application could be eliminated, benefits derived from research often cannot be adequately measured and related to sales revenue of any given period. This fact is especially true regarding fundamental research, which has no immediate objective in terms of specific products or processes.[10]

There is also substantial difficulty in determining the useful life of knowledge gained through research. Because of this difficulty, a basis for amortizing costs over a series of periods is a matter of conjecture.

> In some industries, the commercial life of new products is relatively short while in other instances original development costs must be followed by equally large annual expenditures for improvement to keep the product competitive.[11]

In a study conducted by the National Association of Accountants, it was found that even where a patent is acquired protecting a developed product or process, none of the firms participating in the study capitalized research costs incurred

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[10] "Accounting for Research and Development Costs," N.A.A. Research Report No. 29 (New York: National Association of Accountants, 1955), p. 45.

[11] Ibid., p. 47.

in connection with the patent because of doubt regarding the length of time the patent would have value.[12]

There are certain conditions that can lead companies to take exception to expensing R & D costs. One condition that can lead a firm to defer R & D costs is the initiation of an unusually large (both in operational and financial scope) research project aimed at developing a specific new asset, such as a laser-beam cutting tool, for its own productive use. Such project costs are amortized over a period selected by management; that is, if the desired machine is developed successfully. If the research project is unsuccessful, the accumulated amount deferred should be written off when failure of the project is evident.[13] In effect, what the firm is doing in such a circumstance is developing its own production machinery rather than contracting an R & D concern to create the desired production asset.

Another circumstance in which an industrial firm is likely to capitalize R & D costs is when the firm is relatively new, with just a few years (probably less than five years) of production operation to its history. This fact is supported in an American Institute of Certified Public Accountants study.[14] New firms often have not realized large

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[12] Ibid., p. 47.

[13] Grady, loc. cit.

[14] Ibid.

amounts of annual income, and the expensing of R & D costs could tend to distort the profit and loss presentation in a new firm's financial statements considerably, just at a time when a new firm needs to make a favorable financial impression upon potential investors and creditors.

In order to illustrate the affect the choice of a particular method of allocation by a firm can have upon its profit or loss for a given period or periods, a problem is presented in the next few pages.

A company, Modern Electronics Corporation, has been in operation for approximately ten years. Its sales, production, and research activities are centered upon computer components and quality-control measuring devices.

The firm's controller, Mr. James Elliot, has reviewed certain financial data relating to the firm's operations since its incorporation in order to present an opinion on the impact of a proposal by management that the annual amount spent on R & D be substantially increased over the next three years. The financial data reviewed is presented in Table II on page 23.

The management proposal states that, in order to gain a larger share of the computer market and a better return on sales, an entirely new type of memory core should be developed. Such a development, in the opinion of management, would reverse the downward trend of sales and profits since 1962 that is the result of increased competition and rising labor costs.

TABLE II

MODERN ELECTRONICS CORPORATION

HISTORICAL FINANCIAL DATA

1957- 1966

Year	Gross sales*	R & D expenses*	Net profit after taxes*	Earnings per share**
1957	$ 9,000	$ 600	$ 200	$ 0.20
1958	21,800	1,000	500	0.50
1959	38,000	1,000	1,500	1.50
1960	40,200	900	2,200	2.20
1961	43,000	800	2,400	2.40
1962	48,000	1,000	2,800	2.80
1963	45,000	1,000	2,000	2.00
1964	41,000	800	800	0.80
1965	37,200	1,000	(150)	(0.15)
1966	37,600	1,000	(50)	(0.05)

*000's omitted.
**On 1 million shares outstanding.

Until the current year, the maximum amount expended on any one research project has been limited to $500,000 while the total annual R & D expenditures have usually approximated $1,000,000. Under the new proposal $1,000,000 will be spent annually on the new project alone for the next three years, while spending on existing projects will be $500,000 annually. Research personnel have estimated that it would probably take three years to develop an entirely new concept in computer memory core storage.

The general plan of the research project, as put forth by the R & D director, was that the first year, 1967, would be spent conducting broad basic research on electronic principles applicable to memory cores and their allied components. During the second and third years, it is hoped that a prototype model would be developed and any necessary adjustments made to create a finished product for marketing purposes. The R & D director estimated the probability of success, in this particular case, at about 7 chances out of 10.

The vice-president of sales estimated that, based upon a projected demand for computers during 1970- 1975, sales potential of a new memory core component and its allied systems would be approximately $250 million between 1970 and 1975. From past experience with similar technical developments, management estimated that the competitive edge of the

new component would last at least three years, and possibly as long as five years. After that, competitors were expected to have developed and marketed competing components, and sales and profit margins would tend to decrease. Hence, it was expected that, after the new component had been on the market for two years, advanced research would be initiated to create an improved model.

After considering the various aspects of the new proposal, some of which have been presented, the controller wrote a memorandum to the president of the firm to indicate the financial impact of the proposal and the methods of allocation. The memorandum is presented on pages 26 and 27.

A relatively small number of companies accrue R & D expense at a uniform rate on a monthly basis if it is felt that, in a particular firm, benefits from successful projects are received continually while actual expenditures are frequently concentrated in a few months of the year.[15] Actual expenditures are charged against the accrued-expense balance as payments are made. This accrual method, under such circumstances, avoids distorting the monthly profit by distributing the actual costs over the whole year, rather than just the few months of actual incurrence. Hence, a better picture of profit and loss is obtained.

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[15] "Accounting for Research and Development Costs," N.A.A. Research Report No. 29 (New York: National Association of Accountants, 1955), p. 47.

MODERN ELECTRONICS CORPORATION
Memorandum

To: John Smart, President
From: James Elliot, Controller
Subject: Revised Pro Forma Income Statements, 1967- 1969.

Since the decision to increase annual R & D expenditures from the originally planned amount of $1 million to $1.5 million will have an important impact on anticipated profits for 1967- 1969, I have prepared a revision of the earlier profit estimates.

Regardless of the allocation method used in applying R & D costs over accounting periods, we will continue to follow the expensing method for tax purposes. As a result, we will not have to pay any taxes during 1967- 1969, based upon the figures presented below.

The first revision (see Part A) assumes the expensing of all R & D costs against income as incurred. The second revision assumes deferment of R & D costs of the memory-core project until 1970, the year we hope to start marketing the item.

Original Projection (as of January 1, 1967)
(000's omitted)

Year	Gross Sales	R & D Expenses	Net Profit	Earnings per Share
1967	$40,000	$1,000	$ 20	$ 0.02
1968	41,000	1,000	160	0.16
1969	41,000	1,000	160	0.16

New Projections

A. Expensing of All R & D Costs as Incurred

1967	$40,000	$1,500	($350)	($ 0.35)
1968	41,000	1,500	(150)	(0.15)
1969	41,000	1,500	(150)	(0.15)

B. Deferment of R & D Costs Relating to Project

1967	$40,000	$ 500	$200*	$ 0.20
1968	41,000	500	400*	0.40
1969	41,000	500	400*	0.40

*The balance sheet will indicate the following:

FIGURE 2

JIM ELLIOT'S MEMORANDUM

Memorandum

B. Deferment of R & D Costs Relating to Project (continued)

Assets

Year		
1967	Deferred R & D expenses	$1,000
1968	Deferred R & D expenses	2,000
1969	Deferred R & D expenses	3,000

Liabilities

1967	Deferred tax liability	$ 500
1968	Deferred tax liability	1,000
1969	Deferred tax liability	1,500

I recommend that better accounting practice and consistency with our earlier treatment of R & D costs indicate that we should expense these costs currently.

(s) Jim Elliot

FIGURE 2 (continued)

III. THE AFFECT OF FEDERAL TAX REGULATIONS ON CHOICE OF THE ALLOCATION METHOD

Before indicating the influence tax regulations have upon the choice of a method of allocation of R & D expenditures, the general tax regulations are presented, in part, verbatim in the following paragraphs.

> Research and experimental expenditures of an existing trade or business may be deducted in the year paid or incurred, or deferred over a period of 60 months or more. This applies whether the expenditures were undertaken by the taxpayer, himself, or by another in his behalf (such as an institute or foundation).
>
> Deductible in year paid or incurred— This method be elected for the first year that expenses are paid or incurred by deducting them on the return. Treatment on books is irrelevant. At any other time consent is needed. Once adopted, this method generally applies to all future expenses that taxpayer regularly incurs.
>
> Deferred expenses— If the taxpayer defers his research and experimental expenditures and charges them to capital account, he must deduct them ratably over a period of 60 months or more. If there are two or more projects, different periods may be selected for each.[16]

In further support, Final Regulation § 1.174-1 (I.R.C.) states that "these expenditures (R & D) may be treated as expenses not chargeable to capital account and deducted in the year in which they are paid or incurred, or they may be deferred and amortized."[17]

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[16] Prentice-Hall Federal Tax Handbook (Englewood Cliffs: Prentice-Hall, Inc., 1967), pp. 195- 196.

[17] Prentice-Hall Federal Income Tax Regulations, Volume One (Englewood Cliffs: Prentice-Hall, Inc.), p. 23,333.

Since a common goal of income-tax calculation is often stated as "to report the minimum possible earnings consistent with the rules and regulations prescribed by the law,"[18] it is usually more advantageous to expense R & D outlays in order to minimize a firm's tax liability for a given period.

Businessmen generally prefer to take the more expeditious route and charge R & D expenses against current income since the tax rate is known, and the after-tax impact of R & D expenditures can be established. Since the Federal government uses the power to tax as a combination accelerator-brake devide, depending upon circumstances, on the nation's economy and tax rates are subject to annual change, businessmen cannot, with certainty, predict future tax rates or future after-tax effects on income and deductions.

The dollar difference between capitalizing research costs or charging them to current income can have a significant effect on income, especially in firms where R & D costs may reach several million dollars annually.

IV. SURVEY RESULTS ON APPLIED RESEARCH PERFORMED AND ALLOCATION METHODS USED

The purpose of the survey was to obtain certain information regarding: (1) the type of applied research performed by

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[18] Allan R. Drebin, "Accounting for Proprietary Research," The Accounting Review, 41: 414, July, 1966.

various firms, and (2) the method of allocation used by these firms relating to applied research and development expenditures. The survey covered applied research and development only due to the fact that several surveys have been conducted already relating to the allocation methods used concerning fundamental research expenditures, and a general conclusion has been presented thereon that expensing R & D costs against current income leads all other methods.

The survey included firms in 21 states, with concentration of questionnaires directed toward the Northeastern section of the nation, although other scattered states were included in order to have a greater degree of geographical dispersion in the survey. Numerous industries were surveyed, and the chemical, electronics, aero-space, commercial aircraft and earthmoving equipment were just some of the ones represented in the questionnaires returned.

From a total of 81 questionnaires and letters of transmittal mailed to various firms, 43 completed questionnaires were received by the author. Thus, 53 per cent of the firms returned a completed questionnaire.

The amount of sales revenue recorded by the firms represented ranged from $6 million to a little over $3 billion for 1966. Regarding the type of research performed, 28 per cent of the firms dealt mainly with transforming ideas resulting from pure research activities into commercially

feasible products. More than half (56 per cent) of the firms worked mainly to improve the functional effectiveness of an existing product or products, while 16 per cent of the firms represented were active in both categories.

Regarding the method of allocation utilized to distribute applied research expenditures over fiscal periods, 40 companies out of the total 43 (93 per cent) charged the costs against income for the current period; two firms capitalized the expenditures, and the remaining firm used the accrual method, which provides for the costs before they are incurred by a charge against income.

A bar chart depicting the degree of popularity of each of the three allocation methods for R & D costs with the 43 firms represented in the survey is presented on page 32. It is quite apparent that the method charging R & D expenditures against current income is by far the one utilized most, a conclusion that was reached in several other independent surveys by various organizations, one of which was the National Association of Accountants. The reasons for the popularity of the expensing method have been discussed in previous sections of this chapter.

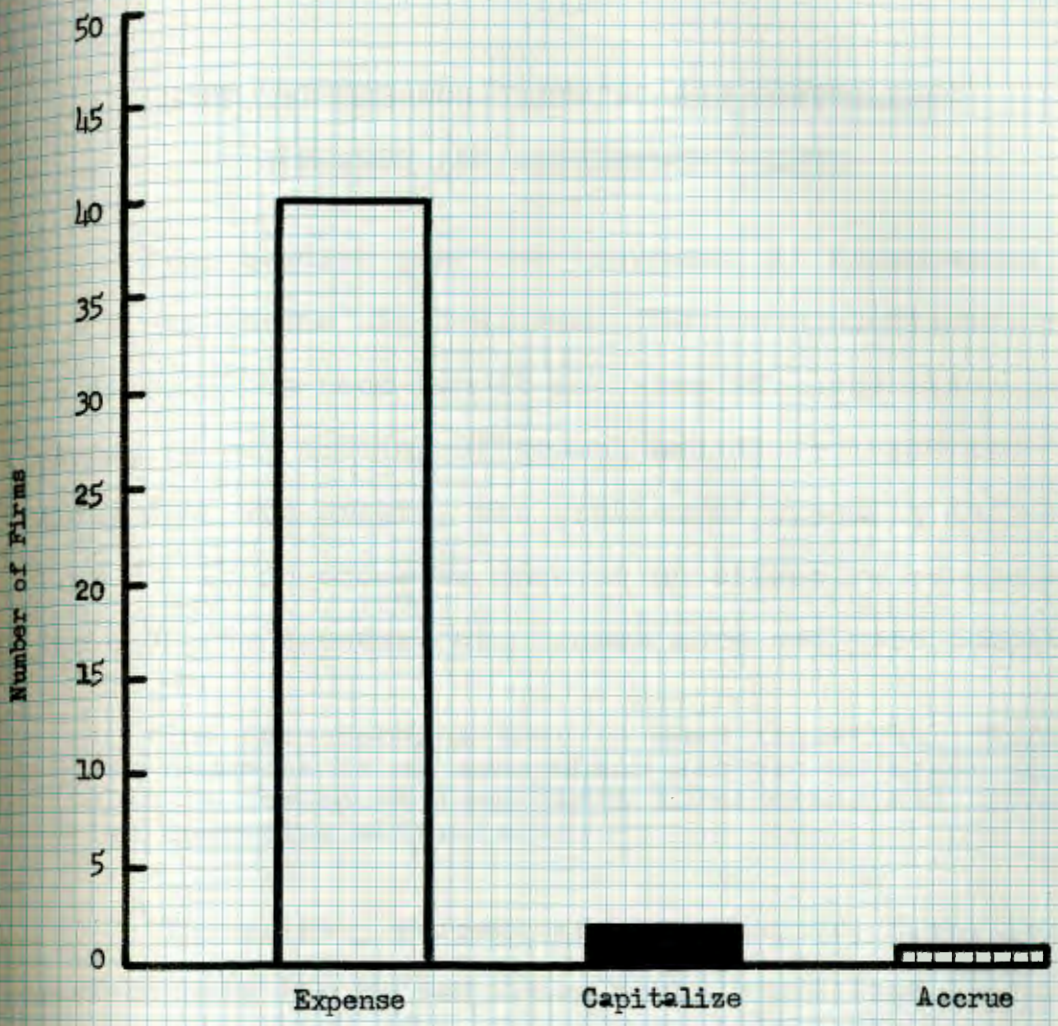

FIGURE 3

A COMPARISON OF THE POPULARITY OF THE VARIOUS METHODS OF ALLOCATING R & D COSTS OVER FISCAL PERIODS

III

SOME METHODS FOR PLANNING AND CONTROLLING RESEARCH AND DEVELOPMENT COSTS

From reading previous chapters, it is apparent that R & D has become big business. "Few managements are inclined to dispute the need for it in terms of competitive survival alone, to say nothing of growth and diversification."[1] Along with its growth, the problem of planning and controlling R & D, in order to make it an effective management tool for economic success, has become more and more complex.

> The fact remains that in most industrial companies research is an area which has proven least amenable to confident long-range allocations and effective operating controls.[2]

The primary purpose of this chapter, then, is to present some of the better known methods utilized by management personnel in planning and controlling R & D expenditures, since the best of accounting methods can become doubtful in value without appropriate planning, control, and review.

I. BUDGETING RESEARCH AND DEVELOPMENT COSTS

The research director of a prominent chemical company in the United States has stated that "one of the great myths

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[1] Carl Heyel (ed.), Handbook of Industrial Research Management (New York: Reinhold Publishing Corporation, 1959), p. 5.

[2] Ibid.

of industrial research has been that if you spend enough money something wonderful will happen. Management is beginning to realize this isn't so."[3]

The research department, like other functional departments of a company, must be held accountable (over a reasonable period of time) for its contribution to a particular firm's goals.

One method of planning and measuring the accomplishments of a research department is to use a comprehensive budget program within a firm. Budgeting aids research planning in several ways:

1. It requires that a proper definition of corporate goals, strategies, and research program policies be clearly thought out, developed, and communicated to personnel contributing to the attainment of those goals.

2. It provides a system of sorts for better coordination of research activities by balancing the various activities within a program, by the necessary exchange of information, and by the intermeshing of short and long-term program objectives.

3. It promotes periodic program review.

4. It establishes a system of check points (standards) for subsequent research controls.

"The research budget is primarily a planning device. Its main function is to express scientific and operating plans in financial terms."[4] Even though the desired results

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[3]Hubert Kay, "Harnessing the R & D Monster," Fortune, 71: 160, January, 1965.

[4]Heyel, op. cit., p. 281.

cannot be predicted with certainty, a research budget provides management with an important tool to plan, direct, and guide research into the desired channels.

Establishing standards for a research program is not an easy task, except for the most routine elements, such as office supplies and other miscellaneous items. Russell W. Henke indicates the difficulty involved in creating budgetary standards for research expenditures in the following comment:

> Budgeting for an operation like manufacturing, where costs are directly related to production levels, is difficult enough. Budgeting R & D, where costs are related to intangibles (ideas), is extremely difficult. Yet, some monetary guide posts must be established (for control purposes).[5]

Comprehensive research budgets are used in: (1) planning and evaluating the cost of research personnel and support personnel (secretaries, purchasing personnel, etc.,), (2) planning and controlling material and supply expenses, and (3) planning capital purchases and verifying the status of facilities and equipment. Also, a research budget aids in planning and controlling R & D overhead expenses.[6]

After management has decided upon what to spend for the initial investment in laboratories, support facilities, and equipment, along with staffing costs, the more difficult step must be taken in establishing what type of projects should be promoted and how much should be spent on these projects.

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[5]Russel W. Henke, Effective Research and Development for the Smaller Company (Houston: Gulf Publishing Company, 1963), p. 53.

[6]James Brian Quinn, "Control of Research and Development Costs," Journal of Accountancy, October, 1960, p. 45.

When an R & D program is new, management may decide that the expenditures should be run strictly on a cost basis (no standard for individual items- only a maximum for total amount that can be spent) for a year or two, in order that some idea of the range of expenses and the problems involved become somewhat established.

Three common guides used in determining how much should be spent on R & D are: (1) historical percentage of sales or capital base, (2) a growth-rate standard— i.e., increasing annual research expenditures 5 per cent to obtain a 5 per cent rate of growth, and (3) matching or exceeding a competitor's total expenditures for research.[7] Another method that is used is keyed to projected rate of return.

A vital element in budgeting applications is reviewing actual results (both operational and financial) with those previously set forth as guidelines. Each program review should bring the appropriate people together to consider technical success, proposed technical plans, and the expected marketing, production, financial, and personnel impact of a particular program, if it is successful in theory and practice.[8] Budget review can be performed both on a departmental basis, covering the overall research program, and it can be done on an individual project basis. Many firms use both types of reviews.

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[7]James Brian Quinn, "Long-range Planning of Industrial Research," Harvard Business Review, 88:97, July, 1961.

[8]James Brian Quinn and James A Mueller, "Transferring Research Results to Operations," Harvard Business Review, 41:63, January, 1963.

An important thing to remember is that, even though a budget is a good device for controlling R & D costs, aggregate R & D expenditures are not necessarily an accurate measure of aggregate R & D productivity. Even if actual expenses amount to less than those budgeted, it does not necessarily follow that a given program is progressing efficiently.

Various formulas have been developed for the purpose of aiding management in deciding how much should be spent on research. One such formula, which keys potential R & D expenditures to anticipated capital investment and sales income, is presented below.

Generalizing, let

P = plant investment,
W = working capital,
R = research and development cost before taxes, and R/2 the amount not deductible for tax purposes,
Y = period established for recovery of investment, including research and development costs,
S = annual sales volume expected,
N = minimum acceptable net margin on sales.

Then: $P + W + R/2 = YSN$

And: $R/2 = YSN - P - W$

$R = 2(YSN - P - W)$*

As an example, assume that management personnel of a particular firm plan to build a plant costing $2,000,000 in

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*"Accounting for Research and Development Costs," N.A.A. Research Report No. 29 (New York: National Association of Accountants, 1955), p. 25.

order that they can meet an expected annual sales volume of $10,000,000. In addition, an investment of $1,000,000 is required for working capital. Management has set forth eight years as the period for recoupment of its investment (including the non-deductible portion of R & D costs for tax purposes). Five per cent has been established as the minimum acceptable net margin on sales. Using the above-mentioned formula, one would get the following:

$$R = 2(YSN-P-W)$$

$$R = 2(8 \times \$10,000,000 \times .05 - \$2,000,000 - \$1,000,000)$$

$$R = 2(1,000,000)$$

$$R = \$2,000,000$$

The formula indicated above, like many formulas, has definite limitations on satisfactory usage. For instance, the formula indicated above does not include a provision for return on investment. Also, management assumptions about sales volume expected and working capital needed are related to the ability of internal personnel and to various external factors such as government legislation and competition from within the particular industry.

Other formulas have been developed to aid management in deciding upon project acceptability and priority. One such formula, called the Hoskold Transformation, is presented on the next page.

$$P = \frac{D}{R + \frac{R'}{(1+R')^n}} \quad **$$

Where:

P = the present worth of the incomes the project will yield if successful,

D = the average annual incremental income yielded if the project is successful,

R'= the average net return on capital invested in the enterprise,

R = the current rate of interest on investments, and

n = the number of years within which research costs must be recovered.

"The calculated P must be compared with the present value of the project's actual and projected costs to determine if the project is financially acceptable."[9] This method is complicated and still does not adjust for time delays between initial investment and realization of profit.

There are quite a few formulas available for use in computing the amount to spend on R & D, the acceptability of a given project, and the priorities of several projects, but most firms tend to use formulas as a supplement to an effective R & D budget and management judgement.[10]

** Carl Heyel, Handbook of Industrial Management Research, (New York: Reinhold Publishing Corporation, 1959), p. 298.

[9] Ibid., p. 300.

[10] Ibid.

W. D. Seyfried, Manager of Research for Humble Oil & Refining Company in 1961, stated the following comments contained in a report presented at an A.M.A. Briefing Session on Research and Engineering:

> We attempt to use a combination of all available techniques (for evaluating research), from fairly detailed quantitative evaluation in the case of major development projects to qualitative or semiquantitative judgments in the case of long-range projects. In the final analysis, we have found that there is no substitute for judgment exercised by qualified, responsible people.[11]

Responsibility accounting, integrated with budgeting techniques, provides a sound way of controlling R & D costs in that the various phases of each project's costs falls within the functional area of some person in the company, and account classifications, based upon functional responsibility, indicate where and by whom various costs were incurred or authorized. This method, along with the method of reporting costs per project, provide a fairly comprehensive check upon R & D expenditures, tied in with a budget.

II. THE SYSTEM CALLED PERT

The PERT (Program Evaluation·Review Technique) information system provides another method of control over R & D costs and program progress.

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[11] Jerome W. Blood (ed.), "Achieving Full Value From R & D Dollars," A.M.A. Management Report No. 69 (New York: American Management Association, Inc., 1962), p. 40.

Created initially (in 1958) to provide progress information to the management team of the Navy Polaris program, PERT was designed to deal with the measurement and control of time, i.e., compliance to plans, scheduling, and prediction of progress.[12] It was the concept of "concurrency," i.e., concurrent research and development in order to decrease overall development time, that gave birth to the PERT system.

Other management research in the area, conducted by the military services and private industry, has extended the PERT concept into measuring and predicting cost and performance — where performance refers to the performance of the item under development.

> Thus, PERT and its extensions represent a long-range research program directed toward the objective of an integrated R & D management system wherein time, cost, and technical performance are effectively portrayed for planning, as well as for management control and communications purposes.[13]

In the PERT system, the development program is initially illustrated graphically as a network of interrelated activities necessary to achieve prescribed events. Events are usually shown as squares or circles in the diagram, and activities are usually shown as the connecting arrows. (See Figure 4 on page 42).

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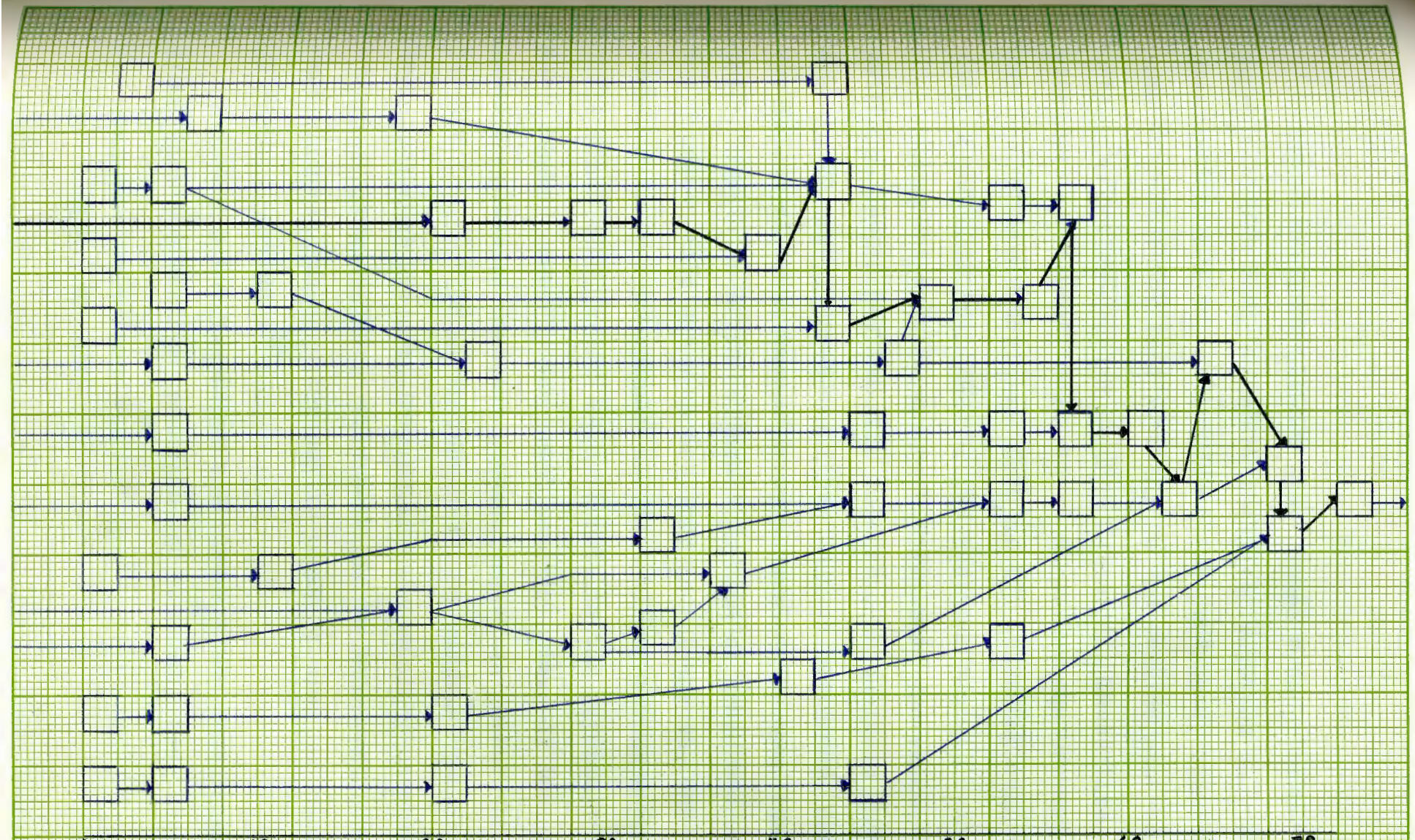
[12] Burton V. Dean (ed.), Operations Research in Research and Development (New York: John Wiley & Sons, Inc., 1963), p. 124.

[13] Ibid.



TIME IN WEEKS

FIGURE 4

THE NETWORK FLOW PLAN OF A PERT SYSTEM

After the PERT network (see Figure 4 on previous page) has been laid out graphically and verified as to representing the work and activities to be performed, elapsed time estimates for each activity in the diagram must be obtained from respective project personnel. These time estimates are usually measured in weeks and are established for each of the activities. This is the amount of time required to progress from one event to the next event.

After the network has been formulated and valid time estimates determined for each activity, an analysis of the ability to meet program deadlines must be performed. Normally, due to the sizeable amount of data involved in many cases, this analysis is often performed by digital computers. After the expected time for each activity is calculated, the computer is then programmed to total all of the expected activity times along every possible path in the network; then, the computer compares the total activity times of the many possible paths to find the longest, which is called the "critical path." It is this part of the program that management personnel are most interested in obtaining, shortening, and monitering, since if this path can be shortened, the whole program can be shortened in terms of time and decreased in terms of dollars.[14]

Research and development programs often contain work areas that are ahead of schedule and therefore have surplus

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[14] Ibid., p. 127.

time in the form of manpower and/or equipment. The PERT system, as a third step, can be used to locate and reveal all areas of the program that are either ahead or behind schedule, while also measuring just how much slack exists.

For operational accounting purposes, extended PERT applications are used to determine manpower requirements (direct labor costs) by skill, time period, and department.[15]

In summary, the PERT network provides an excellent model for planning, tracking, and evaluating a series of research and development activities which need to be coordinated over time. Recently, dollar estimates have been added to the time estimates so that time, effort, and dollars can be measured and controlled with reasonable accuracy.[16] The PERT system, when integrated with an effective comprehensive research budget and company objectives, provides an extremely effective method for planning, measuring, reviewing, and evaluating a firm's R & D progress.

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[15]Burton V. Dean (ed.), Operations Research in Research and Development (New York: John Wiley & Sons, Inc., 1963), p. 137.

[16]James Brian Quinn and James A. Mueller, "Transferring Research Results to Operations," Harvard Business Review, 41:63, January, 1963.

IV

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

As mentioned in the first chapter, research and development has grown tremendously during the past few decades; in fact, industrial R & D expenditures increased more than 7,000 per cent between 1931 and 1966. In the United States the Federal government, private industry, and non-profit organizations have put strong emphasis on various types of research, especially in the area of applied research. Through this strong emphasis and support of research, the United States has become the free-world's research leader in such fields as aero-space, computer science, electronics, nuclear power, commercial aircraft, chemistry, and medicine, to name a few.

The reasons behind the emergence of the United States as a leader in research and development are numerous, varied, and somewhat interrelated. One key reason is the disruption of Western Europe's economic, political, and social establishment during World War II. A second important reason is the existence of the "Cold War" since the end of the Second World War. Both the leading Communist-bloc country, Russia, and the strongest free-world nation, the United States, gained an awareness that R & D was a valuable political and economic weapon to be used for national advancement in world-wide rivalry. It is also significant that both nations, now generally acknowledged as the political and technological

leaders of the world, stress the value of quality education and training for the mass of their respective citizens. Also, both countries maintain economic policies conducive to the relatively rapid progress of research. In contrast, it was indicated that certain countries of Western Europe did not put as heavy an emphasis on R & D, and, in certain cases, some even discouraged widespread research performance, at least until the last few years, when the existence of a technological gap became apparent in certain fields.

Even without the existence of international political and economic challenges, the industrial firms of the United States have been motivated to perform varying degrees of R & D due to the existence of process and product competition within industries and the desire to grow and diversify. It was stated that research and development, in such fields as drugs and chemistry, can very well mean the difference between the success and failure of a firm.

Evidence has been presented, through various studies, that indicates a correlation between the size of R & D expenditures and the resulting sales volume of companies. There also was some evidence presented in a study conducted by the American Telephone and Telegraph Company that indicated companies conducting effective R & D tended to be the more prosperous ones in the long-run, especially in science-oriented fields.[1] R & D has also played an important role in increasing productive efficiency through the creation of not only new, but better production tools, machines, and processes.

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[1]Davidson, loc. cit.

A significant accounting problem, related to the area of research and development, lies in determining in what manner R & D costs should be distributed over fiscal periods by private industrial firms. Two major methods that are in general use and that are approved by the Federal Government for tax purposes were presented. One major method is that of capitalizing R & D costs when incurred and amortizing them over subsequent periods, if and when the project is successful. The other major method, and the one most widely utilized, is that of charging R & D costs against current income during the period incurred. In addition, there exists a third method of allocating R & D costs that is used in a particular type of situation; that is, when revenues derived from research efforts are received at a relatively even rate throughout the fiscal period, while research expenditures for the current period are concentrated in a few months of the period. This third method is referred to as the accrual method.

In the comparison of the two major methods of R & D cost allocation over fiscal periods, it was indicated that most firms were found, through various surveys conducted by professional organizations, to charge the costs against income of the current period.[2] In a survey conducted by the author, over 90 per cent of the responding firms were found to expense such costs against appropriate current revenue.

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[2]Carl Heyel (ed.), Handbook of Industrial Research Management (New York: Reinhold Publishing Corporation, 1959), p. 292.

As a result of extensive reading, oral discussions, analysis of survey results of various organizations, and his own survey, the author recommends that the expensing method of allocating research and development costs be utilized as the preferred method generally because of the following reasons, which were noted by various firms surveyed: (1) conservatism in stating values is necessary when dealing with intangible elements such as R & D; in fact, conservatism is a general objective in valuing tangible elements, which normally have a higher degree of objectivity for valuation purposes, (2) research is normally regarded as a continuing function- a cost of maintaining one's position in the industry- and research costs are thereby regarded as annual recurring costs similar to other operating expenses such as advertising, (3) benefits from particular research project expenditures are generally uncertain in nature, and several accounting periods may pass before the success or failure of a given project becomes apparent. To defer costs of a project until the results are known could cause an overstatement of a firm's asset values; (4) benefits derived from research are not easily related to sales revenue received in a given period, since advertising, public relations, and other elements of a business all play a role in increasing or decreasing sales volume and income; (5) the useful life of knowledge gained through research cannot normally be established with satisfactory reliability to set an amortization period if costs were deferred since many uncertainties influence the success of a product, (6) Federal income tax regulations generously

permitting both the expensing method and capitalizing method currently tend to favor the expense method since the after-tax effect on income can then be computed with reasonable accuracy, while the use of the capitalizing method effectively depends (tax-wise) upon future tax legislation and future tax rates, which are an unknown factor and beyond the direct control of management personnel, (7) failure to match costs and revenue from projects does not significantly distort annual net income if research costs are consistently expensed and relatively stable from period to period.

There are certain occasions, however, that make capitalizing R & D costs preferable over charging them currently. One such situation is the initiation of an unusually large research project aimed at developing a specific new asset for its own use in production. Such a project might tend to seriously distort the income of a firm, especially a small one, for the given period. Even here, however, such expenditures, when deferred, are usually written off over a relatively short period (three to five years). Another situation that can lead to a firm's capitalizing even normal R & D costs is when the firm is itself relatively new, and such costs, if expensed, would present a poorer showing of financial operations over the first few years- a time when the need to obtain credit is usually important. Also, if a firm conducts R & D for an external company on a contract basis, such costs are normally deferred and charged against income when received from the customer.

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APPENDIX

121 Grosvenor Avenue
Pawtucket
Rhode Island 02860

Dear Sir:

As part of the Master of Science Program, I am doing research in one of the major problem areas in Accounting; that is, the allocation of applied research and development costs over accounting periods.

This is an area of growing concern in industry as Research and Development increases in importance, which is evidenced by the increased share of company funds used for that purpose.

With this in mind, would you please complete the brief questionnaire enclosed with this letter and mail it via the self-addressed envelope provided for your convenience.

If you should like any information concerning the conclusions of the study, I will be glad to furnish it to you, upon request, at the termination of the study.

Names of those firms participating will remain anonymous, unless specific permission to the contrary is obtained.

Yours sincerely,

Raphael A. Antrop

JM

QUESTIONNAIRE

FIRM: _____

TYPE OF INDUSTRY: _____

SALES VOLUME (1966): $ _____

1. What percentage of the gross sales dollar does your applied research and development consist of? _____ %

2. Does the firm's applied research and development deal mainly in: (Check one)

   ☐ a. Transforming ideas resulting from pure research activities into commercially feasible products.

   or

   ☐ b. Working to improve the functional effectiveness of an existing product.

3. From the three general methods listed below, which one does the firm use (or most closely adhere to, in principle) in distributing applied research and development expenditures over accounting periods? (Check one)

   ☐ a. Charge the costs against income for the period the expenditure is incurred.

   ☐ b. Defer (capitalize) the expenditures and amortize against future income.

   ☐ c. Provide for the costs before they are actually incurred by a charge against income.