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An analysis of industrial research and development trends and techniques

Keith A. Adams

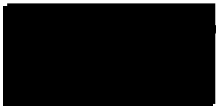
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NORTHERN ILLINOIS UNIVERSITY

"An Analysis of Industrial Research and Development
Trends and Techniques"

A Thesis submitted to the

University Honors Program

In Partial Fulfillment of the

Requirements of the Baccalaureate Degree

With University (Upper Division) Honors

Department of Accountancy

by

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DEFINITION OF RESEARCH AND DEVELOPMENT

In an era of growing global markets, corporate competition has become more intense. Companies that once operated solely in the United States are now diversifying their markets and tapping into the international arena. An important factor involved in such diversification is the ability to compete with large competitors by having similar or more advanced products. A competitive edge can be attained by creating a product that is totally redesigned or completely new. The primary vehicle for achieving such an edge is through industrial research and development.

The definition of research and development (R & D) is frequently divided into two components by the Financial Accounting Standards Board (FASB):

- (1) 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".¹

The key concept in this definition is the search for "new" knowledge and "new" products. Research does not include routine refinements to a manufacturing process, seasonal changes to products, or trouble-shooting in commercial production. It does include designing tools or molds involving new technology, designing and constructing pre-production prototypes, or modifying the design of a product. Those costs are incurred before the mass production of a new product. Such cost descriptions are outlined by FASB Statement No. 2.

The second component of R & D is "development":

- (2) Development "is the translation of research findings . . . 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 use or sale."²

In development, a significant modification can be made to a product or manufacturing process that enhances the design of such products and processes. Such modifications, however, do not include routine changes or seasonal repairs and maintenance to products or processes. Once a new product is being manufactured for commercial sale, any routine costs associated with production are expensed as manufacturing costs, not R & D costs.

History of R & D

The origins of R & D can be traced back to the late nineteenth and early twentieth centuries, a time when the American economy was expanding rapidly. There was a marked expansion "in the transportation, communications, and production technologies."³ Quality control laboratories developed and were primarily concerned with short-term changes to production schedules. These laboratories eventually evolved into corporate research laboratories that focused more on long-term changes to products. The longer-term scope resulted from the organizational changes that many U.S. firms were undergoing at the time due to increased antitrust legislation.

"Structural change in many large U.S. manufacturing firms and their investments in industrial research were influenced by U.S. antitrust policy."⁴ In 1898, the number of corporate mergers was growing rapidly. Such companies as General Electric and AT&T were merging with other companies to increase product lines and to offer more diversified products. As a result of the increase in size, these corporations developed more complex internal structures and began to organize central headquarters to manage the increased number of divisions. However, due to the strength these large firms acquired, price fixing and oligopolic tendencies became a concern in corporate America.

Many firms that were threatened by antitrust prosecution (under the Sherman Act) "used industrial research to diversify out of their primary industry and to accumulate patents that could protect a dominant market position."⁵ By diversifying into new markets, these firms had hoped that benefits from new patents would offset any losses incurred by the antitrust prosecutions.

Antitrust litigation in the early 1900s also affected the research that many firms conducted and introduced a new concept behind R & D. Due to the increase in oligopolies, the U.S. Justice Department began to take strict action. For instance, in 1913, AT&T was no longer allowed "to expand through the acquisition of other telephone operating companies, and meant that future growth would depend on . . . diversification into related lines of business."⁶ Earlier, R & D was used for protection against antitrust accusations. Expansion was sought outside of the primary industry. Now firms were using R & D to retrench into their primary industry and to expand their existing product lines. Greater focus was placed upon internal innovation and improved product lines. The amount of "merger mania" decreased, and as a result, firms sought to increase their market share within their primary industry.

Because of this new philosophy in R & D, the employment of scientists and engineers grew significantly. Between the years 1900 and 1940, "nearly 350 independent laboratories were established, employing close to 5000 scientists and engineers."⁷ Many manufacturing firms were beginning to use outside R & D contractors to conduct a portion of their research. These firms continued to use in-house research, though. Because of the difficulty in fully understanding the needs of an entire industry and the lack of firm-specific knowledge, outside researchers were used only as a supplement to in-house

research. Manufacturing firms were hesitant to rely upon external sources for 100 percent of their research.

The same period between 1900 and 1940 also illustrated a dramatic increase in the use of higher education research. The increase in public funding for higher education influenced such a rise in academic research. More facilities were made available to university faculty, who could use the more advanced equipment and resources to meet the research demands of commercial firms. The use of extensive in-house research, as well as the use of independent laboratories and universities, has continued from the 1940s into the 1990s.

TRENDS IN R & D EXPENDITURES

During the past couple of years, the aggregate U.S. expenditures for R & D by all firms has been increasing at a slow rate. According to R & D Magazine, "Federal, industry, university, and nonprofit research funding sources will spend \$158 billion in 1991."⁸ This amount represents only a 5 percent increase in expenditures that were forecasted for 1990. However, after the effect of inflation is removed from this projection, "the real growth rate in R & D expenditures will be about 1.2 percent from 1990."⁹

To further illustrate the low increase in spending, the following table shows the history of R & D expenditures incurred in various industries during the past four to five years:

Table 1. R & D Expenditures

| | I N D U S T R Y | | | | |
|--|-----------------|-------|-------|-------|------|
| | A | B | C | D | E |
| R & D Expenditures (as a % of budget) | | | | | |
| 1987 | 9.0% | 15.0% | 12.0% | 13.0% | 9.0% |
| 1988 | 13.0 | 15.0 | 13.0 | 18.0 | 13.0 |
| 1989 | 10.0 | 12.0 | 12.0 | 15.0 | 10.0 |
| 1990 | 11.3 | 12.4 | 16.7 | 8.5 | 11.3 |
| 1991* | 10.9 | 9.9 | 12.7 | 9.8 | 10.9 |
| R & D Expenditures (as % of sales) | | | | | |
| 1988 | 7.3% | 2.2% | 1.2% | .6% | .7% |
| 1989 | 7.4 | 2.0 | 1.2 | .6 | .8 |
| 1990 | 9.5 | 4.5 | 1.1 | 1.0 | 4.3 |
| 1991* | 9.2 | 4.6 | 1.1 | 1.2 | 4.4 |

* Percentages for 1991 represent forecasts

Industry Legend:

- A - Pharmaceutical (11-16 companies surveyed) (see Note 1)
- B - Machinery (13-16 companies surveyed)
- C - Paper (6-8 companies surveyed)
- D - Food (11 companies surveyed)
- E - Petroleum (8-11 companies surveyed) (see Note 2)

NOTES:

- (1) The pharmaceutical industry is especially hit by R & D costs. A firm such as Bristol-Myers or Bayer "can take eight to twelve years to develop one new drug, while incurring development costs of up to \$200 million."¹⁰ To offset these high costs, firms have increased their R & D spending as a percentage of sales. This can be seen in the 1989-1990 increase.

Table 1 continued

- (2) In the petroleum industry, the large decrease in R & D spending as a percentage of sales from 1989 to 1990 is due to the change in the number of companies surveyed. In 1989, eleven petroleum companies were surveyed. In 1990 and 1991, only eight companies were surveyed.

Sources: Industrial Research Institute's "Annual R & D Trends Surveys", Research Technology Management, Jan/Feb 1989 (p. 12) and March/April 1991 (p. 12).

The primary focus in this table is the change from 1990 to 1991. In the majority of the five industries, R & D will become a smaller portion of the capital budget. The food industry is the only one of the five industries that will have companies allocating more of their budgets for R & D. The eleven food companies surveyed will allocate 1.3 percent more of their budgets in 1991 for R & D, which represents over a 15 percent increase in percentage allocation from 1990.

In the pharmaceutical and petroleum industries, companies will allocate slightly less capital for R & D in 1991 (3.5 percent decrease in percentage of budget).

The machinery industry will have companies allocating only 9.9 percent of their budgets for R & D. This figure is 2.5 percent lower than 1990, which results in a 20 percent decrease in percentage.

The six companies surveyed in the paper industry will (on average) reduce their capital budget apportionment of R & D to 12.7 percent. This figure is down from 16.7 percent in 1990.

The following table summarizes the data in Table 1. The table illustrates the above discussion and provides the same type of information for the R & D expenditures as a percentage of sales. Primary focus is placed upon the changes from 1990 to 1991.

Table 2. Summary of Changes in R & D Expenditures (1990-1991)

R & D as a Percentage of the Capital Budget

| Industry | 1990 | 1991 | Change in % allocated | % Change |
|----------------|-------|-------|-----------------------|----------|
| Pharmaceutical | 11.3% | 10.9% | (0.4)% | (3.5)% |
| Machinery | 12.4 | 9.9 | (2.5) | (20.0) |
| Paper | 16.7 | 12.7 | (4.0) | (25.0) |
| Food | 8.5 | 9.8 | 1.3 | 15.0 |
| Petroleum | 11.3 | 10.9 | (0.4) | (3.5) |

R & D as a Percentage of Sales

| Industry | 1990 | 1991 | Change in % of sales | % Change |
|----------------|------|------|----------------------|----------|
| Pharmaceutical | 9.5% | 9.2% | (.3)% | (3.2)% |
| Machinery | 4.5 | 4.6 | .1 | 2.2 |
| Paper | 1.1 | 1.1 | -0- | -0- |
| Food | 1.0 | 1.2 | .2 | 20.0 |
| Petroleum | 4.3 | 4.4 | .1 | 2.3 |

Although the industries shown in Tables 1 and 2 indicate that most companies are decreasing their R & D budgets, it should be noted that these industries ~~only~~ represent ^{only} a small portion of all industries in the marketplace. As stated earlier, the spending in the U.S. for R & D is expected to increase 5 percent (before inflation). The five industries discussed, combined with many other industries, are included in this aggregate figure.

Why are many U.S. companies only slightly increasing R & D spending for 1991? The reason may be due to several economic factors. The predominant

economic factor pertains to the recession. A large recession may make the money supply tighter throughout the course of the year. If money becomes tighter, corporate profits will suffer because consumer spending will subsequently decrease. Consumers will become more conservative in their purchasing behavior. If a corporation projects lower profits in 1991, "research managers might have to balance corporate profitability against their R & D budget, which means less money for R & D."¹¹ Much emphasis is placed on the bottom line of the corporate income statement. Earnings per share is an important figure that is examined by investors. If earnings per share decreases substantially from one year to the next due to the economy, a corporation's stock price may decrease. If fewer profits are predicted, a company may wish to reduce expenses to offset the losses. The net effect would be a more stable earnings per share. The expense that is often targeted for reduction is R & D.

Another economic factor affecting R & D spending is the government deficit. The federal government is one of the major spenders for R & D, especially through the Department of Defense. Of the predicted \$158 billion in R & D spending for 1991, "about \$73 billion will come from the federal government, \$78 billion will be spent by industry, and the remaining \$7 billion will be spent by universities and nonprofit organizations."¹² Government spending, therefore, accounts for roughly forty-six percent of all scheduled R & D expenditures. However, "the slowing economy, the savings and loan bailout, and expenses for the recent Gulf War will add to the federal budget deficit."¹³ This increase in scheduled governmental costs will leave less room for R & D spending.

Although the government defense research budgets remain large, a minor decrease in spending would affect many industrial firms. Of the \$158 billion R & D expenditures, industry is expected "to perform \$113 billion of the actual R & D work."¹⁴ In other words, commercial firms will actually conduct nearly 72% of the R & D in the U.S. market in 1991. This figure, combined with the amount of governmental expenditures, can have a serious impact on firms if the government changes its R & D budget. If the impact is serious enough (especially in independent research laboratories), corporations may be forced to restructure financially. When such restructuring becomes major, companies may have to borrow money and increase their debt financing in order to fund the change. An increase in the debt may cause companies to reduce R & D spending. According to Bronwyn Hall, a researcher at the National Bureau of Economic Research, "R & D activity decreases after a sharp rise in the ratio of debt to market capitalization has occurred in a single year."¹⁵

As a result, U.S. firms are ~~being~~ more conservative in changing their own budget. Many companies are either slightly increasing their budgets or they are remaining at 1990's expenditure levels. Nigel Gault, a senior economist at the consulting firm of DRI/McGraw Hill, was disappointed in the small spending increase. He stated that "in a couple of years, if we can lower the budget deficit and get interest rates down, we may see an improvement in R & D spending."¹⁶

ACCOUNTING FOR R & D

R & D Costs

As discussed earlier, R & D can be defined in terms of its "research" and "development" components. To further enhance the discussion of R & D expenditures, the costs can be divided into five types.

The first type of cost is that associated with materials, equipment, and facilities used in R & D. According to FASB Statement No. 2, materials can include a "company's normal inventory and inventory acquired specially for research and development activities."¹⁷ These costs are expensed immediately as they are incurred and are included in R & D expense on the corporate income statement.

The costs for equipment and facilities are also expensed immediately if such assets are used for only one R & D project. If the equipment purchased or the facilities used can be utilized in various R & D projects, then the cost would be capitalized and depreciated over a reasonable period of time (the estimated useful life of the asset). The annual depreciation taken on these assets is then included in the R & D expense for the current year. For example, suppose a company constructed a laboratory for \$100,000 for use in the R & D Department. The new laboratory will be used for researching various new products through a series of many projects. In the company's general journal, the following entry would be made:

| | | |
|-----------------------|---------|---------|
| Building (Laboratory) | 100,000 | |
| Cash | | 100,000 |

Through this entry, the laboratory has been capitalized for the entire cost of construction. The asset appears in the company's balance sheet under the "Noncurrent Assets" section.

When adjusting entries are made at the end of the accounting period, the following general journal entry is made (assuming the building has an estimated useful life of 10 years and is depreciated on a straight-line basis):

| | | |
|--------------------------|--------|--------|
| R & D Expense | 10,000 | |
| Accumulated Depreciation | | 10,000 |

In this way, the cost of the laboratory is being allocated and expensed over several accounting periods benefited by its use.

If the laboratory was going to be used by only one R & D project, the entire construction cost would be expensed immediately. No annual depreciation would be incurred. In this situation, the following entry would be made:

| | | |
|---------------|---------|---------|
| R & D Expense | 100,000 | |
| Cash | | 100,000 |

A second type of cost associated with R & D is the cost of personnel. This includes the salaries, wages, and other costs of technicians, engineers, or scientists who devote their time entirely to R & D. These costs are expensed as they are incurred and become part of R & D expense. No salaries or wages are ever capitalized and subsequently depreciated or amortized.

The third R & D cost involves intangible assets purchased from external parties. These costs may include patents, franchises, licenses, or property rights that would enable the acquiring company to conduct R & D activities. "If an intangible asset purchased is to be used in only one R & D project, then the cost of the intangible should be expensed immediately."¹⁸ If, on the other hand, the intangible is to be used in many future R & D projects, then its cost is capitalized and amortized in accordance with APB Opinion No. 17 (which specifies the amortization periods for various types of intangibles).

For example, assume that a company acquires a patent for \$85,000 that will be used by the R & D Department. If the patent is to be used for only one R & D project, then the following journal entry would be made:

| | | |
|---------------|--------|--------|
| R & D Expense | 85,000 | |
| Cash | | 85,000 |

If, however, the patent is to be utilized in various R & D activities, the cost would be capitalized and amortized over a period of seventeen years (as prescribed by APB Opinion No. 17). The following entries would be recorded:

| | | |
|--------------------------|--------|--------|
| Patent | 85,000 | |
| Cash | | 85,000 |
| R & D Expense | 5,000 | |
| Accumulated Amortization | | 5,000 |

Notice how the periodic amortization becomes a part of the R & D expense for the accounting period.

The fourth type of cost associated with R & D is "the cost of contract services performed by others in connection with the R & D activities of the purchasing company."¹⁹ These costs include the R & D conducted by an outside firm on behalf of the company paying for the research. For example, Company A may contract with Research Firm Z in which Firm Z is to conduct some research on behalf of Company A. The costs arising from the services of Z are expensed immediately by A. The expense is shown as R & D Expense on A's income statement in the year the costs were incurred.

The final type of R & D cost involves a reasonable allocation of indirect costs associated with R & D activities. These costs may include, for example, the electricity needed to power the R & D equipment. Indirect costs cannot be directly linked to some unit of output. They are, however, an important part

in the operation of an activity. Consequently, indirect costs incurred by a firm's R & D activities are appropriately allocated to R & D Expense.

Upon assessing the five types of R & D costs, a company can accumulate the costs throughout the accounting period. As can be determined by the definition of the costs, a great majority of R & D expenditures are expensed, not capitalized, in the year they are incurred. "In a survey sent to 200 U.S. R & D directors in 1983, 62 percent of the respondents stated that more than 50 percent of their R & D costs are currently expensed."²⁰ In the same survey, "over 41 percent thought that 10 percent or more of the R & D expenditures should be capitalized and written off over time."²¹ As a result, the nature of each R & D cost should be examined to ensure that all expenditures are accounted for in accordance with FASB Statement No. 2.

R & D Disclosure

The disclosure of R & D Expense in a corporation's financial statements can take many different forms. Basically, the general rule is to disclose R & D expenditures in the footnotes of the financial statements and to include the costs in the "Expenses" section of the income statement. Any capitalized costs are reported on the balance sheet.

Including the costs on the income statement may take one of two forms. The first form involves specifically itemizing R & D expenses on the face of the income statement. The Clorox Company "Statement of Consolidated Earnings" on page 14 illustrates this type of disclosure. Notice how R & D is separately stated as an expense and is not combined with "Cost of Goods Sold" or "Other Expenses".

ements of Consolidated Earnings

THE CLOROX COMPANY

| In thousands, except per-share amounts | Years Ended June 30 | | |
|--|---------------------|--------------------|--------------------|
| | 1989 | 1988 | 1987 |
| Net Sales | <u>\$1,356,294</u> | <u>\$1,153,103</u> | <u>\$1,022,339</u> |
| Costs and Expenses | | | |
| Cost of products sold | 642,141 | 524,572 | 479,214 |
| Selling, delivery and administration | 269,586 | 235,629 | 204,453 |
| Advertising | 200,696 | 161,722 | 139,041 |
| Research and development | 37,161 | 30,735 | 31,049 |
| Interest expense | 7,182 | 4,085 | 5,377 |
| Other (income) expense, net | (30,158) | (12,450) | (22,176) |
| Total costs and expenses | <u>1,126,608</u> | <u>944,293</u> | <u>836,958</u> |
| Earnings from Continuing | | | |
| Operations before Income Taxes | 229,686 | 208,810 | 185,381 |
| Provision for Income Taxes | 84,126 | 77,884 | 80,599 |
| Earnings from Continuing | | | |
| Operations | 145,560 | 130,926 | 104,782 |
| Earnings (Loss) from Discontinued | | | |
| Operations (Note 2) | (21,416) | 1,644 | 117 |
| Net Earnings | <u>\$ 124,144</u> | <u>\$ 132,570</u> | <u>\$ 104,899</u> |
| Earnings per Common Share | | | |
| Continuing Operations | \$2.63 | \$2.39 | \$1.93 |
| Discontinued Operations | (.39) | .03 | — |
| Total | <u>\$2.24</u> | <u>\$2.42</u> | <u>\$1.93</u> |
| Weighted Average Shares Outstanding | 55,333 | 55,127 | 54,652 |

See Notes to Consolidated Financial Statements.

STATEMENT OF INCOME

Clark Equipment Company and Consolidated Subsidiaries

(Amounts in thousands, except per share data)

| | Years ended December 31 | | |
|---|-------------------------|------------------|--------------------|
| | 1989 | 1988 | 1987 |
| NET SALES | \$1,391,940 | \$1,278,277 | \$1,055,498 |
| OPERATING COSTS AND EXPENSES: | | | |
| * Cost of goods sold | 1,133,715 | 1,048,607 | 911,335 |
| Selling, general and administrative expenses | 164,611 | 155,752 | 143,804 |
| | <u>1,298,326</u> | <u>1,204,359</u> | <u>1,055,139</u> |
| Operating income | 93,614 | 73,918 | 359 |
| OTHER INCOME AND EXPENSE: | | | |
| Other income, net | 30,024 | 34,186 | 21,846 |
| Interest expense | (26,799) | (27,818) | (29,157) |
| Equity in net income (loss) of associated companies | 22,411 | 12,334 | (1,946) |
| Pre-tax income (loss) from continuing operations | 119,250 | 92,620 | (8,898) |
| Provision for income taxes | 54,510 | 48,492 | 11,951 |
| Income (loss) from continuing operations | 64,740 | 44,128 | (20,849) |
| Income (loss) from discontinued operations | 116 | (6,696) | 1,911 |
| Income (loss) before extraordinary credit | 64,856 | 37,432 | (18,938) |
| Income tax benefit from loss carryforward | 4,057 | 8,659 | 2,314 |
| NET INCOME (LOSS) | \$ 68,913 | \$ 46,091 | \$ (16,624) |
| INCOME (LOSS) PER SHARE: | | | |
| From continuing operations | \$ 3.77 | \$ 2.58 | \$ (1.19) |
| From discontinued operations | .01 | (.39) | .11 |
| Extraordinary credit | .24 | .51 | .13 |
| Net income (loss) | \$ 4.02 | \$ 2.70 | \$ (.95) |

(See Notes to Financial Statements)

SUPPLEMENTARY INCOME STATEMENT INFORMATION

| | Amounts in millions | | |
|--|---------------------|--------|--------|
| | 1989 | 1988 | 1987 |
| Maintenance and repairs | \$35.0 | \$28.5 | \$21.7 |
| Taxes, other than payroll and income taxes | 6.9 | 5.9 | 5.9 |
| Rents | 11.8 | 10.8 | 11.9 |
| Advertising costs | 9.2 | 8.0 | 10.0 |
| * Research and development costs | 24.7 | 20.8 | 23.4 |

combination of current, average, and historic exchange rates, and translation impacts are included in income. Transactions carried out in different currencies result in exchange adjustments which are also included in income. The impact of foreign currency translation and exchange transaction costs included in cost of goods sold were losses of \$0.5 million and \$8.1 million in 1989 and 1988, respectively, and income of \$6.3 million in 1987.

* Research and development expenses of \$24.7 million, \$20.8 million, and \$23.4 million were included in cost of goods sold in 1989, 1988, and 1987, respectively. The continued high level of spending reflects the Company's commitment to develop new products and to maintain current product superiority through use of the latest technologies.

Reductions of certain domestic inventory levels produced LIFO income which reduced cost of goods sold by \$3.3 million in 1989 compared with \$3.9 million and \$3.1 million in 1988 and 1987, respectively.

Selling, general and administrative expenses were \$164.6 million, or 11.8 percent of sales, in 1989 compared with \$155.8 million, or 12.2 percent of sales, in 1988 and \$143.8 million, or 13.6 percent of sales, in 1987. The 1989 dollar increase resulted largely from the higher selling expenses relating to sales increases. Employee-related benefit costs and charitable contributions were also contributing factors. The increase in the 1988 dollar level resulted from improved sales, higher finance charges, and the effects of management incentive compensation programs.

Macr Trucks, Inc.
and Consolidated Subsidiaries

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. Summary of Significant Accounting Policies

Leases

The Company's leasing agreements (see Note 7) consist of three general types of arrangements.

The Company leases certain equipment at two locations under the terms of sale-leaseback agreements classified as operating leases with terms ranging from seven to eighteen years. The deferred gains on the sales of the assets are amortized on a straight-line basis over the lease terms. The agreements contain purchase options available to the Company.

In the normal course of business, the Company leases computer equipment and facilities throughout the United States, Canada and Australia to support its operations. The lease agreements covering this equipment and facilities are classified as either capital or operating leases as appropriate.

Lastly, the Company leases motor vehicles to customers under operating leases, generally for periods of three to five years.

Investments

Investments are recorded at net realizable value.

Deferred Expenses

The deferred debt expense included in other assets is being amortized over the terms of the issues.

Product Warranty Costs

Provision for estimated costs related to product warranties is made at the time the products are sold.

Research and Development Costs

Expenditures for research and development are charged to expense as incurred and amounted to \$27,029,000 in 1989, \$26,247,000 in 1988, and \$26,174,000 in 1987.

Interest Costs

Capitalized interest costs amounted to \$3,584,000, \$5,922,000, and \$1,889,000 in 1989, 1988, and 1987, respectively.

Instead of separately disclosing R & D expenses, a company may include R & D costs with the "Cost of Goods Sold". This represents the second form of showing R & D costs on the income statement. The "Statement of Income" for Clark Equipment Company on page 15 illustrates this type of disclosure. However, when such expenses are combined on the income statement, a footnote disclosure is needed to provide more detailed information. The supplementary footnote detail is located on the bottom of page 15. These costs are lumped together and included in either the "Cost of Goods Sold" or the "Selling, General, and Administrative Expenses". By examining the Management Discussion and Analysis (MD & A) section of Clark's annual report (top of page 16), one can see that the R & D Expense is specifically included in the "Cost of Goods Sold". The MD & A is a section of the annual report that usually mentions R & D expenditures. R & D, to many corporations, is an important component of the firm's strategy in the marketplace. Keeping investors informed about corporate strategies and trends is an important function of the MD & A.

The supplementary information in the financial statement footnotes may not necessarily be in the form of a schedule, as it is with Clark Equipment Company. Management may decide to summarize the R & D expenses in a paragraph form rather than in schedule form. The narrative is usually mentioned in the "Summary of Significant Accounting Policies" footnote, which is a footnote that is required by the Securities and Exchange Commission. An illustration of this type of footnote is shown by the partial example of Mack Trucks, Inc. on the bottom of page 16. Notice how R & D costs are specifically stated in the footnote.

In summary, an investor would be able to discover a corporation's R & D expenditures by looking in three places in an annual report. The first place is the income statement, which can either show the R & D Expense separately or as a component of another expense. The next place is the financial statement footnotes, which provide the necessary supplementary information. The final place is the MD & A, which highlights management's major strategies and trends over the past few years. By examining these areas, an investor should be able to fully understand an entity's R & D Expense practices.

COOPERATIVE R & D

Forms of Cooperative R & D

During 1991, the use of R & D resources is expected to change. According to the Industrial Research Institute, "a shift (in R & D expenditures) is projected toward the support of existing businesses and new business projects."²² In other words, companies are expected to focus more of their R & D resources towards their core businesses. This focus is also expected to involve an emphasis on shorter-term projects due to the riskiness that long-range projects often carry. Especially with the recessionary times experienced in the early 1990s, many corporations are unsure about what the future holds. If, for example, the government deficit increases in the years to come, the funding for future R & D projects may become scarce since the government is a major spender of R & D. As stated earlier, in order to help balance the budget, the government may decrease its R & D spending.

A way to offset these R & D risks is through cooperative R & D. Cooperative R & D occurs when two or more firms join resources and work

together in conducting R & D activities. The use of cooperative R & D offers many advantages to individual companies. The first advantage includes "a pooling of the best technology to undertake major developments that would go beyond the resource capabilities of individual companies."²³ In other words, a corporation will benefit from the technology that can be offered by another firm. By combining various types of technology, more effective and efficient research can be conducted.

Another advantage of cooperative R & D is "the distribution of risk involved."²⁴ R & D, by definition, involves activities conducted to find new technology that may lead to new products or new manufacturing processes. The concept of "new" inherently possesses risk. For instance, an electrical equipment manufacturer is attempting to research a new type of circuit breaker that would revolutionize the home construction industry. If, after substantial R & D efforts, the company finds that the new idea is infeasible to produce due to significant costs and lack of adequate suppliers. Although the research expenditures would end up on the income statement, no benefit was yielded by the activities. The company may have gained some insights into possible new projects, but no direct or immediate benefit was derived from those specific R & D expenses. The costs represent sunk costs and cannot be regained since no return on the investment was incurred. Such a risk goes hand-in-hand with R & D. However, through cooperative R & D, the risks can be dispersed among the participating firms. If this had been done in the above example, the electrical equipment company would have assumed only a portion of the risk and the sunk costs. By the same token, however, any benefits received from a cooperative effort are also shared by the firms involved.

A final, major advantage of cooperative R & D is "the avoidance of wasteful, redundant effort."²⁵ In a competitive market, firms are often scrambling for the newest innovative ideas. Many of these ideas are shared by different companies, especially those operating in the same industry. Since some ideas may overlap, the research behind these ideas may also overlap. However, through cooperative R & D, the repetition of efforts can be reduced. Companies involved in the efforts could then make more efficient use of their R & D resources.

An example of an R & D cooperative organization is Microelectronic and Computer Technology Corporation (MCC). "MCC, a consortium of 12 companies formed early in 1983, serves as the R & D arm of computer and electronics firms . . . In 1984, the group had an annual budget of \$50-\$100 million, which far exceeds the capabilities of any single participating member."²⁶ As one can see, cooperative R & D such as MCC provides individual firms with substantial resources with which to conduct R & D activities.

According to trends indicated by the Industrial Research Institute's R & D survey, "about forty-two percent of the respondents expected to increase their R & D participation in alliances and joint ventures."²⁷ This figure is up from thirty-three percent, which was the amount of respondents who expected to increase such participation in 1990.

R & D Joint Ventures

Cooperative R & D is typically divided into two types. The first type is known as an R & D joint venture. By definition, a joint venture is an agreement where two or more firms come together to conduct business in a limited number of transactions. A partnership, the second type of cooperative

R & D that will be discussed later, is organized as an aggregate to conduct continuing business in many transactions.

R & D joint ventures begin when two or more companies join their common interests to formulate an agreement to cooperate in the activities of a few R & D efforts. On an international level, R & D joint ventures are becoming a way for U.S. firms to increase their global competitiveness. Many foreign companies, particularly those in the East bloc, often welcome U.S. companies into their R & D markets. In fact, "several East bloc governments (notably Hungary, Poland, and the USSR) are quite responsive to Western firms proposing to engage their inventors in joint ventures."²⁸ In many of these countries, especially the USSR, research is so abundant that many researchers and scientists receive little recognition for their efforts. The only way some of these researchers receive any recognition for their work is through publication. As a result, "the Soviets do maintain the largest technical abstracting service in the world."²⁹

In addition to such abundant resource abstracts, the USSR has a high concentration of researchers within its population. "The USSR has more scientific researchers than any other nation in the world. The Ph.D population is 10-30 percent greater than the U.S. . . . and one-third of the world's scientists work inside the Eastern bloc group of nations."³⁰ Such resources could provide tremendous advantages for U.S. firms.

With joint ventures, companies may come under special antitrust scrutiny. By having such cooperative efforts, a joint agreement may appear to involve collaboration efforts on the parts of the firms involved. Into the early 1980s, "joint ventures were barred by U.S. antitrust laws."³¹ However, during the Reagan administration, the antitrust legislation regarding joint ventures

became more liberal. According to recent statutes, "no antitrust problems exist when participating members represent no more than half of the relevant market of an industry and when they still leave room for four to six competitors."³² A joint venture is considered in violation of antitrust policies only if the venture is anti-competitive in nature and makes price-fixing easier among the cooperating firms. Each firm would then be liable for the actual damages that the joint venture caused in the market.

R & D Partnerships

Instead of cooperating in the R & D activities for a limited number of projects, individual companies may organize what is called an R & D partnership. This type of partnership is "a business organization that makes it possible to form syndicates for R & D venture capital."³³ The companies that form the partnership are aggregating their capital resources and using them to perform various R & D activities.

Like any other partnership, an R & D partnership is governed by a partnership agreement. The agreement is a legal document, usually expressed in writing, that provides information about the partners in the organization, the name and purpose of the organization, the amount of capital invested, and the life of the organization. The criteria for distributing partnership profits and losses is usually described in the agreement as well.

The partnership agreement allows partners to be in either of two classes: general partners, or limited partners. Both types of partners have a fiduciary duty to the partnership. General partners, however, have unlimited liability in the partnership. In other words, if an R & D effort yields little profit and/or causes substantial debt to arise, the general partners

are liable for any amount of loss or debt. They can take part in the management of the partnership and are required to act as an agent of the partnership. Limited partners, on the other hand, have only limited liability. Their liability for losses or debt is limited to the amount of their capital investment. They cannot take part in the management of the partnership and cannot act as an agent of the partnership in consummating R & D contracts.

R & D partnership profits come from the sale of research services. The partnership may act as the outside researcher for a firm ^{that} ~~who~~ is seeking supplementary research in addition to its own in-house research. Profit may also come from the sale of research findings. In this case, the partnership receives royalty income from the usage of its findings by other commercial firms.

R & D partnerships offer some major advantages for the participating firms. In addition to pooling technology, avoiding redundant efforts, and dividing risks, the partnership can:

- (1) "Allow off-balance-sheet financing for the firms involved,
- (2) Allow sponsoring companies to recapture ownership by buying out the limited partners, and
- (3) Mitigate (decrease) antitrust problems." ³⁴

As pointed out in the third advantage, a partnership can help protect R & D cooperatives from antitrust legislation. By forming a legal agreement, the resulting aggregate has a purpose for conducting collaborative efforts. Unlike a joint venture, the partnership is less susceptible to price-fixing suspicions.

R & D Policies

According to recent trends, American firms are focusing more on short-term R & D projects. Companies are reacting to changing markets that are becoming more saturated due to intense competition. "As certain markets become more saturated, we (companies) are forced to do more basic research to come up with completely new products . . . faster environmental change requires responsive innovation."³⁵ Because of such a quickly changing environment, U.S. firms are looking at the short-term prospects in order to remain competitive. As a result, the R & D projects conducted for the long-term horizon are often put on the "back burner."

How do companies set their R & D expenditure levels? The policies used often vary widely from one company to the next. For example, researchers found that in a survey of twelve companies, "the R & D budget was determined by 'availability of money' for four firms, by 'fixed percentages of sales' for three firms, and a combination of historical costs, availability of money, and competitor's actions for the other firms."³⁶

In conducting the survey, researchers divided R & D into its two components. Research was subdivided into two parts: basic and applied. Basic research is "investigation to gain knowledge for its own sake."³⁷ Applied research is "investigation directed toward obtaining specific knowledge with commercial applications."³⁸ Development, once again, is the translation of research findings into physical new products.

In a survey of thirty-six companies, researchers found that "the growth rate of the firm and the rate of technological obsolescence are the most important factors" when a company is determining the amount to spend on basic research.³⁹ For both applied research and development, "estimated rate of return on the project is as important as the growth rate of the firm or the obsolescence rate."⁴⁰ For basic research, the rate of project return is ranked much lower in importance. For all components of research and development, the researchers found that setting the R & D budget as a percentage of sales is not a common practice. In addition, the levels of R & D spending by competitors is also only a secondary consideration by most firms.

Japanese R & D Model

The Japanese style of management has proven to be successful for business people of the small, island country. Immediately after World War II, Japan began its rise into the competitive business world. With such concepts as JIT (just-in-time inventory), the Japanese have developed methods to maximize corporate profits, minimize expenses, and to yield the highest possible return on investment. Japan has even begun to revolutionize policies regarding R & D. The difference between Japanese R & D scope and attitude and that of many U.S. companies provides a unique basis for comparison.

In terms of R & D scope, most Japanese firms examine more long-term R & D projects than short-term ones. The typical horizon for an R & D project is ten years for a Japanese company. As one Japanese executive jokingly stated, "America thinks ahead ten minutes, Japan ten years."⁴¹

This difference in scope can be especially seen in the automotive industry, where R & D plays an important role in new product design and new

automotive capabilities. In Japan, "entirely new automotive designs with greater variety of technically sophisticated features appear about every three years. . . most U.S. autos have remained cosmetically-improved models until they reach an age of about five years."⁴² Such a two-year difference gives Japan an advantage in the market. By setting R & D plans ten years "down the road", Japanese manufacturers can change automotive designs much more frequently without jeopardizing short-term or long-term profits. American companies are often concerned with short-term profits and the bottom line on the income statement. They do not consider the long-term scope as much as the Japanese do in determining their R & D budgets.

Another factor of Japanese R & D policies that helps them to succeed is their overall philosophy towards R & D. The following quote summarizes a good portion of that philosophy:

"the Japanese have pursued broad-based technical opportunities, filed patent claims from every conceivable angle, and patiently planned for long-term effects of fall-out from their R & D. They count on all-out development of a technology, leading to major breakthroughs or at least to spin-offs from that technology platform."⁴³

Such a philosophy is used by Japan's biggest company, Nippon Telegraph and Telephone Corporation (NTT). The company was created and is protected by government policy and has "consolidated sales of almost \$38 billion and total assets of \$70 billion."⁴⁴ The company is a strong believer in R & D. Managers within each division of the firm investigate any type of technology that would be likely to improve any form of communication. NTT employs thousands of engineers and scientists, whose efforts are coordinated by "an R & D

headquarters and eleven telecommunications research laboratories.⁴⁵ In each division of the firm, there are applied research sections that examine R & D prospects.

Hitachi Corporation, a large manufacturer of electronics components, represents another illustration of Japan's R & D practices. Hitachi's management techniques "are designed to fully exploit each opportunity, and they have resulted in the company's consistent position as a world leader in patents awarded."⁴⁶ The company operates more than twenty research laboratories which focus mostly on the long-term anticipation of technological opportunities. In addition to looking at the long-term, many of Hitachi's research labs "formulate a five-year research plan every two years by synthesizing the plans of 17 technology committees . . . and departments that examine technology and market trends."⁴⁷ Through this process, management can get a feel for future R & D prospects and begin to plan the needed activities. Such a strategy helps the company to maintain its competitive edge.

The Japanese philosophy concerning R & D has proven to be effective for many of its domestic corporations. The success of the long-term scope may cause U.S. companies to revise their shorter-term R & D strategies. Through this change, U.S. firms may be able to regain a competitive edge in the global market.

R & D TAX CREDIT

The federal government began the R & D Tax Credit to stimulate progress in the U.S. To provide an incentive to conduct research, the U.S. Congress made a provision in the tax law that would give firms a tax credit if they

continued to spend money for R & D. The goal of the credit was to stimulate many of the production markets in the economy.

Since the original issuance of the tax credit, Congress has modified the provisions that grant the credit. In order to increase the amount of tax revenue, Congress was even considering repealing the credit. However, Congress renewed the corporate tax credit for R & D expenditures through September, 1990, but rejected requests to make it permanent.

The following three-step process is currently used to calculate the credit. Federal Tax Form 6765 is used to file the credit. That form is layed out in this three-step format:

- (1) Calculate the ratio of R & D costs to gross sales for the past five years,
- (2) Multiply the ratio in Step 1 by the total average gross sales. This number represents the fixed base.
- (3) Compare the current year's R & D expenditures with the fixed base calculated in Step 2. A tax credit is granted for 10 percent of the amount that current expenditures exceed the fixed base.

Through this process, one can see that a firm will only receive a credit if it continues to increase R & D expenditures from year to year. However, this credit is a dollar-for-dollar reduction in the total tax liability of a firm. Form 6765 is completed and attached to the corporate income tax form, Form 1120, which is due within two and one-half months after the corporate year-end. The actual amount of credit is shown in the "Tax Computation" section on page 3 of Form 1120 (please see page 30).

CONCLUSION

Industrial research and development is a major means by which commercial firms can maintain competitive edges against an increasingly intense competition. As U.S. markets become more saturated, domestic corporations may be forced to seek opportunities in the global arena. Through the use of R & D joint ventures or R & D partnerships, U.S. companies may be able to tap into the vast international resources that are currently available. By examining the internal methods of budgeting R & D and by analyzing the R & D practices of successful firms, corporations will be able to sustain a continued aggregate growth rate in R & D expenditures. Through the proper accounting classifications and disclosures of R & D costs, investors will be able to understand the corporate strategies that will carry us into the future.

Schedule J Tax Computation

| | | | |
|---|--------------------------|---------------------------|-----------|
| 1 Check if you are a member of a controlled group (see sections 1561 and 1563) | <input type="checkbox"/> | | |
| 2 If the box on line 1 is checked: | | | |
| a Enter your share of the \$50,000 and \$25,000 taxable income bracket amounts (in that order): | (i) <input type="text"/> | (ii) <input type="text"/> | |
| b Enter your share of the additional 5% tax (not to exceed \$11,750) ▶ | <input type="text"/> | | |
| 3 Income tax (see instructions to figure the tax). Check this box if the corporation is a qualified personal service corporation (see instructions). ▶ | <input type="checkbox"/> | | 3 |
| 4a Foreign tax credit (attach Form 1118) | | | 4a |
| b Possessions tax credit (attach Form 5735) | | | 4b |
| c Orphan drug credit (attach Form 6765) | | | 4c |
| d Credit for fuel produced from a nonconventional source (see instructions) | | | 4d |
| * e General business credit. Enter here and check which forms are attached: | | | 4e |
| <input type="checkbox"/> Form 3800 <input type="checkbox"/> Form 3468 <input type="checkbox"/> Form 5884 | | | |
| <input type="checkbox"/> Form 6478 <input checked="" type="checkbox"/> Form 6765 <input type="checkbox"/> Form 8586 | | | |
| f Credit for prior year minimum tax (attach Form 8801) | | | 4f |
| 5 Total—Add lines 4a through 4f | | | 5 |
| 6 Line 3 less line 5 | | | 6 |
| 7 Personal holding company tax (attach Schedule PH (Form 1120)) | | | 7 |
| 8 Recapture taxes. Check if from: <input type="checkbox"/> Form 4255 <input type="checkbox"/> Form 8611. | | | 8 |
| 9a Alternative minimum tax (attach Form 4626) | | | 9a |
| b Environmental tax (attach Form 4626) | | | 9b |
| 10 Total tax—Add lines 6 through 9b. Enter here and on line 31, page 1 | | | 10 |

Additional Information (See instruction F.)

| | Yes | No | | Yes | No |
|--|-----|----|----------------------|-----|----|
| H Refer to the list in the instructions and state the principal: | | | | | |
| (1) Business activity code no. ▶ | | | | | |
| (2) Business activity ▶ | | | | | |
| (3) Product or service ▶ | | | | | |
| I (1) Did the corporation at the end of the tax year own, directly or indirectly, 50% or more of the voting stock of a domestic corporation? (For rules of attribution, see section 267(c).) | | | | | |
| If "Yes," attach a schedule showing: (a) name, address, and identifying number; (b) percentage owned; and (c) taxable income or (loss) before NOL and special deductions of such corporation for the tax year ending with or within your tax year. | | | | | |
| (2) Did any individual, partnership, corporation, estate, or trust at the end of the tax year own, directly or indirectly, 50% or more of the corporation's voting stock? (For rules of attribution, see section 267(c).) If "Yes," complete (a) through (c) | | | | | |
| (a) Attach a schedule showing name, address, and identifying number. | | | | | |
| (b) Enter percentage owned ▶ | | | | | |
| (c) Was the owner of such voting stock a person other than a U.S. person? (See instructions.) <i>Note: If "Yes," the corporation may have to file Form 5472.</i> | | | | | |
| If "Yes," enter owner's country ▶ | | | | | |
| J Was the corporation a U.S. shareholder of any controlled foreign corporation? (See sections 951 and 957.) | | | | | |
| If "Yes," attach Form 5471 for each such corporation. | | | | | |
| K At any time during the tax year, did the corporation have an interest in or a signature or other authority over a financial account in a foreign country (such as a bank account, securities account, or other financial account)? | | | | | |
| (See instruction F and filing requirements for form TD F 90-22.1.) | | | | | |
| If "Yes," enter name of foreign country ▶ | | | | | |
| L Was the corporation the grantor of, or transferor to, a foreign trust that existed during the current tax year, whether or not the corporation has any beneficial interest in it? | | | | | |
| If "Yes," the corporation may have to file Forms 3520, 3520-A, or 926. | | | | | |
| M During this tax year, did the corporation pay dividends (other than stock dividends and distributions in exchange for stock) in excess of the corporation's current and accumulated earnings and profits? (See sections 301 and 316.) | | | | | |
| If "Yes," file Form 5452. If this is a consolidated return, answer here for parent corporation and on Form 851, Affiliations Schedule, for each subsidiary. | | | | | |
| N During this tax year, did the corporation maintain any part of its accounting/tax records on a computerized system? | | | | | |
| O Check method of accounting: | | | | | |
| (1) <input type="checkbox"/> Cash | | | | | |
| (2) <input type="checkbox"/> Accrual | | | | | |
| (3) <input type="checkbox"/> Other (specify) ▶ | | | | | |
| P Check this box if the corporation issued publicly offered debt instruments with original issue discount | | | | | |
| If so, the corporation may have to file Form 8281. | | | | | |
| Q Enter the amount of tax-exempt interest received or accrued during the tax year ▶ | | | <input type="text"/> | | |
| R Enter the number of shareholders at the end of the tax year if there were 35 or fewer shareholders ▶ | | | <input type="text"/> | | |

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43. Ibid., p. 28.

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May 14, 1991

Mr. Keith Adams


Dear Keith:

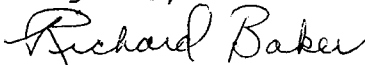
I have finished grading your Honors Thesis entitled, "An Analysis of Industrial Research and Development Trends and Techniques." I have assigned a grade of "A" for your work on this project. The grade will be administered as a change of grade for the Accountancy 499 course. You may receive an initial grade report of Incomplete for the Accountancy 499 course because grades were turned in on Friday, May 10, 1991. You were taking the CPA Exam so you and I had previously agreed to have you turn your paper in on Monday, May 13th. I have signed the necessary forms for your grade change to an "A" in Accountancy 499.

I enjoyed reading your paper. I liked your development of the topic, the discussion of alternative R&D models and vehicles such as cooperative associations and partnerships, and your presentation of the social, political, and economic inducements for encouraging R&D efforts.

You did an excellent job of filling out your selected topic. Your development of ideas and manifested points effectively illustrated your arguments. I was very impressed with your high level of writing quality.

Congratulations on a very good paper, and best wishes for continued successes in all your endeavors.

Regards,


Richard E. Baker

HONORS THESIS ABSTRACTS
THESIS SUBMISSION FORM

AUTHOR: Keith A. Adams

THESIS TITLE: "An Analysis of Industrial Research and Development Trends
and Techniques"

ADVISOR: Dr. Richard Baker ADVISOR'S DEPT: Accountancy

DISCIPLINE: Accountancy YEAR: 1991

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SUBJECT HEADINGS: (Choose 5 key words or phrases by which a reader could
find your thesis)

Research and Development (R & D) Cooperative R & D

Research and Development Costs Research and Development Models

Research and Development Tax Credit

ABSTRACT (100-200 WORDS): Research and Development has always been an
important part of American industry. Individual corporations often have
different attitudes towards R & D, but the major purpose for R & D
continuously arises: to remain competitive in the expanding global
marketplace. The purpose of this project is to present a thorough
analysis of industrial R & D.

The project consists of five sections. The first section begins
with a definition of R & D. The definition divides R & D into its
"research" and "development" components. How R & D began and developed
over the past ninety years is then discussed. The second section involves
a study of the trends in R & D expenditures over the past five years. Due
to the wide array of industries in the marketplace, this study is limited
to the following five industries: pharmaceutical, machinery, food, paper,
and petroleum. Two tables show that many companies intend to decrease
their R & D expenditures as a percentage of budget from 1990 to 1991.
The third section explores the techniques used by companies to disclose
their R & D expenditures in the annual report. The fourth section studies
cooperative R & D. R & D joint ventures and partnerships are discussed
and the forms and incentives for each are explained. This section also
includes an analysis of the criteria corporations use to set R & D
policies. The final section of the project provides an illustration of
how the R & D Tax Credit is computed. A concise conclusion then follows.

For Office Use:

THESIS NO: _____