

A CASE STUDY ON CAPITAL BUDGETING

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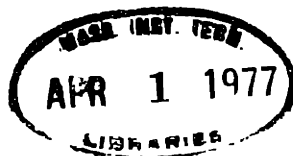
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Theories on capital budgeting have traditionally been financial theories, concentrating on selection of projects in a way which will maximize the value of the firm or maximize the return per dollar invested. Divergent theories defend different techniques for evaluating and ranking projects on their abilities to achieve this objective. But most firms operate under constraints that are assumed away by the theories: capital rationing, scarce resources other than capital, and performance evaluation based on several short term financial and non-financial measures.

Corning Glass Works developed and implemented in 1976 a new capital budgeting procedure which attempts to capture these elements, selecting projects on the basis of their ability to satisfy multiple objectives within a variety of constraints. The key elements of the new selection criteria are financial measures, strategic considerations and optimum utilization of technical manpower.

Although Corning's capital budgeting procedures in the early 1970's had written project selection criteria based only

on financial measures, there were a variety of implicit, subjective considerations which the resource allocators included in the selection of projects. It is believed by many that the new capital budgeting procedure is really only a formalization of the actual criteria that were being used in project selection prior to 1976. And this is the hypothesis to be tested.

Through interviews with Corning's management and review of many capital budgeting records and memoranda, historical capital budgeting procedures have been defined. The process operating in 1974 is explained, and projects submitted and approved for 1975 are presented and analyzed. This is followed by a description of the 1976 capital budgeting procedure, and the changes (if any) that would have occurred applying the new selection criteria to projects proposed in 1974 are discussed.

Indeed, it appears that the new capital budgeting procedure would have selected a different portfolio of projects than the 1974 process selected. The study is concluded with discussion of advantages and problems with the new capital budgeting procedure.

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I. Introduction

All ongoing firms face a common problem: what capital investments should be made--what investments will increase future earnings and the firm's value, and what investments are necessary simply for continuation of the business. The problem is further complicated by a variety of constraints: the amount of total capital funds to be invested, technical manpower and expertise and managerial resources available for project implementation to name a few. To be sure some of these constraints are self-imposed, but they are very real nevertheless.

The subject of capital budgeting encompasses a variety of issues--generation of projects, techniques for estimating project results, treatment of risk in project evaluation, determination of the total amount of capital to be invested in a given time frame, financing decisions, the locus of decision making for project selection, criteria for project selection, and monitoring results of the projects being implemented. The focus of this study will be on the process and criteria for selecting projects from a set of proposed projects.

The purpose of this thesis is to study how one company, Corning Glass Works, chooses to invest its capital funds when there is a variety of opportunities. In 1976 Corning adopted a new process and set of decision rules for selecting projects for the 1977 capital budget. This study will

examine in depth the new capital budgeting process as well as the process that was in place in 1974. Projects submitted in 1974 will be reevaluated using 1976 decision rules in order to determine whether any different choices would have been made--if so, what those switchings would have been and their impact on the company. The hypothesis is that the new explicit capital budgeting procedure was operating implicitly in 1974.

Sources of information concerning past and present capital budgeting techniques at Corning were written rules and guidelines for capital decisions published and circulated within Corning, intercompany memoranda concerning 1974 and 1976 capital budgets, records of capital project submissions and acceptances over the past three years, interviews with Corning managers (both staff and line) who were involved in the 1974 and 1976 capital budgeting processes and personal experience working within the system.

The case study will be presented in five parts. Section II presents a brief review of capital budgeting techniques recommended in the current literature.. Section III explains in detail the explicit rules and (to the extent it is possible to determine) the implicit rules governing project selection at Corning in 1974, as well as the profile of projects submitted and selected for 1975. Similarly the next section will describe the explicit rules and process used to select 1977 projects in 1976. These new rules will be applied to

1974 project submissions to provide the alternate portfolio of projects for 1975. Section V concentrates on comparison of the two selection procedures, evaluating each. Conclusions will then be summarized in the final section.

II. Review of Capital Budgeting Literature

Most of the capital budgeting literature reviewed was written by academicians, concentrating on the financial aspects of projects and the firm, and trying to explain the "theoretical" way to optimize investment decisions. These theories on project selection techniques have been and still are evolving without a consensus as to the optimal procedure for allocating capital funds.

Most theoretical capital budgeting procedures assume that the objective is to maximize the value of the firm, and different views emerge concerning the way this can best be achieved. There are essentially five families of recommended project selection techniques: payback, net present value (NPV), internal rate of return (IRR), accounting rate of return (ARR), and mathematical programming techniques.

Payback methods are the simplest and most easily understood techniques, but the least sophisticated. The simplest version requires only estimates of the initial cash outlay and future cash inflows from the project. A maximum acceptable payback period is determined by the firm, and without capital rationing, any project which will recoup the initial outlay within this time frame is accepted. This technique fails to consider the time value of money and the pattern of cash flows during the payback period. Hence a modified payback method has been devised whereby cash inflows are

discounted by the firm's cost of capital to determine the number of years required to recover the initial investment. The basic problem with either of these methods is failure to consider a project's future earnings after the payback period. However, payback is useful as a constraint, weeding out projects with very long payback periods regardless of other considerations. This may be desirable for two reasons: to limit the time of risk exposure for any single project or for behavioral reasons, increasing the likelihood that a single project sponsor will see a project through implementation enabling him to reap the benefits of his work, enabling top management to better evaluate his performance and providing consistent leadership throughout project implementation.

The NPV techniques discount future cash inflows of each project and accept the project as long as discounted cash flows are greater than the initial cash outlay. Modifications include a risk adjusted NPV using certainty equivalents rather than actual estimates for future cash flows, and the profitability index or benefit/cost ratio where projects are accepted as long as the ratio of discounted cash inflows to cash outlay (or discounted cash outlay) is greater than one. This latter modification purports to discriminate between projects with the same present value but different costs. However, the primary problems with any NPV technique center on determination of the appropriate discount rate. It is difficult enough to determine a firm's cost of capital at one

point in time, but the cost of capital may be different at different times in the project's life because of internal factors such as changes in the level of risk (either for the individual project or for the portfolio of projects if the firm's cost of capital is used) or changes in the firm's capital structure (when the firm's cost of capital is used). External factors such as market conditions and government monetary policy may also affect the cost of capital of the firm. Added to this are the questions of whether to consider risk class and individual financing decisions for specific projects or businesses, and if so, how to best estimate the project (or business) discount rate with these considerations. However, NPV is the generally recommended "simple" technique for project selection, in spite of the discount rate complications.

The internal rate of return method considers the cash inflows and investment outlay to determine what discount rate (IRR) yields an NPV equal to zero. Projects are accepted as long as the IRR is above some hurdle rate, theoretically the firm's cost of capital, or in order of decreasing IRR with capital rationing. The drawbacks of this method are the possible existence of more than one root (i.e. IRR value) as a solution, with mutually exclusive projects of different sizes the IRR may reject the one with much larger cash inflows, and IRR ranks differently from NPV projects of different length lives, with NPV generally

considered the more valid method. There also is a great deal of controversy over the basic assumptions of the internal rate of return method. Some theorists maintain that the IRR method assumes that cash generated by the project can be reinvested at the IRR rate, that this assumption is unrealistic, and that the NPV method is much more valid because it assumes an external reinvestment rate. An opposing view held by the author is that the IRR is the opportunity cost of not taking the project, merely reflecting the required rate of return of an alternate project of equivalent investment.

The last "simple" family of techniques is accounting rate of return which uses a ratio of some measure of accounting income (e.g. income in the first year or average income over the life of the project or some portion of that life) to investment (e.g. initial investment, average investment over the project's life, or average book value of investment). These techniques are not highly regarded by the "finance experts" because they do not consider the time value of money, patterns of cash flows or economic (rather than accounting) income, and they are subject to the whims of the firm's accounting policies. However, they can be useful if the firm's objective is maximizing short run accounting income as opposed to maximizing the value of the firm. And managers are often motivated to set short run profit goals because their performance is evaluated on the basis of results for a relatively short time period (1 - 5 years).

In addition to this, stockholders often view short run financial results as indicators of future earnings potential of the firm, and a policy of sacrificing short run profits for long run profits may be misinterpreted or simply not believed by the market.

The last family of techniques, mathematical programming, considers an objective with multiple constraints and requires a relatively high level of sophistication on the part of its designers and users. Essentially the firm's objectives and constraints are quantified and projects are evaluated in such a way as to optimize goal achievement within existing constraints. Usually the program optimizes NPV or a utility function choosing the project portfolio from efficient (minimum risk for any given return) collections of projects on the basis of the firm's desired risk/return trade-off. This technique sounds good, but there are many practical problems. The firm must be able to quantify all objectives and constraints, including those appropriate for projects such as maintenance of business or legally required safety and pollution control investments, and the firm's risk/return utility function if using portfolio selection. Determination of the appropriate discount rate is again required. In addition, integer programming should be used since most projects are either "GO" or "NO-GO", without the option of implementing fractions or multiples of a project. Research of recent literature uncovered only a few lines referring to

use of integer programming for capital budgeting purposes.

Studies of actual capital budgeting practices show that most firms analyze a project by one or a combination of more than one of three primary techniques: payback, ARR and IRR. Exhibit 1 shows the results of two recent surveys by Thomas Klammer (1970) and James Fremgen (1971). Firms reported that the formal analysis results are not necessarily the primary determinants of project choice.

A variety of reasons can be proposed to explain why management on the whole does not use more rigorous, sophisticated analyses or the "recommended" decision criteria. First of all, the basic assumptions of the theoretical models are not always justified. For example, the models assume a single objective of the firm--to maximize its value. There are two basic problems inherent in this assumption. Management often has short term (1 - 10 year) objectives of maximizing earnings, target annual sales growth or some other single or combination of financial and/or non-financial performance measures rather than the long term objective of "value maximization." It might be argued that these goals are operational surrogates of the value maximizing goal, but in fact, the results do not point to alignment between project selection with the two (sets of) goals. The "short term" manager is forced to look at trade-offs between conflicting objectives such as increasing profits and increasing market share, and he must also consider the interaction or

EXHIBIT 1

	KLAMMER - 1970	FREMGEN - 1971		
	Most sophisticated evaluation technique used	Evaluation methods used	Most important method used in selection	Ranking techniques used under capital rationing
PAYBACK	12%	67%	14%	45%
NPV	57%	20%	4%	11%
IHR		71%	38%	60%
ACCOUNTING ROR	26%	49%	22%	40%
PI or B/C	---	6%	1%	40%
L. P.	---	---	---	19%

synergy resulting from combinations of individual projects. The traditional project selection models such as NPV consider projects one at a time on the basis of one attribute (NPV), and by doing so may not truly maximize value of the firm. Basic capital budgeting theory assumes each project of a firm is independent, that returns will be the same regardless of who implements the project, and that each project should be evaluated on its own merit. This is a fallacy; management and technical expertise and various economies of scale (manufacturing, marketing, etc.) unique to the firm affect returns of projects. The value of a collection of projects selected by evaluation on several dimensions may in fact be greater than the sum of the values of individual projects selected one at a time by evaluation on one dimension only.

Another faulty assumption of capital budgeting theory is unlimited resources of the firm. Not only do traditional capital budgeting techniques sweep under the rug the problems associated with capital rationing, but they fail to recognize the limits placed on project selection by management and technical resources. And by so doing, the models can yield project portfolios with suboptimal utilization of all the firm's resources.

A second problem with traditional models is the concept of an annual project selection process optimizing an objective function when actual implementation occurs in a dynamic world of changing opportunities, constraints and threats

imposed from inside and outside the organization. It is highly improbable that any choice of a portfolio would remain optimal throughout the next twelve months.

A third problem is the lack of general understanding of the more sophisticated techniques--the underlying theories, how to use the techniques and how to relate the techniques to one's experiences and intuitive algorithms--on the part of the business community as a whole.

III. Corning's Capital Budgeting--1974

Information contained in this chapter and in chapter IV was collected in personal interviews and from various intra-company memoranda from Corning Glass Works. Quotes will not be referenced individually.

A. Background

Corning Glass Works is a large, multinational manufacturing corporation with 1974 sales of \$1 billion. Although Corning is diversified, the primary basis of all its operations is glass and ceramic technology. The objectives of the firm are stated in terms of target annual sales growth, return on investment, return on assets and return on sales.

Corning's organization is semi-decentralized with nine major operating divisions in 1974. Each division is relatively homogeneous in terms of generic products and markets and is responsible for its own manufacturing, basic engineering, sales and marketing, and control functions. Central staff groups provide basic research and development, engineering, personnel administration and overall planning and control for the entire corporation. For the purposes of planning and control, Corning's operations are further broken down into business units, of which there were approximately 30 in 1974 and over 60 in 1976.

Corning's basic capital budgeting process applies in both 1974 and 1976; the details and actual decision rules to be described later are the changed elements. Early in the year the Corporate Finance Division establishes guidelines for overall capital spending for the following year. In June each division submits its proposed capital projects for the next year. For projects > \$100,000 individual proposals are submitted specifying the relevant business unit, class of spending, IRR, payback period and business ROA (Return on Assets). (The method of calculation for each of the financial measures is described in Appendix 1.) A lump sum is also requested by each division for projects less than \$100,000. A committee of individuals from corporate staff groups then reviews the proposals and recommends a capital budget of specific projects > \$100,000 and discretionary funds for smaller projects for each division. This recommendation is then approved by top management, sometimes with minor modifications to the original recommendation. However, approval of this budget does not mean each project is automatically accepted. Prior to starting each project an Appropriation Request (AR) must be submitted, providing firm estimates of costs, returns and project justifications. Depending on the amount of capital requested, the AR must be approved at various levels of management with > \$250,000

requiring approval by the Board of Directors. This is the final approval determining whether the project will "GO" or not.

B. Project Selection Criteria in 1974

Prior to the capital budgeting process in 1974, a list of criteria for project selection was drawn up by the Corporate Controller's office. According to this list there were six types of criteria to be considered. They were project type, project economics, nature of business, required resources, risk and "other" considerations.

Project Type

For several years Corning had used five classes of spending to categorize projects: non-discretionary or legally required, cost reduction, expansion of established businesses, maintenance of established businesses and development. In addition to these types of projects, warehouses and diversifications were used in 1974. The projects were to be evaluated differently depending on what type each was. Only intuitive, unwritten guidelines of distribution by classes of spending existed for the divisions and the corporation as a whole. The only explicit rules for different evaluation and selection criteria were spelled out in project economics guidelines.

Project Economics and Nature of Business

Project economics included project IRR, payback, maximum exposure and effect on near term earnings. The nature of the business to which the project was relevant was characterized by ROA (Return on Assets), classification on the BCG (Boston Consulting Group) matrix, the importance of the business to Corning and the importance of the project to the business.

Relative to these two categories, a memo was issued from the Corporate Controller to division managers and division controllers in June, 1974. This memo set forth "basic guidelines" for capital projects and stated that "These guidelines are not an absolute sieve through which every project must pass. However, projects which do not meet the guidelines will not normally be approved."

These guidelines were as follows:

I. Non-discretionary Projects

These projects are actually discretionary in that the alternative is to go out of the business. Decision rules are:

1. Projects will not be approved if the current business ROA is less than 10% and not projected in an approved (5 year) plan to be greater than 18%.
2. Even if the business ROA is $> 18\%$, if the non-discretionary project will reduce the overall ROA it will be challenged for alternative courses of action.

II. Cost Reduction

1. A minimum 15% IRR, adjusted for probability

of success is required.

2. The appropriate project life used in IRR calculations should be the shortest of product life cycle, process life cycle or physical asset life, or a maximum of 24 months if current business ROA is $< 10\%$ and not projected to be $\geq 18\%$ in five years.

III. Expansion of Established Businesses

1. A minimum 20% IRR, adjusted for probability of success is required.

2. The project must be driving the business ROA to 25% if it is currently $< 25\%$, or the project must provide at least an ROA of 25% on the assets involved if the current business ROA is $\geq 25\%$, i.e. the project has heavy front end loads, but the long term benefits are very good.

IV. Maintenance of Business

1. IRR for these projects may be calculated on a defensive basis--the project is necessary to maintain current sales and earning levels. This type of IRR must be $> 25\%$ and the project should maintain the business ROA $> 18\%$.

2. If cash flow projections on the maintenance project are not possible, the project must maintain the business ROA $\geq 18\%$.

3. Projects will be challenged if current business ROA is $< 10\%$ and projected to be $< 18\%$.

V. Developing Businesses

No explicit criteria were stated, but factors to be considered were:

1. Expected ROA, assuming success.
2. Defendability of the business created.
3. Expected market position.
4. Competitive prices.
5. Exposure--both expense and capital.
6. Future opportunities created by the business
7. Pricing flexibility.
8. Customer profile.
9. The timing "window."

IV. Acquisitions, Diversifications, Other Investments

"Standard financial and economic projections will be prepared (expected ROA, DCF, etc.). However, the fundamentals of the proposal in non-financial terms are critical. We will pay a high price in present value for future earnings. The earnings must be of high quality."

With regard to maximum exposure, effect on near term earnings, BCG classification and importance of business and project, no explicit selection criteria were given. In fact, at this time all businesses had not been formally classified vis-a-vis the BCG marketing matrix, and this information as well as relative importance of businesses and projects were only resident in the minds of the decision makers.

Required Resources

The next group of considerations were required resources--capital, expense and people, both new and existing. With regard to people, a key limiting resource was corporate technical manpower--both from the Technical Staffs Division (research) and particularly from the Manufacturing and Engineering Division (development and service engineering) which provided the hands and technical expertise for most major projects. Although this was supposedly a key consideration, it was not considered in the appropriate way. When divisions submitted their project proposals, none of them submitted the M & E people required either in terms of number of people or

special expertise required. Therefore it was up to the corporate resource allocators to determine what the M & E requirements for each project were and the appropriate trade-offs where resources were limited. This was impossible since neither division personnel nor M & E managers were on the allocating committee. The Vice President of the M & E division said that in 1974 capital was approved for projects before they (M & E) even knew what (resources) was required.

Risk

Considerations of technical, marketing and manufacturing risks were also to be included. But for many projects, the proposals did not involve very "solid" projections of costs and returns, and only pessimistic, optimistic and most likely return estimates were provided as a clue to project risk.

Other Considerations

Two final considerations were to be whether the project would bring "profitable derivative investment opportunities" and whether the project could be delayed and how a delay would affect the project returns. Since there was no formal mechanism for determining and communicating the derivative opportunities or impact of delay, this was another very subjective element.

In addition to the criteria for business related projects, Corning normally allocated 10% of its total

capital budget to "non-producing assets." Examples of non-producing assets are new office buildings, renovation of existing buildings, property and maintenance of parking lots and corporate airplanes. The 10% target level was based on the historical spending level for such assets, and the decision criterion was "top management discretion."

C. The 1974 Capital Budgeting Process

The actual process of choosing projects from the submissions did not appear to be as rigorous and straightforward as the guidelines might suggest. Ranges for capital spending by each division had already been established on the basis of the division's sales, historical growth in assets, opportunity for growth in sales, relative age of assets and the Controller's knowledge of the businesses, divisions and large projects "coming down the pike." Even a division with relatively poor performance would not be denied any funds at all because of the impact of such action on the morale of the division's organization. On the other hand, a plant or other organizational unit with a heavy load of project implementation would not have all of its project submissions approved, regardless of the projects' economics, if overload of the organization would result. Such criteria for project selection were very subjective, and only some of the subjective factors that were verbalized.

The actual "GO"- "NO-GO" decisions on the capital projects were made by a committee of seven top managers. The committee consisted of the Vice Chairman of the Board of Directors, President, Senior Vice President of Staff Divisions, Vice President of Corporate Plans, Vice President and Treasurer, Vice President and Corporate Controller and the Director of Business Planning.

The process was described by one member of the group as sorting through projects one division at a time. Tentative, general selection guidelines were used at the beginning of the process, and as more projects were discussed in this context, the guidelines were fleshed out into more specific criteria. Each project was examined to determine if it should obviously be rejected because of incompatibility with the business' strategy, technical feasibility or because it "just didn't make sense." Generally, however, each division's projects were approved in the order in which the division had ranked them until the dollar limit set for that division by the Corporate Controller was reached. Once the initial capital budget for a division was determined, the group informally reviewed the division's mix of class of spending, but no changes were made since there were no really "hard" guidelines for mix. At no time during the meetings did the group look at the book of project

submissions that provided the estimated financial returns of the projects.

As tentative capital budgets were established for each division, these were sent back to the division. The division could appeal the allocation at a special session of the committee within a week. The format of such a session was the division manager "came, he spoke, and he left," and the committee made its final decision after the manager left. This final capital budget was the committee's recommendation to be approved by the Board of Directors.

The capital budget at this point will be the basis of comparison of new and old capital budgeting procedures. But in fact, this capital budget was not recommended to the Board of Directors. Because of unfavorable economic conditions in the fall of 1974, the capital budget was reduced, primarily through withdrawal of expansion projects by the divisions and selective reductions of other projects by the Corporate Controller. This should be kept in mind when comparing budget decisions with projects actually approved and implemented during 1975.

D. Capital Projects for 1975

The total amount of capital funds requested for 1975 was \$325,046,000. Exhibit 2-A shows the breakdown of requests by class of spending, both for projects directly related to businesses of the operating divisions and for staff projects. Of the \$54,104,000 requested by staff, 91% or \$49,367,000 was for "non-producing assets" such as a new engineering building and office area renovations.

When the capital budgeting process was over, \$89 millions were approved for 1975. Distribution of the approved capital budget over class of spending and business/staff projects appears in Exhibit 2-B. Only \$2,866,000 of the \$9,019,000 approved for staff projects was allocated to "non producing assets." In both Exhibits 2-A and 2-B, the funds labeled "Non Specific" were chunks of discretionary capital requested and approved for the operating divisions to spend on <\$100,000 projects. These discretionary funds amounted to approximately 30% of the 1974 capital budget.

Exhibit 2-C shows the kinds of projects that were actually approved during 1975. Comparisons between capital budget and actual approvals will be more revealing in later charts. Here the class of spending distribution of discretionary funds clouds the comparison of actual projects vs. planned projects >\$100,000 as does

EXHIBIT 2

1975 PROJECTS BY CLASS OF SPENDING (\$000)

A. PROJECTS SUBMITTED--1974

	LEGALLY REQUIRED	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT	NON SPECIFIC	TOTAL
BUSINESS RELATED	\$ 16,779	\$ 28,807	\$104,852	\$ 13,785	\$ 32,306	\$ 74,413	\$ 270,942
STAFF	0	600	22,253	2,435	2,643	26,173	54,104
TOTAL	\$ 16,779	\$ 29,407	\$127,105	\$ 16,220	\$ 34,949	\$100,586	\$ 325,046

B. CAPITAL BUDGET PROJECTS

BUSINESS RELATED	\$ 13,731	\$ 14,870	\$ 18,289	\$ 1,696	\$ 13,345	\$ 18,054	\$ 79,985
STAFF	0	0	307	0	1,628	7,084	9,019
TOTAL	\$ 13,731	\$ 14,870	\$ 18,596	\$ 1,696	\$ 14,973	\$ 25,138	\$ 89,004

EXHIBIT 2 (cont.)

C. PROJECTS APPROVED DURING 1975

	LEGALLY REQUIRED	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT	NON SPECIFIC	TOTAL
BUSINESS RELATED	\$ 5,924	\$ 8,810	\$ 6,454	\$ 7,376	\$ 8,797	\$ 39	\$ 37,400
STAFF	26	706	57	175	377	1,006	2,347
TOTAL	\$ 5,959	\$ 9,516	\$ 6,511	\$ 7,551	\$ 9,174	\$ 1,045	\$ 39,747

the fact that the capital budget was reduced before 1975.

Legally Required Projects

Exhibit 3 shows the distribution of business ROA for the "Legally Required" projects--those submitted, approved in the capital budget, and actually authorized in 1975. No projects were approved where the business ROA was stated as less than 10%; such projects were delayed for further review of the viability of the business, review of technical and economic feasibility of the proposed solution to the pollution problem, and generation of "better" alternative solutions. A significant portion (~50%) of legally required funds were allocated in capital budgeting and authorized during the year for projects either with no stated business ROA on the proposal or an ROA less than the 18% target level.

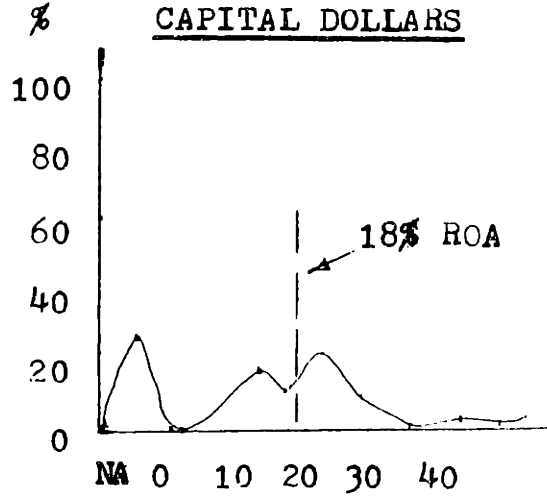
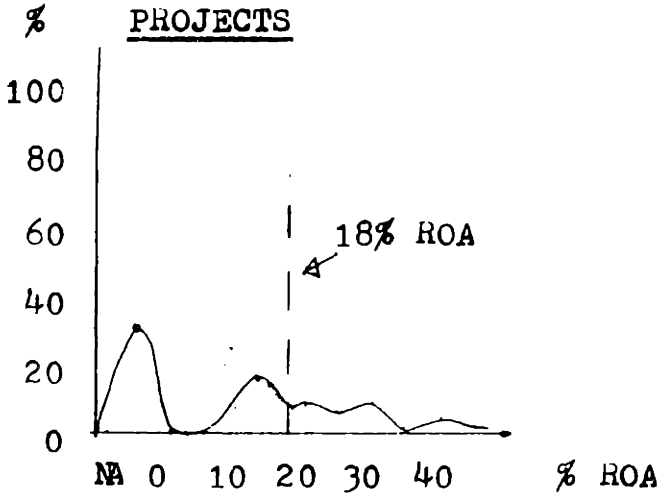
Cost Reduction Projects

Exhibits 4 and 5 show the financial profiles of cost reduction projects. Of the 85 projects requested, only 7 of these, totalling \$2,275,000 were not projected to have the minimum IRR of 15%. For most of these seven projects, the investment required was the only financial information provided; for others, only the business ROA was given in addition to project cost. This means that either divisions internally screened out projects which did not meet the IRR hurdle rate or they "adjusted" the

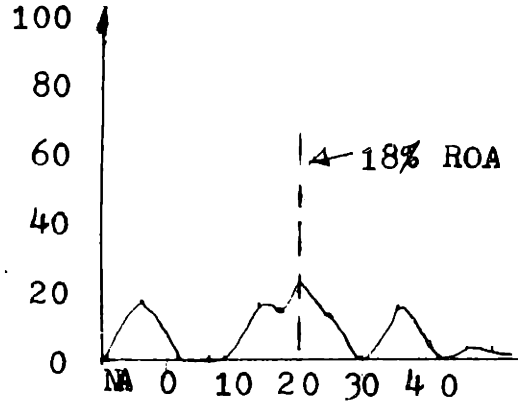
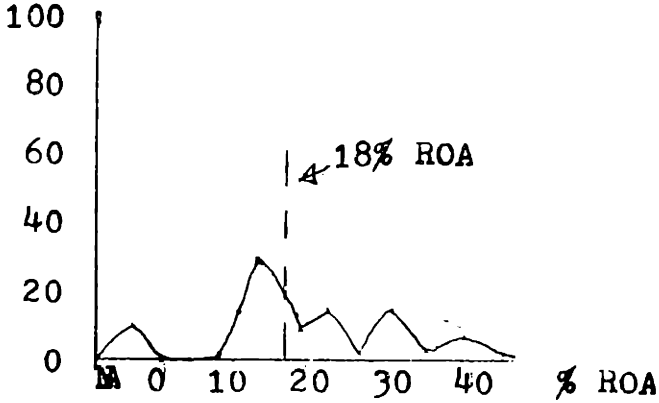
EXHIBIT 3

LEGALLY REQUIRED PROJECTS - BUSINESS ROA

A. PROJECTS SUBMITTED



B. CAPITAL BUDGET PROJECTS



C. PROJECTS APPROVED DURING 1975

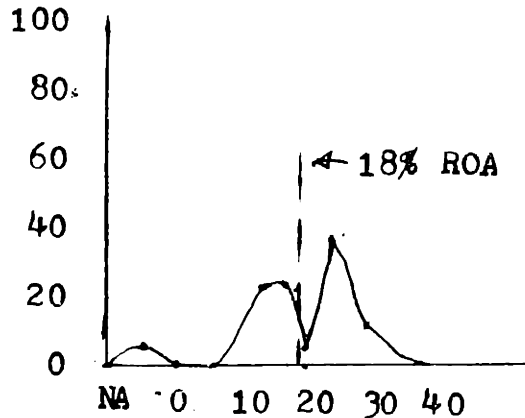
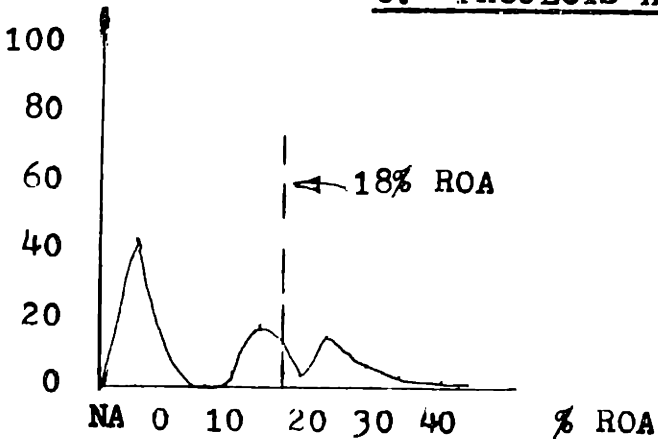
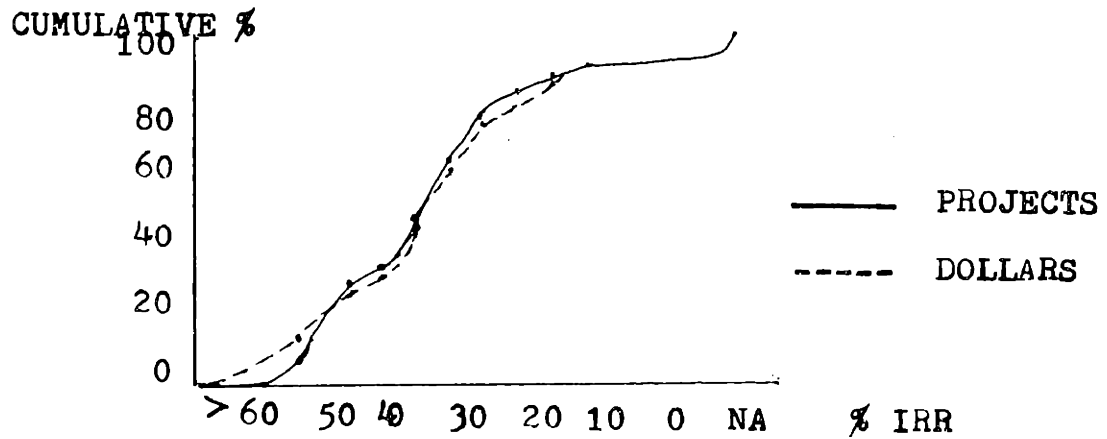


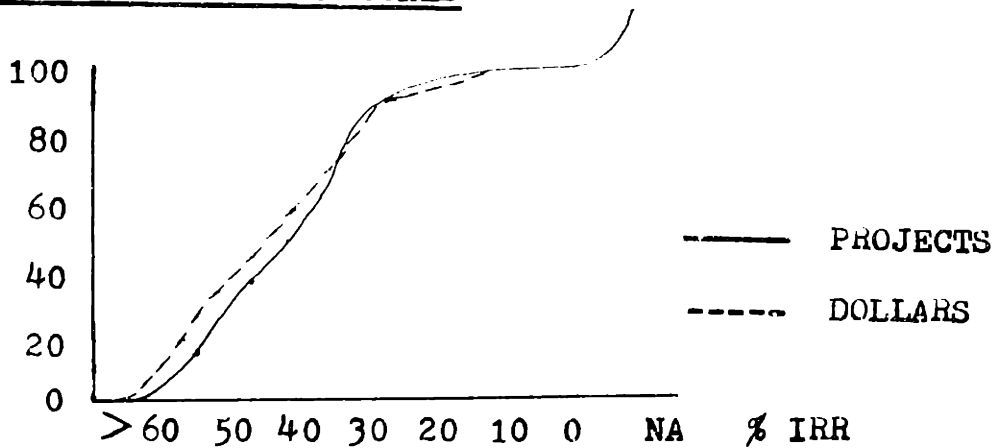
EXHIBIT 4

COST REDUCTION PROJECTS - IRR PROFILES *

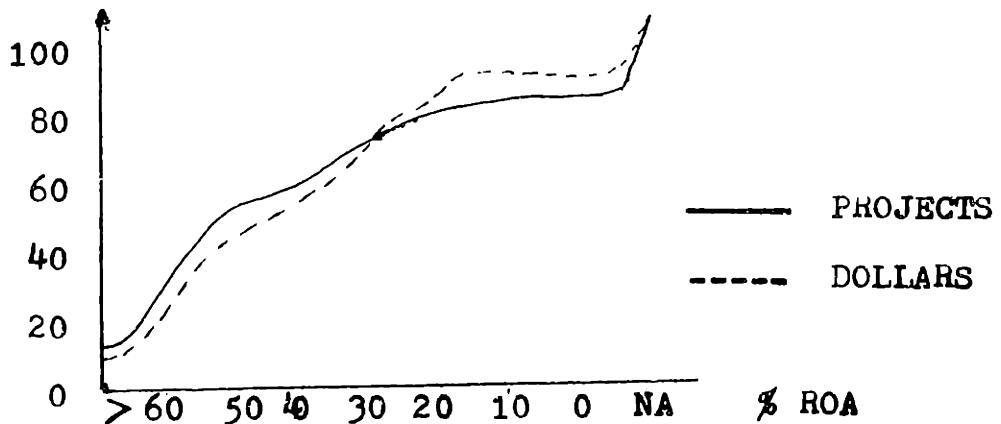
A. PROJECTS SUBMITTED



B. CAPITAL BUDGET APPROVALS



C. PROJECTS APPROVED DURING 1975

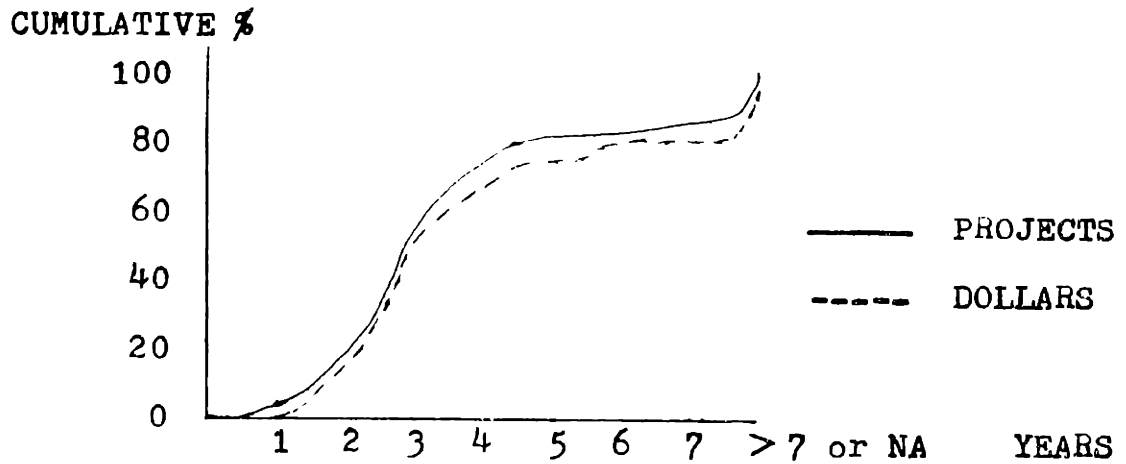


* Frequency distributions appear in Appendices 2-A and 2-B

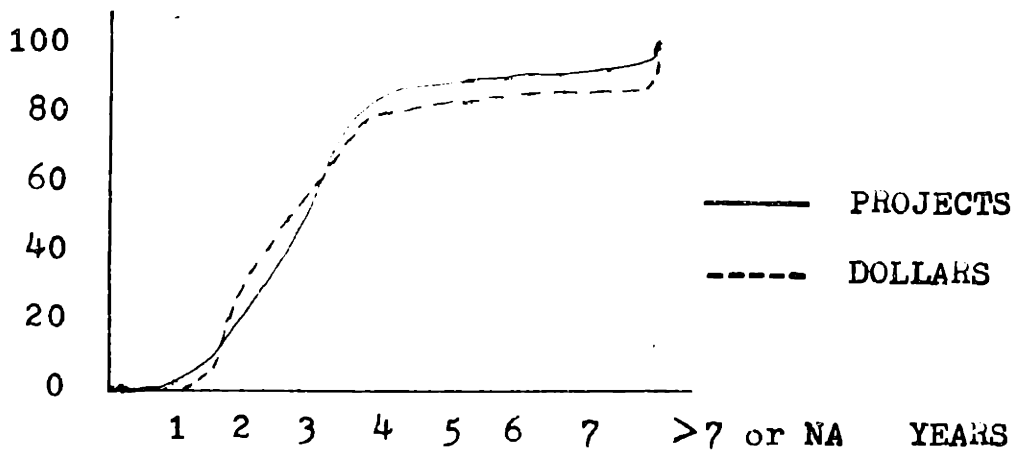
EXHIBIT 5

COST REDUCTION PROJECTS - PAYBACK PROFILES

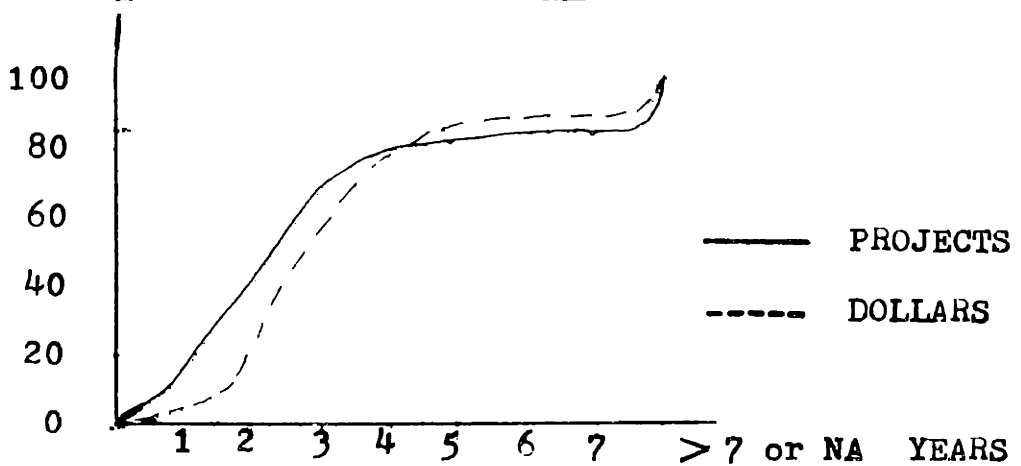
A. PROJECTS SUBMITTED



B. CAPITAL BUDGET APPROVALS



C. PROJECTS APPROVED DURING 1975



figures so that all projects were acceptable on the basis of IRR. This latter notion seems neither unreasonable nor devious since the scope of a project can be adjusted to change the returns, and often return estimates are nebulous at best when calculated 6-18 months before the project will be implemented.

The bulk of the cost reduction projects submitted fell into the IRR range of 26-50% (70.5% of the projects, 63.5% of the capital dollars). Generally the projects with larger capital commitments fell at the high end (> 50% IRR) of the IRR range and in the 36-40% IRR category as evidenced by the differences in the cumulative distributions of capital dollars and of number of projects.

The IRR distribution of cost reduction projects approved in the capital budget appears in Exhibit 4-B. This distribution is more skewed toward the high IRR projects, showing also that the proportion of large projects chosen in the 36-60% IRR range was much higher than the proportion submitted in that range. Only two of the seven projects with no estimated IRR survived this screening.

Looking at Exhibit 4-C one sees the actual distribution of IRR as submitted on Appropriation Requests for cost reduction projects in 1975. In terms of number of projects, a higher proportion were in the 36 - > 60%

range, but also a greater proportion were in the <15% or Not Available categories. The reasons for differences between this distribution and the capital budget are 1) small (<\$100,00) projects sourced from the divisions' discretionary funds, 2) new opportunities and rejection of capital budget projects during 1975 and 3) more realistic estimates of costs/returns available at the time of AR submissions.

With regard to payback distribution for cost reduction projects, most of the projects approved in the capital budget were in the 2-4 years payback range (66.5% of projects, 57% of capital dollars), and a smaller percentage of projects with no payback estimates were approved than were submitted. However, actual approvals during 1975 were heavily weighted by even more rapid paybacks--25% of the projects had a less than 18 months payback, 50% less than 2½ years. This movement can be attributed to the same factors as the shift in IRR distribution plus the fact that unfavorable economic conditions in late 1974 and all of 1975 made it desirable for the firm to reap the benefits of investment projects as quickly as possible.

Expansion Projects

Expansion projects were also to be evaluated on the basis of IRR and payback, and the profiles of projects submitted, approved in the capital budget and

actually accepted during 1975 appear in Exhibits 6 and 7. The IRR distributions of projects submitted and approved in the capital budget are very similar. However, the approved projects were slightly more skewed in number and much more skewed in terms of capital dollars toward the high end of the range. Only two projects were submitted with an estimated IRR below the 20% hurdle rate; four projects had no estimate of returns. Neither of the first two were approved in the budget; three of the four projects without IRR estimates were approved. Proportionally, much quicker payback projects were also approved than were submitted.

Expansion projects actually approved during 1975 were much fewer in number and total dollars, and much more heavily weighted by high returns (~ 50% had IRR > 50%) and to a lesser degree weighted more by quick payback (50% with $< 3\frac{1}{2}$ years payback). This is what one would expect given the economic conditions and the position of choosing a few expansion projects from a large number of requests.

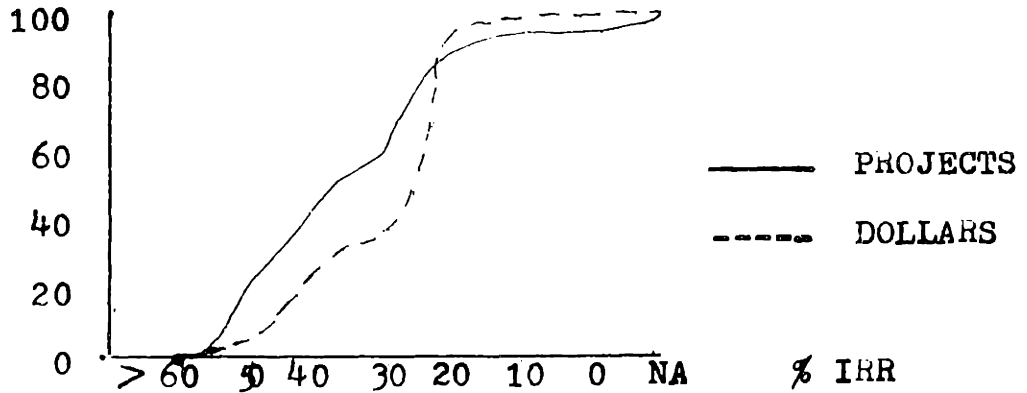
Expansion projects were also to be evaluated on the basis of current business ROA, where the project was "driving" the business ROA and the project ROA. These measures were not available from either project submissions for capital budgeting or Appropriation Requests.

EXHIBIT 6

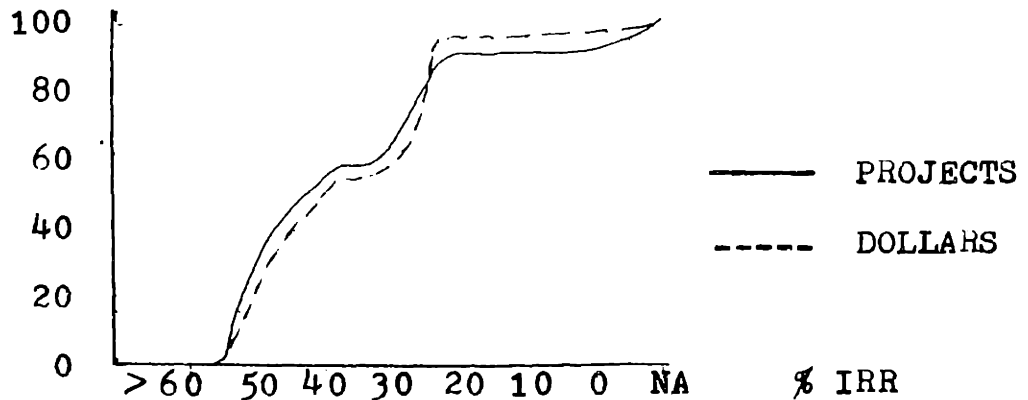
EXPANSION PROJECTS - IRR PROFILES *

A. PROJECTS SUBMITTED

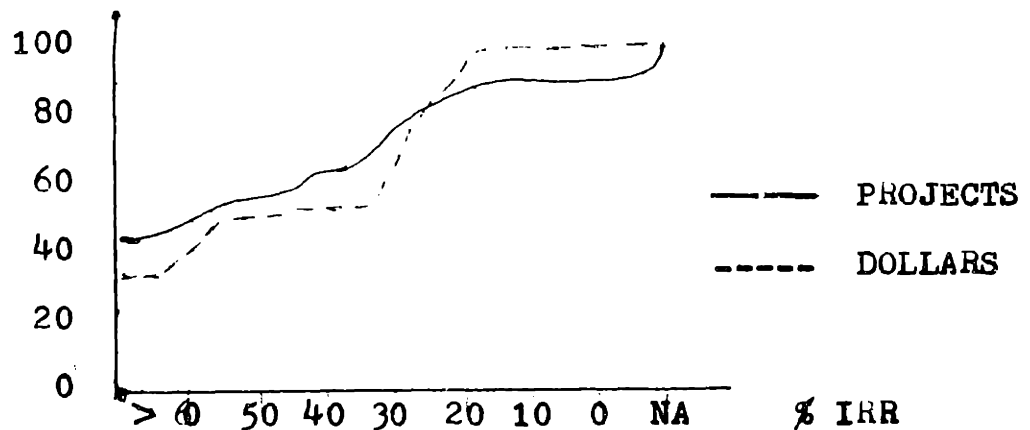
CUMULATIVE %



B. CAPITAL BUDGET APPROVALS



C. PROJECTS APPROVED DURING 1975



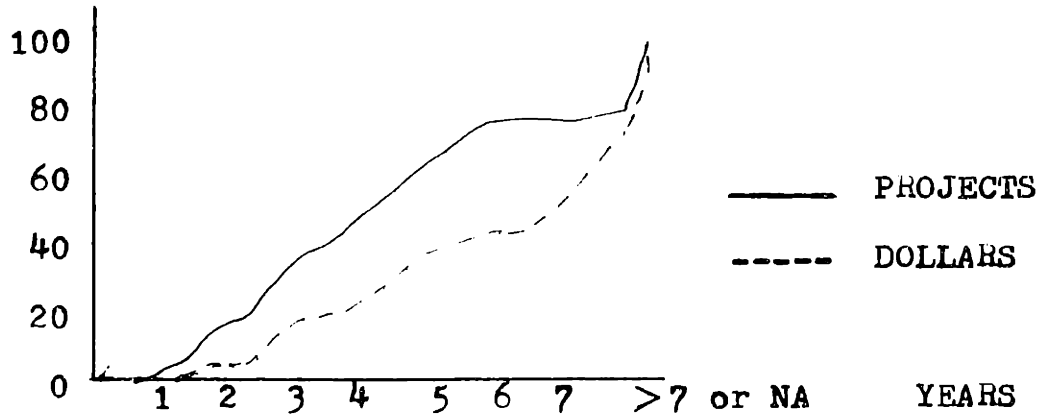
* Frequency distributions are shown in Appendices 3-A and 3-B

EXHIBIT 7

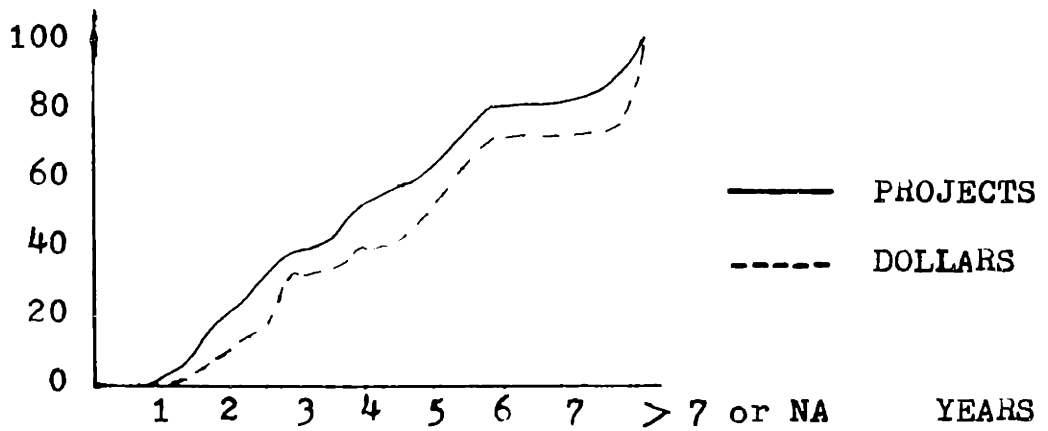
EXPANSION PROJECTS - PAYBACK PROFILES

A. PROJECTS SUBMITTED

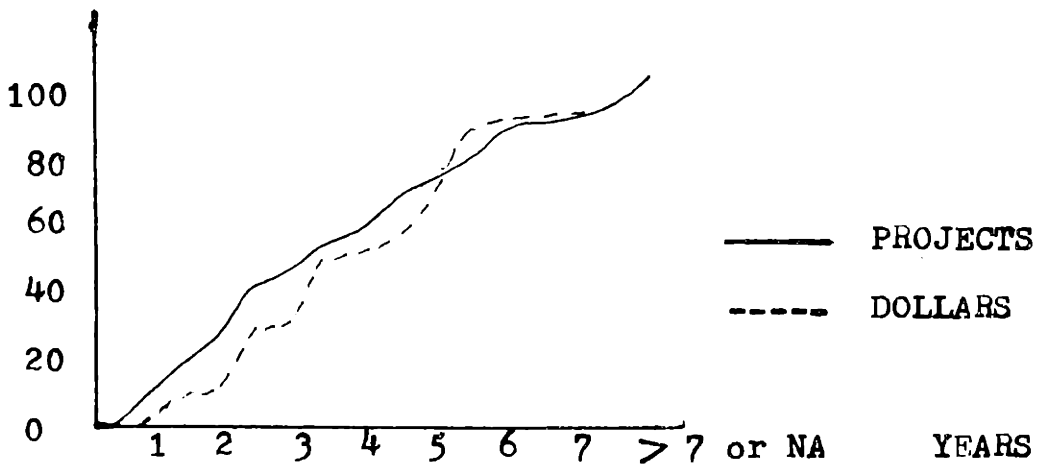
CUMULATIVE %



B. CAPITAL BUDGET APPROVALS



C. PROJECTS APPROVED DURING 1975



Maintenance Projects

Maintenance projects were to be evaluated on the basis of defensive IRR, or the return available by maintaining equipment that would not be available without the maintenance project, if such cash flows could be determined. No maintenance projects submitted for capital budgeting provided any such return measures, and only 5 of the 124 maintenance Appropriation Requests submitted in 1975 had such estimates.

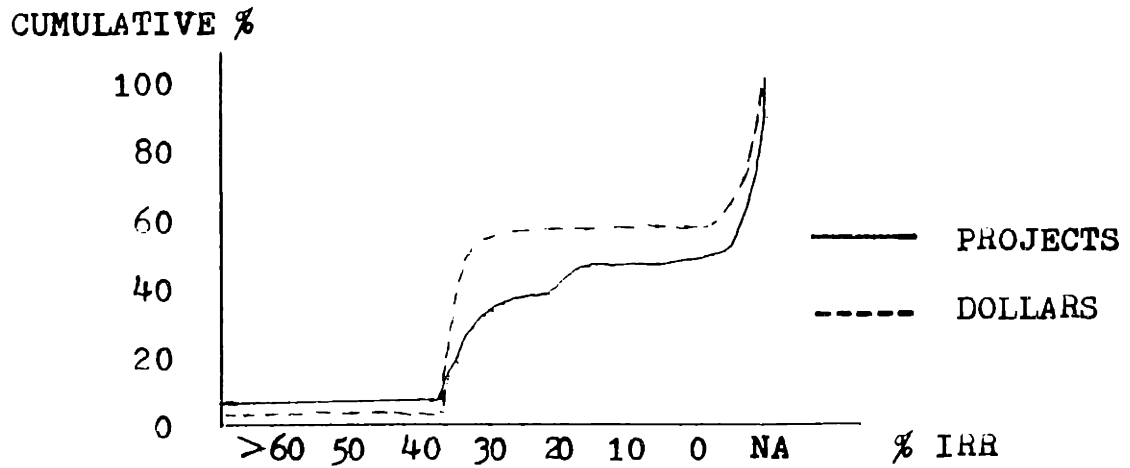
Development Projects

Development projects were to be evaluated on the basis of several considerations, with no clear cut "GO"- "NO"- "GO" criteria. However, Exhibits 8 and 9 show the returns expected from the proposed and approved projects. Approximately 60% of the projects requested and 40% of those approved during capital budgeting had no estimated IRR or payback. Of the approved capital budget projects with estimated returns, expected IRR was 15-35% and the payback was 6 years or more. During 1975 only about 15% of the development projects approved (involving 30% of the capital dollars) had projected returns, with most of those having an IRR $> 45\%$ and payback of $2\frac{1}{2}$ -5 years.

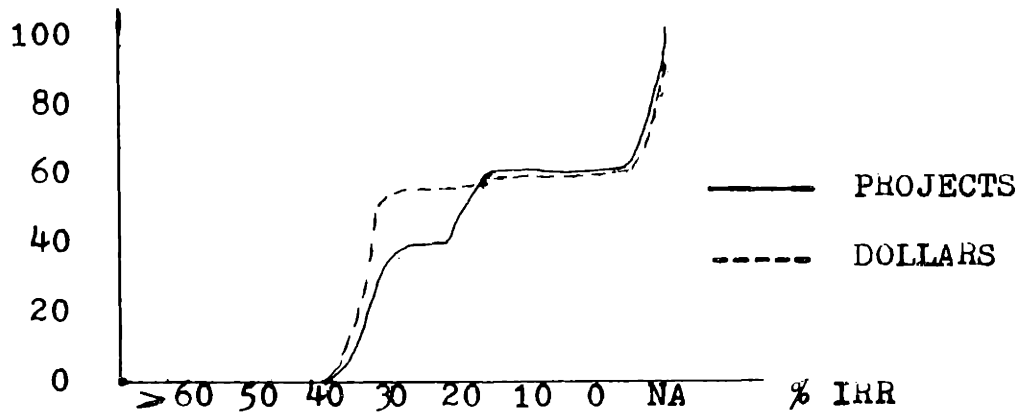
EXHIBIT 8

DEVELOPMENT PROJECTS - IRR PROFILES *

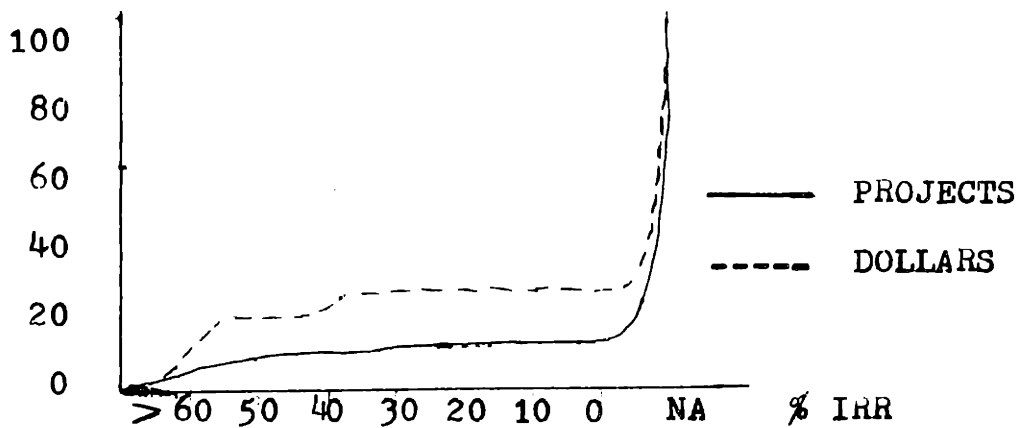
A. PROJECTS SUBMITTED



B. CAPITAL BUDGET APPROVALS



C. PROJECTS APPROVED DURING 1975

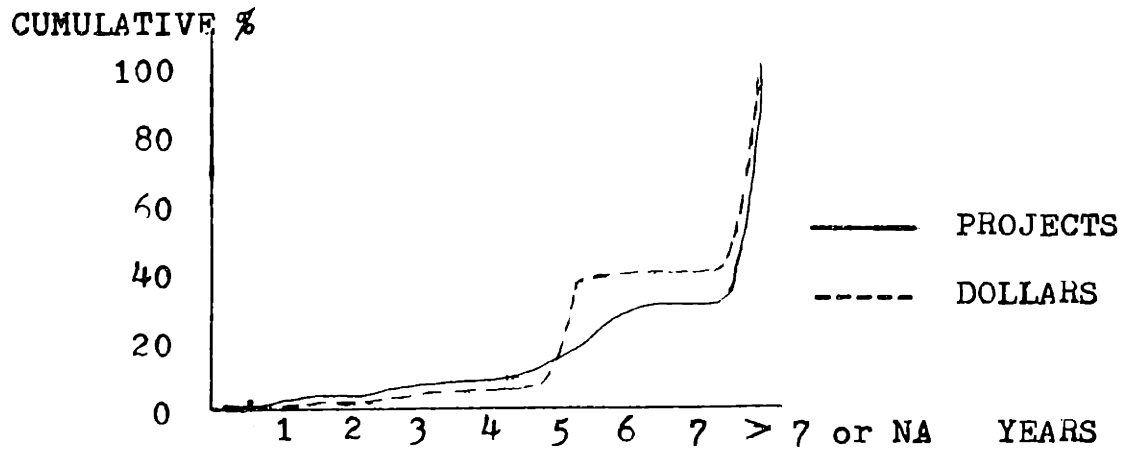


* Frequency distributions appear in Appendices 4-A and 4-B

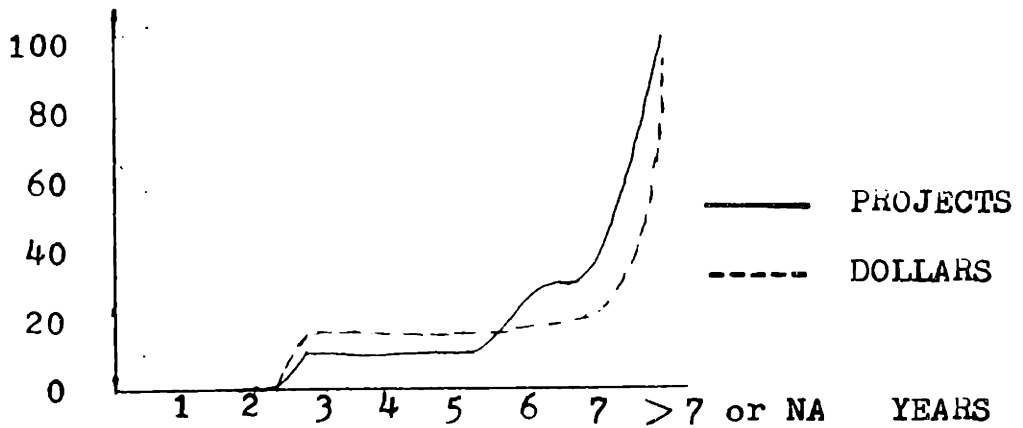
EXHIBIT 9

DEVELOPMENT PROJECTS - PAYBACK PROFILES

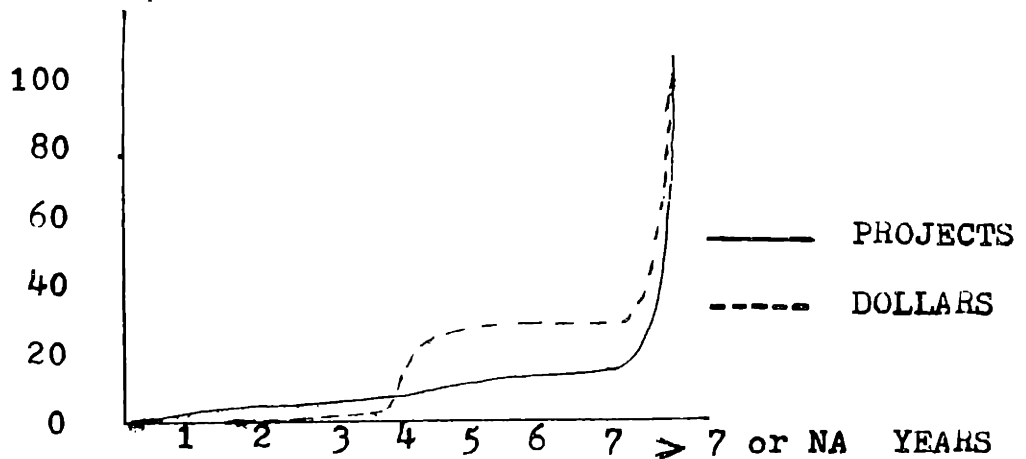
A. PROJECTS SUBMITTED



B. CAPITAL BUDGET APPROVALS



C. PROJECTS APPROVED DURING 1975



E. Summary of 1974 Capital Budgeting

The items included in the list of selection criteria--type of project, project economics, nature of business, resources required, risk and derivative opportunities--are very valid criteria. But the actual capital budgeting process that was in place at Corning in 1974 did not implement the concept adequately.

Financial criteria seemed to primarily serve the purpose of screening projects at the division level so that submissions either satisfied minimum hurdle rates or were submitted without financials provided and justified on other grounds. Project financials were not the key to final decisions made by the capital budgeting committee, as evidenced by the description of the process and the resulting IRR profiles of selected projects.

Resources required were conceptually of great importance, especially since technical manpower was a limiting resource. But there was no mechanism in the capital budgeting process for determining specific requirements for and availability of these human resources. And with regard to monetary resources, only fixed capital requests, not working capital or expense requirements were explicitly considered in the selection of projects.

The other factors were considered very subjectively with no common information base relative to these

factors, no framework for comparing the subjective attributes and no common guidelines for relative importance or classification as "good" or "bad" with respect to the business attributes. Two implications of this are 1) the decision makers were not all "playing by the same rules" simply because the rules were internalized and unique to each person and 2) there were no consistent rules or common language for helping the divisions to understand why projects were chosen or not chosen. Even if the process of project selection were actually consistent and all the subjective guidelines were completely and uniformly understood and implemented by the decision makers, the formal system required "fleshing out" to state these guidelines and legitimize the process and choices to the rest of the corporation.

IV. Corning's Capital Budgeting--1976

A. Background

In 1976 few changes had been made to the nature of Corning's business. However, some organizational changes and changes in the 5 year planning process helped to set the stage for the new approach to capital budgeting begun in 1976.

In August 1975 there was a major reorganization of Corning with the result of consolidating operations into eight major divisions, some additional shifts of business responsibilities between the divisions and consolidation of Corporate Treasury, Control and Planning groups into a single Finance Division. An Operating Management Group (OMG) was formed with its members being the Vice Chairman, President, operating divisions' Vice Presidents, and some staff Vice Presidents. The purpose of this group was to position the corporation to assure proper profitability and cohesiveness, to approve strategy plans for major business units Worldwide, to resolve critical operating issues, to deploy corporate resources, to monitor business results and to approve key staff priorities.

The planning process in 1976 was also important to the resource allocation process to follow. The strategic planning unit was still a business, but there were more than 60 businesses, indicating further segmentation

of the 30 businesses in 1974 on the bases of markets, products and geographical areas. The key change was in the tool used to characterize each business and aid in determining the appropriate strategy for that business: what Corning calls the Business Matrix.

The Business Matrix is a modification of the BCG marketing matrix. It is a 4 x 4 matrix with stage of the business' life cycle on one dimension and Corning's strength in the market on the other dimension. (See Exhibit 10.)

The stage of the life cycle could be characterized as Embryonic, Growth, Mature or Aging. Characteristics of each are as follows:

1. Embryonic

Very low dollar sales volume.

No clear market (product) growth trend.

No industry standardization leader.

2. Growth

Three consistent years of increasing market (product) sales volume.

Corning sales of \$1 million or more.

Suppliers to the market start to stabilize.

Market (product) growth rate > 1.5 times GNP growth rate.

3. Mature

Technology and market relatively stable.

Market (product) growth rate $.75 - 1.5$ times GNP growth rate.

EXHIBIT 10
BUSINESS MATRIX

	EMBRYONIC	GROWTH	MATURE	AGING
STRONG				
FAVORABLE				
EQUAL				
WEAK				

4. Aging

New technology obsoleting present products.

Market (product) growth rate less than .75 times GNP growth rate.

The strength dimension could be characterized as Strong, Favorable, Equal or Weak. Strength was to be judged relative to Corning's "principal competitor," and it was a subjective determination based on three fundamental factors--marketing, manufacturing and technology. Considerations to be given to each factor were:

1. Marketing

a. What is Corning's market share compared to its principal competitors? Is Corning's market share increasing or decreasing?

b. Is Corning's distribution and/or service superior to the competitors'?

2. Manufacturing

a. How does Corning's unit cost experience curve compare to the nearest competitor?

3. Technology

a. Does Corning have proprietary or patent control over the market or does Corning play a major role in setting or enforcing industry standards?

b. Is Corning's product superior to the competitors'?

4. Overall

a. Has a customer backward integrated or has a supplier forward integrated?

b. Did Corning, or can Corning, make a price increase stick without a significant loss in market share?

B. Project Selection--1976

In 1976 the process and the guidelines for choosing capital projects changed significantly. Capital project proposals for 1977 were submitted by line and staff divisions during the planning process, and the strategies put forth in the plan were either approved or modified in June. July was the month for resource allocation, which involved allocating line division manpower, technical manpower and capital dollars to divisions, businesses and projects. Line division manpower allocation was not an integral part of the capital budgeting process, but technical manpower allocation was.

The committee with the responsibility for making the capital budget recommendations consisted of the Vice President and Corporate Controller, the Vice President of Manufacturing and Engineering, the Director of Planning and the Director of Technical Staffs Division (research). These people were the key actors with interaction between them and the Vice Chairman and President who concurred on intermediate screening decisions. These key actors brought to bear the perspectives of their own areas of responsibilities, but participated in evaluating projects on all dimensions.

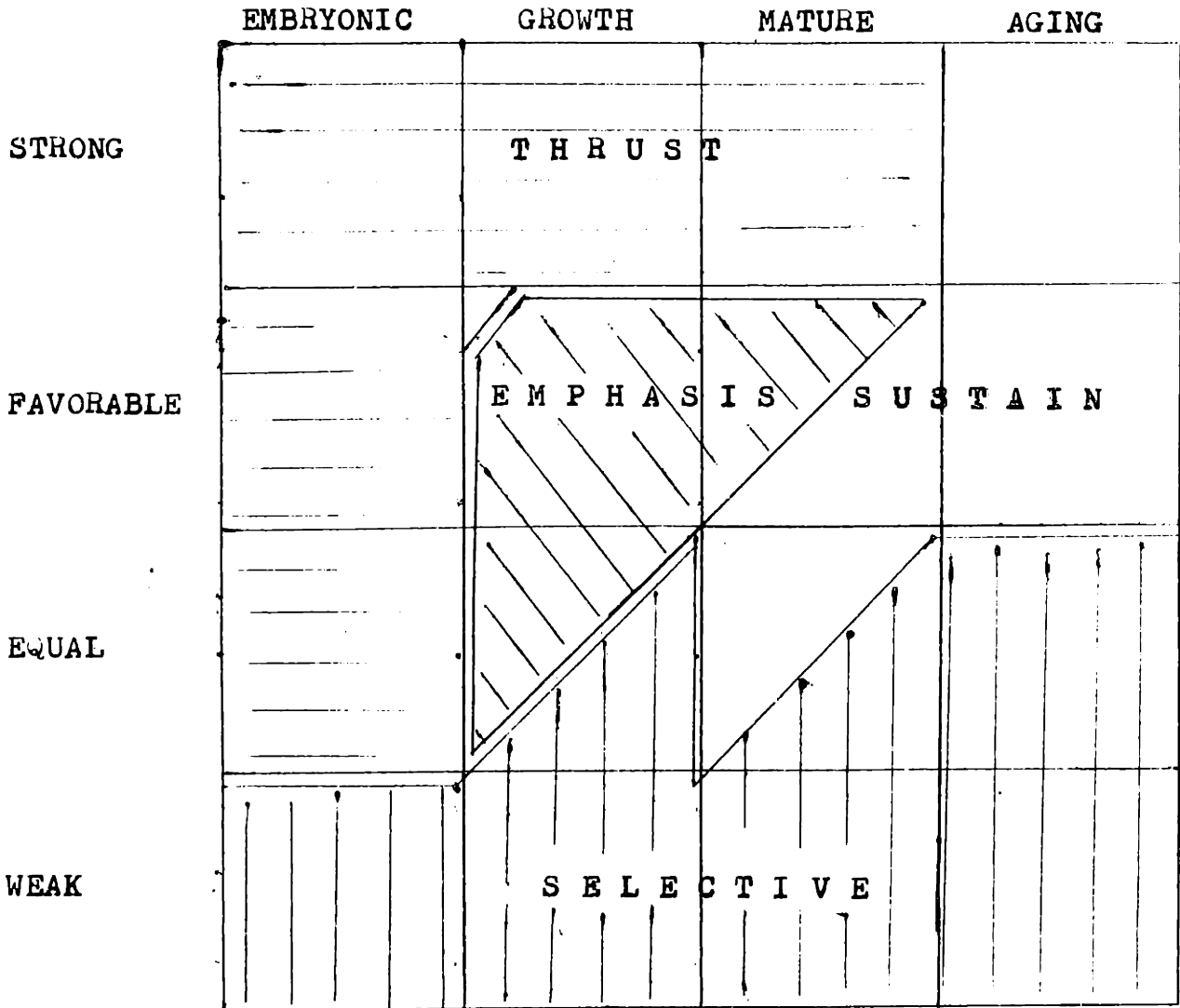
Strategic Considerations

With regard to the planning perspective, there were several considerations. The key to these criteria was where a business was positioned on the Business Matrix. Based on matrix position and the strategy proposed in the five year plan, businesses were categorized as Thrust, Emphasis, Reposition, Sustain and Selective. Although there were no definitions, per se, of these categories, certain characteristics and resource allocation implications were associated with each. Thrust businesses were key areas for the future, and they had clear priority for resources. Emphasis businesses were "substantial future areas" and should get all "reasonable" resources. Reposition businesses were striving to attain favorable positions and would require a high level of resources. Sustain businesses were "normal" businesses which should receive sufficient resources to keep their positions. Selective businesses had a limited future, and resource commitment should be "selective."

There was no financial analysis involved in classifying businesses into the proper categories, the criteria were market conditions and opportunities and Corning's position in the different markets. These descriptions of business categories sound a bit nebulous, but the real key was matrix position. Exhibit 11 shows how the

EXHIBIT 11

BUSINESS CATEGORIES



business categories fit onto the matrix. Where more than one category is in a single box on the matrix, opportunities and strategies are the keys to business category.

It might be hypothesized that although financial criteria were not used to categorize businesses, that unique financial return profiles would characterize projects generated in each business category nevertheless. One might expect IRR to be highest for projects in Thrust businesses and decreasing as the capital allocation to the category decreases (Emphasis, Reposition, Sustain and Selective in decreasing order). Exhibit 12 shows that this was not the case for projects proposed in 1974 for 1975. In fact, Sustain projects had the highest returns followed by Thrust projects, with very similar profiles for the other three categories. Hence business category considerations in determining the level of capital spending must be purely strategic.

In addition to business category, the types of projects to which capital should be allocated for each business depended upon matrix position. For example, expansion projects should be funded for Growth businesses in which Corning's strength is at least Equal, and development funds should be allocated to Equal to Strong Embryonic businesses. Exhibit 13 shows the desired distribution of classes of spending on the Business Matrix.

EXHIBIT 12

DISTRIBUTION OF IRR BY CAPITAL DOLLARS PROPOSED IN 1974
COST REDUCTION, EXPANSION, DEVELOPMENT PROJECTS

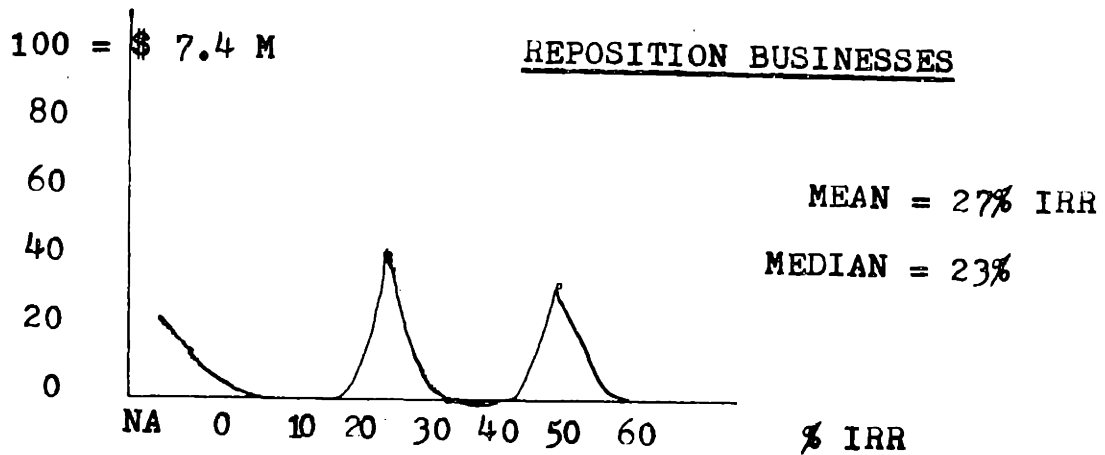
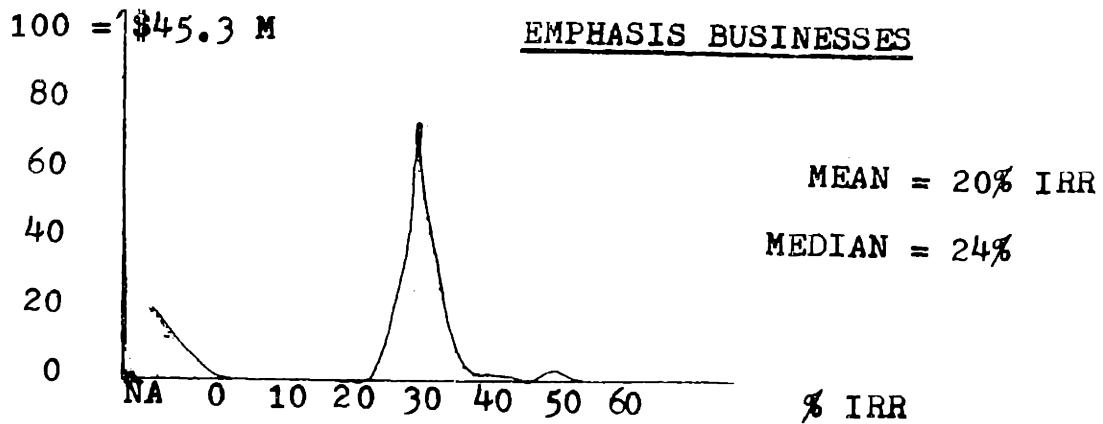
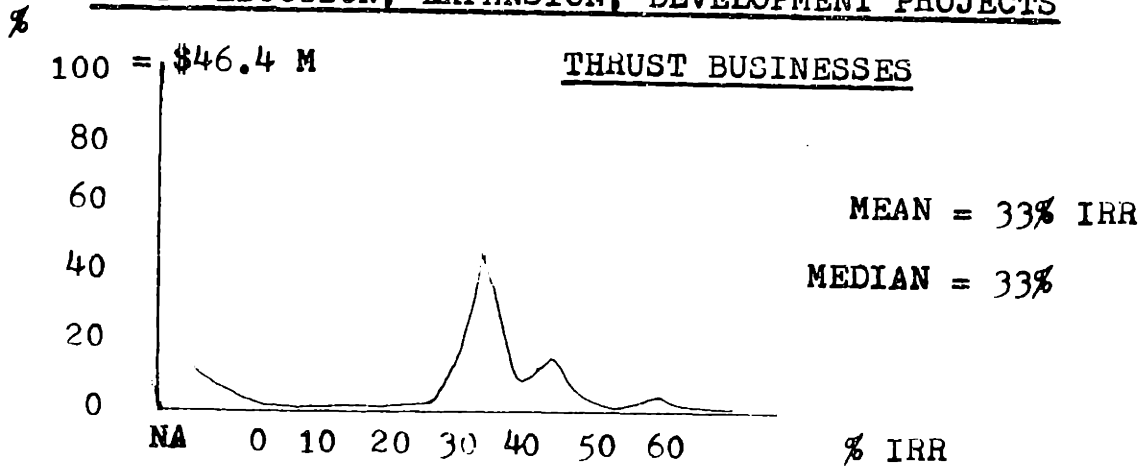


EXHIBIT 12 (cont.)

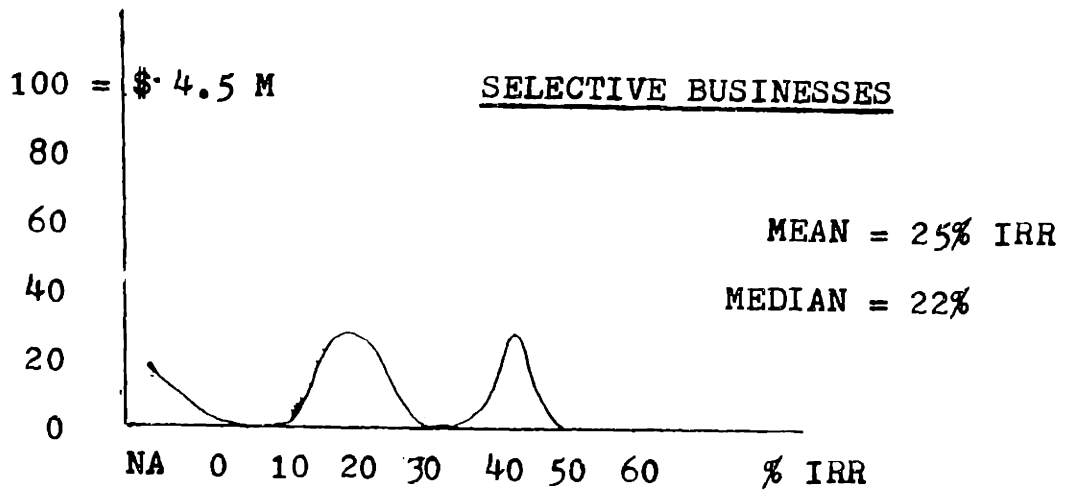
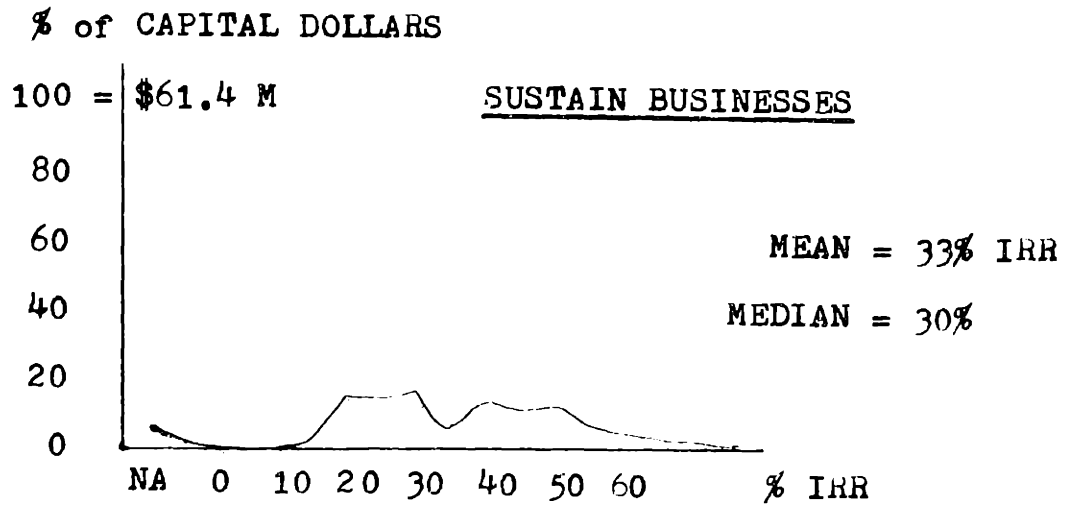
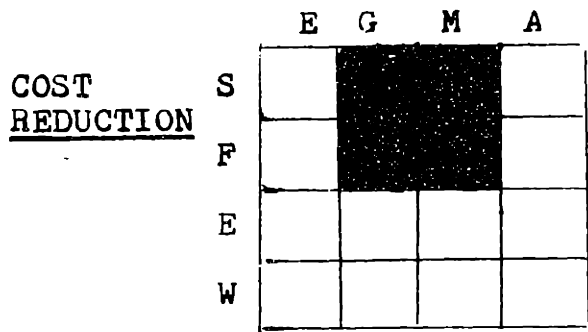
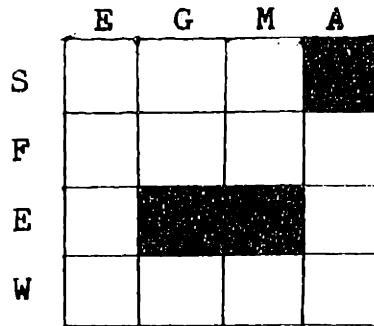


EXHIBIT 13

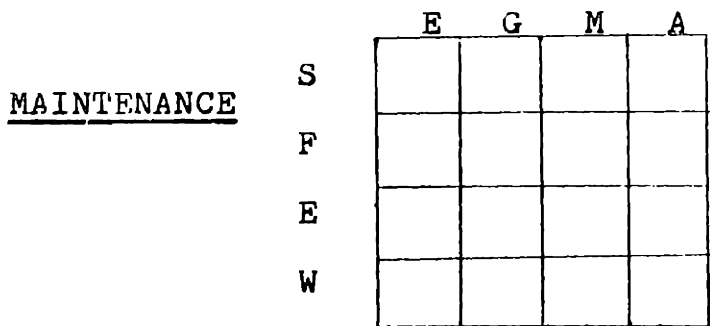
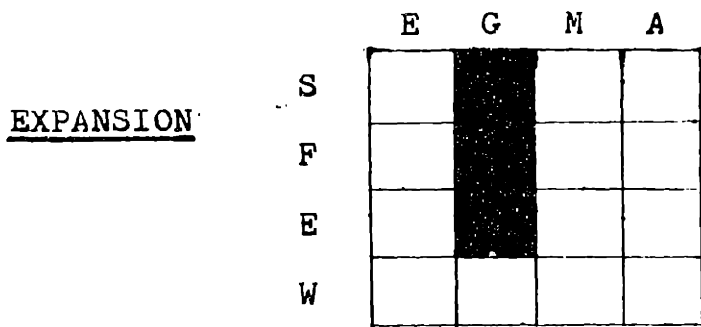
THEORETICAL CLASS OF SPENDING DISTRIBUTION



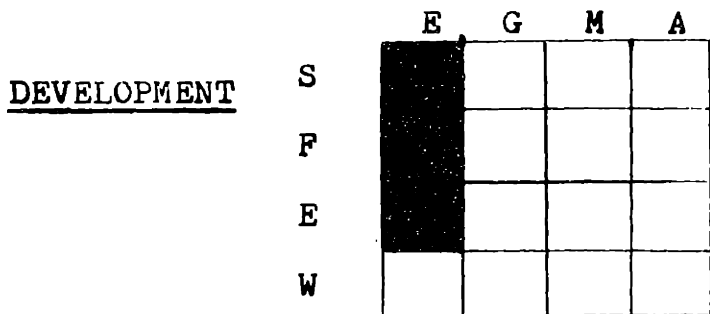
. 75 %



25 %



----- 50%
 ----- 50%



The Director of Planning combined the effects of business category and class of spending on the matrix to arrive at the total amount of capital that should be allocated to each business category and for each class of spending within each category. This "formula" appears in the table in Exhibit 14. The "formula" presented in this table was not explicitly used in the 1976 capital budgeting process. Dr. McKinney provided this as the resultant of two sets of criteria used to select projects. The first set of criteria related to scale of spending, depending on the business category and the level of annual depreciation. For example, businesses with a Sustain strategy require investment only at the current depreciation level. The second set of criteria related to distribution of capital dollars by class of spending. This was determined by matrix position (see Exhibit 13) and business strategy/category. The "formula" of Exhibit 14 is the best available approximation of the combinatory effects of these two sets of capital budgeting criteria.

A third consideration by Planning was whether the proposed capital projects for each business were compatible with the approved strategy of the business. For example, if a business strategy called for a large increase in sales and the plants producing the product were currently operating at capacity, expansion projects should be approved.

EXHIBIT 14

CAPITAL ALLOCATION BY BUSINESS CATEGORY

1976 SELECTION CRITERIA

BUSINESS CATEGORY	CLASS SPENDING DISTRIBUTION					TOTAL AS % OF ANNUAL DEPRECIATION
	LEGALLY REQUIRED	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT	
THRUST	NA*	20 %	40 %	10 %	30 %	200 + %
EMPHASIS	NA*	30 %	30 %	30 %	10 %	150 %
REPOSITION	NA*	30 %	30 %	30 %	10 %	150 %
SUSTAIN	NA*	40 %	20 %	40 %	0 %	100 %
SELECTIVE	NA*	40 %	10 %	50 %	0 %	50 %

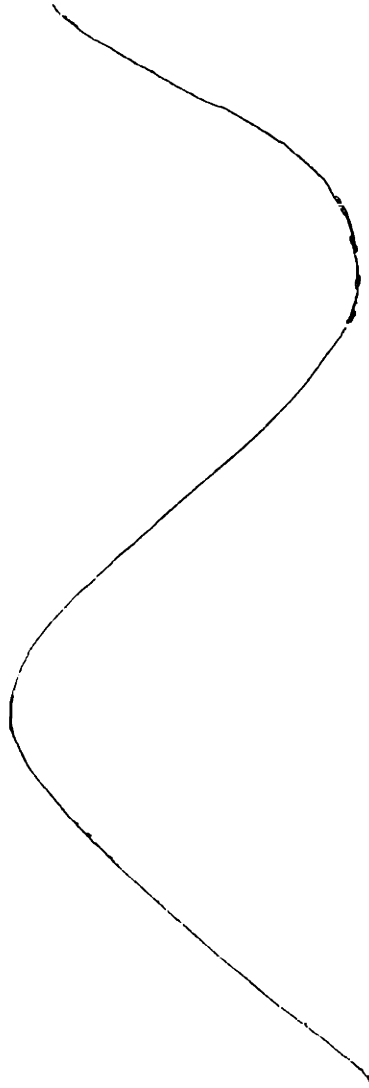
* Legally Required projects are unrelated to strategy as long as the business is to continue. Therefore they are excluded.

Finally, the concept of cyclical management was being promoted by the Planning department, and the elements of this concept were being considered in the capital budgeting process. Essentially this concept required that expansion be planned during the first part of a downswing of the business cycle and expansion funds committed as the business cycle approached the trough so that added capacity could be utilized in the upswing. Cost reduction and maintenance each would have an ongoing base level with variable cost reduction in the downswing and variable maintenance funded at the peak. Legally required projects would be ongoing as necessary, and development projects would be funded as opportunities arose. Exhibit 15 presents the cyclical management capital spending implications.

In 1975 the cyclical management concept was really not used to a great extent for two reasons. Rigorous application requires models of the business cycles for each business and variable application between businesses. Although such models are available in the Corporate Economic Forecasting group, they are not widely used by line division management. Secondly, management at Corning is not psychologically ready to implement this concept--to "bite the bullet" and invest in expansion projects in bad times. As the Corporate Controller said, "The best we can do is move forward bit by bit in our expansion decisions."

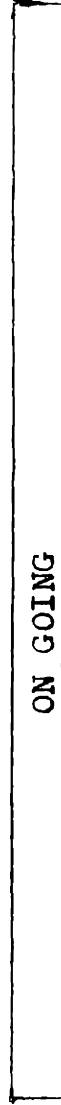
EXHIBIT 15

CAPITAL SPENDING IMPLICATIONS OF CYCLICAL MANAGEMENT

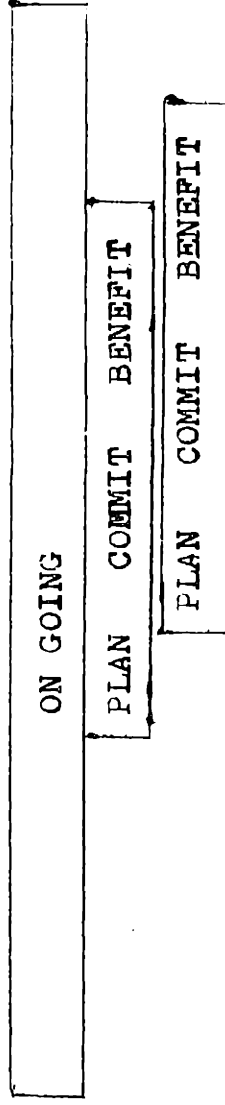


BUSINESS CYCLE

LEGALLY REQUIRED

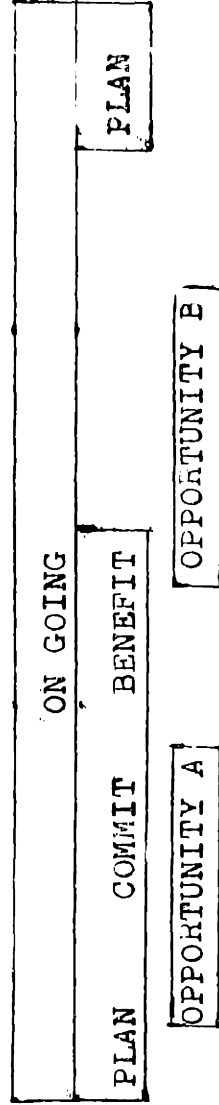


COST REDUCTION - BASE VARIABLE



EXPANSION

MAINTENANCE - BASE VARIABLE



DEVELOPMENT

Financial Considerations

The financial perspective brought to bear upon 1976 project selection was little changed from the 1974 perspective. Selection criteria in terms of IRR, payback and business ROA were essentially the same. But where total spending for the corporation and individual divisions was determined prior to 1974 project selection, only the corporate range was predetermined in 1976. This corporate range was determined on the basis of limits as a percent of annual depreciation, limits as a percent of historical spending and expected cash flow. Division spending levels were determined during capital budgeting on the basis of business capital requirements.

Technical Considerations

The inputs of the Technical Staffs Division were primarily related to technical feasibility and priority of various projects in the research group. The research inputs were less substantial than the others because by the time most projects are to the stage of requiring major capital, they are out of the realm of research and into development or actual production.

The Manufacturing and Engineering (M & E) perspective was very important. First of all, M & E must pass judgment on the technical feasibility of projects. Often this was done before projects were even submitted,

with the line division consulting with the appropriate technical expert(s) in M & E. But this was not always done, when it was done there was inadequate coordination between M & E departments and a final check by M & E was required.

The major role of M & E was in determining the technical manpower requirements for each project, where there were scarce resources and what the trade-offs should be in terms of "return per engineer." The problem is not only one of sheer numbers, but also special disciplines required for each project. It has been stated by several managers that in the last few years capital has not been the limiting factor, but engineering availability has limited the number of projects which could be implemented. So for the first time, in 1976, M & E meshed the available engineering resources, project engineering requirements and the priority of projects from the engineering perspective with the capital budgeting process.

Manufacturing and Engineering's first four priorities were, in order, 1) service projects--where their special skills are required for minor process improvement and problem solving in the plants, 2) legally required projects, 3) committed projects--either legally or contractually committed or the project is already in progress and incremental returns demand project priority

and 4) long range development projects key to corporate strategy, no dollar value attached. Once these priorities were satisfied, projects were evaluated on the basis of NPV per engineer committed, IRR and Business Matrix position. The portfolio of projects with the highest rank was found using this method. Then it was reviewed to find discipline problems, e.g. if these projects required 20 annealing lehr experts in the next year and only 10 would be available. Finally the portfolio was modified to yield the highest rank utilizing available resources. As it turned out in 1976, once the first four priorities were satisfied there were only enough resources available for Thrust businesses' projects.

Other Considerations

There were many other, less explicit criteria for project selection, some of which the Corporate Controller explained. There was the issue of cost reduction projects which had applicability in more than one business; perhaps the business proposing the project could not justify it on the basis of matrix position, but it is in the Company's interest to implement the project. Another issue related to the segmentation of businesses. It might be true that a small business does not warrant further investment on its own, but it may be a necessary, integral part of a larger business group important to

Corning. There were also psychological considerations. Denying an organizational unit any capital funds would be demoralizing and should be avoided unless the plan is to get rid of that unit. And often uneconomic decisions were made because of the potential psychological impact of the economic choice. For example, completion of a "non-producing asset" was delayed during an economic dip, and the delay greatly increased the total cost of the project.

Obviously there were many constraints and overlapping objective functions involved in Corning's capital budgeting. But decisions were reached, through negotiations at the corporate level, trading off conflicting criteria and constraints in such a way that the committee, with general concurrence of the Vice Chairman and President, believed optimized the benefit to the corporation.

Adding another change to the process, the 1976 capital budget recommendation was then presented to the OMG where the division Vice Presidents could make their appeals to their peers, the allocation committee, the Vice Chairman and the President. In at least one case division Vice Presidents offered to give up some of the resources allocated to them in order for another division to implement a specific project. After three days of OMG meetings, final decisions were made by the

President and Vice Chairman, subject to later approval by the Board of Directors.

Each quarter the OMG is scheduled to meet in order to review actual vs. planned investment and to adjust the project portfolio for optimization when changes are required.

C. Selection of 1975 Projects--1976 Selection Criteria

The key question to ask at this point is "What difference does the new procedure make, if any?" Where data were available and 1976 explicit criteria clear, projects will be chosen from the 1974 project submissions. Where criteria and constraints were either not available or overlapping, it will be impossible to conclusively determine the capital budget that would have resulted from ensuing negotiations.

The key criteria used in 1976 capital budgeting were financial criteria, determination of level and class of spending by business category, distribution of class of spending by matrix position and technical manpower requirements and constraints. The financial criteria remained nominally unchanged from 1974, so there is no need to apply these criteria to 1974 projects. The two sets of planning criteria based on business category and matrix position will be applied to 1974 to select new portfolios of capital projects. With regard to technical criteria, there is no way to

determine what the total impact would have been on the 1974 capital budget. There were no records of manpower requirements for requested projects, there were too many factors at work to determine which capital budget projects not implemented during 1975 were not implemented because of scarce engineering resources, and the knowledgeable managers could not specifically determine what the nature and degree of M & E's inputs to 1974 capital budgeting would have been.

The third cut at determining the changes the new system would have made is subjective. The three key resource allocators (Vice President of M & E, Corporate Controller and Director of Planning) reviewed the 1974 projects and decided which ones they believed would have been approved and which ones would have been rejected with the 1976 approach.

It is recognized that retrospective project selection is very difficult, particularly when trying to apply current criteria using the projects and project/technical/business knowledge as they existed in 1974. First of all use of the matrix approach to business planning in 1974 might have resulted in submission of a different set of projects from which to choose. Secondly, any implicit rules used in the 1976 capital budgeting process cannot be applied here because they necessarily arose to accommodate peculiar circumstances and by

definition have not been incorporated in the formal capital budgeting guidelines. Similarly, any peculiar circumstances that may have existed in 1974 will not be treated individually by application of the 1976 formal selection criteria. In addition, 1974 projects are selected here by 1976 capital budgeting criteria taken one at a time. Since no two sets of criteria used in the process yield the same capital budget, it is necessary to rely on the opinions of the resource allocators as to what decisions would have resulted from application of all 1976 criteria and "negotiations" on trade-offs. In spite of their good intentions, their decisions may be affected by additional knowledge of businesses and projects that has been gained in the last two years.

1974 Capital Budget--Business Category Considerations

Taking a macro view of the capital budgeting, total spending by business category and by class of spending for business related projects can be determined on the basis of the Director of Planning's "formula." With the help of the Corporate Planning department, 1974 businesses were positioned on the Business Matrix and categorized as Thrust, Emphasis, Reposition, Sustain and Selective. The new distribution of capital based on the "formula" in Exhibit 14, 1974 matrix position, 1974 business categories and annual depreciation appears in Exhibit 16. This can be compared with Exhibit 17

EXHIBIT 16

DISTRIBUTION OF CAPITAL BY BUSINESS CATEGORY

1976 CAPITAL BUDGETING PROCEDURE

BUSINESS CATEGORY	TOTAL	COST REDUCTION	EXPANSION	MAINTANANCE	DEVELOPMENT
THRUST	\$ 19,300,000	\$ 3,860,000	\$ 7,720,000	\$ 1,930,000	\$ 5,790,000
EMPHASIS	17,232,000	5,170,000	5,170,000	5,170,000	1,722,000
REPOSITION	1,385,000	415,000	415,000	415,000	140,000
SUSTAIN	14,149,000	5,660,000	2,829,000	5,660,000	0
SELECTIVE	5,540,000	2,216,000	554,000	2,770,000	0
TOTAL BUSINESS RELATED CAPITAL	\$ 57,606,000	\$17,321,000	\$ 16,688,000	\$ 15,945,000	\$ 7,652,000

EXHIBIT 17-A

DISTRIBUTION OF CAPITAL BY BUSINESS CATEGORY

1974 CAPITAL BUDGET

BUSINESS CATEGORY	TOTAL*	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT
THRUST	\$ 24,468,000	\$ 5,692,000	\$ 5,793,000	\$ 579,000	\$ 8,500,000
EMPHASIS	15,254,000	2,354,000	3,420,000	778,000	3,905,000
REPOSITION	4,146,000	0	3,107,000	0	640,000
SUSTAIN	20,845,000	5,824,000	4,622,000	339,000	300,000
SELECTIVE	1,541,000	0	1,347,000	0	0
TOTAL	\$ 66,254,000	\$ 13,870,000	\$ 18,289,000	\$ 1,696,000	\$ 13,345,000

LEGALLY REQUIRED 13,731,000

TOTAL BUSINESS RELATED CAPITAL \$ 79,985,000

* The total does not equal the sum of cost reduction, expansion, maintenance and development; the capital budget contained "discretionary funds."

EXHIBIT 17-B

DISTRIBUTION OF CAPITAL BY BUSINESS CATEGORY

PROJECTS APPROVED DURING 1975

BUSINESS CATEGORY	TOTAL	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT
THRUST	\$ 12,616,000	\$ 1,762,000	\$ 3,748,000	\$ 3,329,000	\$ 3,777,000
EMPHASIS	5,518,000	228,000	0	547,000	4,473,000
REPOSITION	162,000	88,000	0	9,000	65,000
SUSTAIN	11,466,000	6,372,000	1,381,000	3,463,000	212,000
SELECTIVE	1,715,000	361,000	1,326,000	28,000	0
TOTAL	\$ 31,477,000	\$ 8,810,000	\$ 6,454,000	\$ 7,356,000	\$ 8,797,000
LEGALLY REQUIRED	<u>5,924,000</u>				
TOTAL BUSINESS RELATED CAPITAL	\$ 37,401,000				

which shows the 1974 capital budget and actual project approvals during 1975 as they were distributed across business categories and spending classes.

On an overall basis, 12% more capital was approved in the 1974 capital budget for business related projects than the "optimum" formula would dictate. But actual project approvals during 1975 were only ~50% of the "optimum." Part of this reduction in spending was the result of a reduced capital budget in late 1974 and an "almost" moratorium on capital spending in mid- to late 1975. Another part of the reduction was reputed to be the result of scarce M & E manpower, but no records were available to substantiate that, and management was not sure of the exact effect of this factor.

Looking at the breakdown among spending levels for each business category, the capital budget allocated proportionally more to Thrust, Reposition and Sustain categories and less to Emphasis and Selective. But when projects were actually approved during 1975, the Thrust and Sustain categories received more funds proportionally than either the capital budget or the formula allocation. Emphasis businesses were the real losers in terms of capital dollars. It is not true that Emphasis businesses had projects with lower than average rates of return, but a couple of reasons for the effect can be hypothesized. The Thrust businesses in 1974 consisted of "Developing

Businesses" which had corporate commitment for continuation and the Established Businesses which historically have had the highest profit margins. It is reasonable to expect that in "hard times" major capital reductions would not come from this group. The second reason relates to the sheer numbers of businesses involved. Although depreciation on Emphasis businesses was quite high, greater than for Thrust businesses and only \$2.5 millions less than for Sustain businesses, only 3 business units were in the Emphasis category compared to 12 in Thrust and 11 in Sustain. From the standpoint of "something for everyone" and the ability of line personnel per organizational unit to implement projects, it is not surprising that the Emphasis businesses lost ground. In addition, no projects were submitted for one of the three businesses, and a great deal of effort was being devoted to a major development project for the second of the three.

Exhibit 18 shows that neither the capital budget nor actual project approvals in 1975 approximated the desired distribution of class of spending by business category. The two most glaring discrepancies were development for Emphasis businesses and expansion for the Selective category. As mentioned earlier, one of the three Emphasis businesses was heavily involved in a new development. And it appears that cost reduction and

EXHIBIT 18

ACTUAL CLASS OF SPENDING DISTRIBUTION

1974 CAPITAL BUDGET

BUSINESS CATEGORY	COST REDUCTION		EXPANSION	MAINTENANCE		DEVELOPMENT		
		*						
THRUST	28%	(+ 8%)	28%	(-12%)	3%	(- 7%)	41%	(+11%)
EMPHASIS	32%	(+ 2%)	33%	(+ 3%)	7%	(-23%)	37%	(+27%)
REPOSITION	0	(-30%)	83%	(+53%)	0	(-30%)	17%	(+ 7%)
SUSTAIN	53%	(+13%)	42%	(+22%)	3%	(-37%)	3%	(+ 3%)
SELECTIVE	0	(-40%)	100%	(+90%)	0	(-50%)	0	0

PROJECTS APPROVED DURING 1975

BUSINESS CATEGORY	COST REDUCTION		EXPANSION	MAINTENANCE		DEVELOPMENT		
THRUST	14%	(- 6%)	30%	(-10%)	26%	(+16%)	30%	0
EMPHASIS	4%	(-26%)	0	(-30%)	10%	(-20%)	86%	(+76%)
REPOSITION	54%	(+24%)	0	(-30%)	6%	(-24%)	40%	(+30%)
SUSTAIN	56%	(+16%)	12%	(- 8%)	30%	(-10%)	2%	(+ 2%)
SELECTIVE	21%	(-19%)	77%	(+67%)	2%	(-48%)	0	0

* The number in parenthesis equals the actual % in the category minus the percentage prescribed in the "formula," i.e. absolute deviation from the "optimum."

maintenance suffered because of the development. (No expansion was needed; in fact, Corning closed one of its plants for this business in 1975.) The Selective business category is distorted by a situation typical of problems with the matrix approach. The 1974 businesses were categorized on a "Worldwide" basis, but one of the two Selective businesses, primarily domestic in 1974, was not really a Selective business in Europe, and the planned expansion was for that segment. Without the European component, the Selective capital budget would have been only \$1.3 millions with \$1.1 millions legally required; actual project approvals in 1975 would have been \$508,000---8% legally required, 71% cost reduction, 15% expansion and 6% maintenance.

Business Matrix Considerations

Exhibits 19 and 20 show the distribution of capital dollars in the budget and in actual approvals during 1975 as they were distributed on the Business Matrix. These distributions should be compared with the 1976 "theoretical" distribution shown in Exhibit 13. It must be kept in mind, however that the capital budget distribution includes only major projects (> \$100,000) where the actual 1975 approvals include all projects.

The actual project selections correlate much better with this set of criteria than with the previous set relating to business category. With respect to cost

EXHIBIT 19

CLASS OF SPENDING DISTRIBUTION - 1974 CAPITAL BUDGET

		E	G	M	A
<u>COST REDUCTION</u>	S		25%	16%	
	F		2%	32%	
	E				
	W				

75 %

		E	G	M	A
	S				
	F				12%
	E			13%	
	W				

25 %

EXPANSION

		E	G	M	A
	S		9%	22%	
	F		3%	39%	7%
	E		4%	16%	
	W				

MAINTENANCE

		E	G	M	A
	S		25%	9%	
	F		20%	46%	
	E				
	W				

----- 34 %

----- 66 %

DEVELOPMENT

		E	G	M	A
	S	39%			
	F	24%	6%	31%	
	E				
	W				

EXHIBIT 20

CLASS OF SPENDING DISTRIBUTION - 1975 ACTUAL APPROVALS

		E	G	M	A			
<u>COST REDUCTION</u>	S		14%	6%		S		
	F		15%	20%		F		
	E					E		
	W					W		
					55 %			

		E	G	M	A
<u>EXPANSION</u>	S		28%	29%	
	F		4%	8%	5%
	E			26%	
	W				

		E	G	M	A		
<u>MAINTENANCE</u>	S		1%	45%		-----	46 %
	F		7%	18%	7%	-----	54 %
	E			30%		-----	
	W						

		E	G	M	A
<u>DEVELOPMENT</u>	S	27%		2%	
	F	13%		55%	
	E	1%	1%	1%	
	W				

reduction, the capital budget was very close to the theoretical "ideal," as were the AR approvals. The major differences were in Aging businesses and the Equal/Growing and Equal/Mature categories. Corning had no businesses in the Strong/Aging category. The Favorable/Aging business was the only business of one line division, and since there was no intention of doing away with that division, it should receive some capital (according to the behavioral theories of Corning's management). Cost reduction and maintenance seem the reasonable uses for such funds. With regard to the Equal/Growing category, there were only 2 businesses in this group: a new business still classified as "Developing" and a subsidiary which Corning was planning to divest. It does not seem reasonable to invest in cost reduction for these businesses. The only real unexplainable deviation on cost reduction was the high proportion devoted to the Equal/Mature category when projects were actually approved in 1975. Although it is true that 8 businesses were in this category, approximately twice the number in each other Mature or Growing category, the cost reduction dollars were spent on half of those businesses.

Actual maintenance project approvals during 1975 were very close to the target distribution, although the budget projects were not. This can be explained by the

fact that a large proportion of maintenance projects were small (38% were <\$100,000) and therefore appeared in the divisions' discretionary funds in the budget instead of in the maintenance class of spending.

The real differences between class of spending distributions--theoretical vs. actual--are in the expansion and development categories. The theoretical case recommends expansion only in the Growing businesses, but significant capital was actually allocated to expanding Mature businesses. The fallacy here seems to lie with the theoretical case. Although Mature businesses are only growing at .75 - 1.5 times the GNP growth rate, they are growing. And as long as sales volume increases, each Mature business will occasionally need to expand production capacity to meet the sales demand. Some people would concede that point, but maintain that significant expansions should not exist for Mature businesses where Corning's strength is only Equal (26% of the expansion was here). But that is again a problem of proper segmentation of businesses. The businesses in Equal/Mature were primarily domestic in 1974, hence business position was based on characteristics of the market and Corning's strength in the U.S. But four-fifths of the expansion capital for Equal/Mature businesses was for expansion abroad, into markets which were not as mature as those in the U.S.

With regard to development capital, first glance inspires a vote for the theoretical distribution and questions the large portion of development capital allocated to Mature businesses. Almost all of the development capital for Favorable/Mature businesses was for a single project for a single business. The purpose of this development was to leapfrog current technology with cost reduction benefits. And this seems a reasonable strategy to pursue, even though the project is development and the business is not Embryonic. In general, it is desirable to have development projects underway in Mature businesses as a strategy for repositioning the business into a better position on the matrix.

1974 Project Selection by 1976 Resource Allocators

A third approach to applying the 1976 criteria to 1974 projects was taken by asking each of the three key resource allocators to review the 1974 projects and determine which ones would be excluded or added to the 1974 capital budget on the basis of 1976 selection criteria and the existing business and project knowledge in 1974. Needless to say, the three individuals did not come up with same new capital budget.

On the basis of business position, two allocators would have rejected the pollution control project, all expansion projects and 75% of the cost reduction projects

for the Favorable/Aging business. The third allocator would have rejected the cost reduction projects, but not the pollution control and expansion projects. His reasons were the legal requirement for the pollution control if the business (the only one for a line division) was to continue and the fact that the processes could support segments of businesses that were not Aging.

All three individuals would have reduced cost reduction for one of the Sustain Equal/Mature businesses by anywhere from \$655,000 to \$1,230,000. Reasons given for these reductions were both business position and economic feasibility from the engineering viewpoint. The Director of Planning would also have eliminated \$1,100,000 allocated for pollution control for this business.

One of the Developing Businesses, categorized as Reposition Equal/Growing would not have received any funds according to two of the three allocators; the reason was matrix position. Neither would the Director of Planning have recommended the \$2,250,000 allocated to another Developing Business in Favorable/Embryonic.

The Vice President of M & E believed that he would have rejected a \$450,000 cost reduction project for another Favorable/Mature business in the Sustain category, because the project was never economically

feasible. He would also have rejected \$375,000 worth of building renovations because the engineers were not available to work on the projects in 1975.

The Director of Planning recommended rejection of on overseas expansion project involving \$1,247,000 for a Selective business in Equal/Mature. He also recommended some additions to the list of accepted projects, all associated with Favorable businesses in the Growing or Mature stages, categorized as Emphasis or Sustain.

Although there was no unanimous decision on the capital budget revisions, there certainly would have been some changes with the 1976 criteria and process. Exhibits 21 - 23 show the extreme case where every change mentioned by a single allocator was made. Overall spending would have been reduced by almost \$9 millions. Comparing Exhibit 22 to Exhibits 14 and 17, the new selection provides a better approximation for the "optimum" spending levels for Thrust, Emphasis and Reposition businesses than the actual capital budget, but not for the Sustain and Selective categories. With regard to changes in class of spending distribution by business category (see Exhibits 14, 18, and 22), there were no major changes, with both "old" and "new" budgets short on maintenance projects, at least partially attributable to the exclusion of < \$100,000 projects.

Exhibit 23 shows the new distribution of class of

EXHIBIT 21

CAPITAL BUDGET - 1974 (\$ 000)

AS SELECTED BY 1976 ALLOCATORS

BUSINESS CATEGORY	LEGALLY REQUIRED	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT	SPECIFIC	TOTAL
THRUST	\$ 550	\$ 6,093	\$ 5,793	\$ 579	\$ 6,250	\$ 3,904	\$ 23,169
EMPHASIS	1,432	2,771	3,420	778	3,905	4,797	17,103
REPOSITION	4,600	0	2,287	0	640	399	7,926
SUSTAIN	4,959	4,407	3,220	339	300	8,760	21,985
SELECTIVE	1,140	0	100	0	0	194	1,434
TOTAL BUSINESS	\$ 12,681	\$ 13,271	\$ 14,820	\$ 1,696	\$ 11,095	\$ 18,054	\$ 71,617

8,644

\$ 80,261

TOTAL NEW CAPITAL BUDGET

EXHIBIT 22

DISTRIBUTION OF CAPITAL BY BUSINESS CATEGORY

PROJECT SELECTION BY 1976 ALLOCATORS

BUSINESS CATEGORY	TOTAL AS % OF DEPRECIATION	% COST REDUCTION	% EXPANSION	% MAINTENANCE	% DEVELOPMENT
THRUST	234 %	33 %	31 %	3 %	33 %
EMPHASIS	136 %	25 %	25 %	7 %	36 %
HEPOSITION	360 %	0	78 %	0	22 %
SUSTAIN	120 %	53 %	39 %	4 %	4 %
SELECTIVE	3 %	0	100 %	0	0

EXHIBIT 23

CLASS OF SPENDING DISTRIBUTION - 1976 PROJECT SELECTION

COST REDUCTION

	E	G	M	A
S		28%	22%	
F		3%	39%	
E				
W				

92 %

	E	G	M	A
S				
F				3%
E			5%	
W				

8 %

EXPANSION

	E	G	M	A
S		11%	28%	
F		11%	36%	
E			14%	
W				

MAINTENANCE

	E	G	M	A
S		25%	9%	
F		20%	46%	
E				
W				

----- 34 %
----- 66 %

DEVELOPMENT

	E	G	M	A
S	47%			
F	8%	7%	38%	
E				
W				

spending on the Business Matrix. The major changes here are elimination of expansion in the Aging business and switching more cost reduction capital to the "good" businesses (Strong and Favorable, Growing and Mature) from the other businesses, decisions which make strategic sense.

The return profiles of cost reduction and expansion projects would not be altered with the recommended changes; the weighted IRR's for projects excluded and projects added for both classes of spending were approximately 40%. The rejected development project would cause the weighted average IRR for development projects to drop from 33% to 32%, hardly significant.

The Line Division Perspective

It is impossible to determine objectively and quantitatively what the outcomes of projects would have been with different choices. Because of joint processes and products, joint costs and benefits and the existing accounting system it is impossible to attribute any added or reduced returns to the individual projects and other changes in the environment. The capital audit system primarily tracks project implementation costs and subjective forecasts of project returns on a small sampling basis. Therefore interviews were conducted with the Vice Presidents, Manufacturing Managers and Controllers of two operating divisions to try to

determine the impact of selecting 1975 projects using 1976 selection criteria.

The first division examined consisted of three major businesses in 1974, one each in Thrust (Strong/Mature), Emphasis (Strong/Mature) and Sustain (Favorable/Mature). Based on business category and annual depreciation, capital would have been allocated to the businesses as shown in Exhibit 24, doubling the total capital allocated to the businesses. According to the recommendations of the resource allocators, the only change would have been the addition of \$401,000 for cost reduction in the Thrust business. The Vice President of this division believed that there might have been some minor changes in his capital budget, but no major reductions or additions. He firmly believed there would have been no changes in the projects actually implemented. The Manufacturing Manager of this division believed that the new system would simply bring the planned capital budget closer to actual approvals during the following year, but the numbers show this was not the case. It is true that total capital spending was reduced in 1975 because of overall economic conditions, partly explaining the discrepancies in levels of spending, but actual distribution over classes of spending was not close to the theoretical distribution.

The other line division consisted of two Thrust

EXHIBIT 24

ORIGINAL 1974 CAPITAL BUDGET - DIVISION I (\$ 000)

BUSINESS	TOTAL*	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT
THRUST	\$ 2452	\$ 2152	\$ 150	\$ 150	\$ 0
EMPHASIS	0	0	0	0	0
SUSTAIN	200	0	200	0	0

MODIFIED 1974 CAPITAL BUDGET - DIVISION I

BUSINESS	TOTAL*	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT
THRUST	\$ 2982+	\$ 596	\$ 1193	\$ 298	\$ 895
EMPHASIS	466	140	140	140	46
SUSTAIN	2793	1117	279	1397	0

PROJECTS ACTUALLY APPROVED IN 1975 - DIVISION I

BUSINESS	TOTAL*	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT
THRUST	\$ 546	\$ 67	\$ 7	\$ 312	\$ 160
EMPHASIS	89	0	0	89	0
SUSTAIN	758	331	349	78	0

* These totals do not include Legally Required projects.

businesses, one Reposition business, one Sustain business and one Selective business. Exhibit 25 shows the theoretical capital allocation for each business compared with the 1974 capital budget. For this division the theoretical levels and distribution better approximate the actual approvals than does the 1974 budget.

The resource allocators had recommended reducing the Sustain cost reduction for this division by 50-100%. The division Vice President and Manufacturing Manager both said they would have fought such a recommendation. The Vice President added that he didn't think the new capital budgeting procedure would have made any difference in his 1974 capital budget, and that all the major projects (> \$100,000) implemented by the division in 1974 were successful with one exception where the problem was technical and couldn't have been foreseen.

The one project failure was for a segment of one of the Thrust businesses, and considered as an individual business, this segment was not strong and should have been categorized as Selective. According to the division Controller the new system conceptually should have eliminated it, but because of Corning's implementation it would not have. His analysis follows:

"The biggest strategic mistake this division has made in the past 3 years was the pursuit of ----- (the segment). We have paid for it dearly. Had we been into profit positioning prior to making the go decision on the ---- program we might not have chased it. (The

EXHIBIT 25

ORIGINAL 1974 CAPITAL BUDGET - DIVISION II

BUSINESS	TOTAL*	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT
THRUST I	\$ 1735	\$ 0	\$ 1735	\$ 0	\$ 0
THRUST II	2429	300	1700	429	0
REPOSITION	1240	0	600	0	640
SUSTAIN	1230	1230	0	0	0
SELECTIVE	0	0	0	0	0

MODIFIED 1974 CAPITAL BUDGET - DIVISION II

BUSINESS	TOTAL*	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT
THRUST I	\$ 2629+	\$ 526	\$ 1052	\$ 263	\$ 789
THRUST II	2629+	526	1052	263	789
REPOSITION	900	270	270	270	90
SUSTAIN	1314	526	263	526	0
SELECTIVE	585	234	58	293	0

PROJECTS ACTUALLY APPROVED IN 1975 - DIVISION II

BUSINESS	TOTAL*	COST REDUCTION	EXPANSION	MAINTENANCE	DEVELOPMENT
THRUST I	\$ 3003	\$ 443	\$ 1458	\$ 1102	\$ 0
THRUST II	2657	750	1818	89	0
REPOSITION	58	32	0	0	26
SUSTAIN	1977	1519	62	396	0
SELECTIVE	10	0	10	0	0

* TOTAL is without Legally Required Projects.

division) perceived itself as being pretty strong (potentially) in ---- at that time, however, some good challenges from corporate might have brought us back in line.

"Another key point. ----(the segment) today is part of the -----(Thrust business). It is possible, and probably is happening today, to bury a decision on a weak business in the protective arms of a strong business. The message being to optimize the use of profit positioning, businesses must be very intelligently constructed to enable the system to focus properly."

Taking an opposite stand on the segmentation issue, the Vice President of this division believed that each division should be considered a single business, capital allocated to a division on the basis of its position relative to the other divisions in the corporate portfolio, and that the division should then internally allocate its funds to projects.

V. Evaluation

The lore at Corning in operating and staff divisions is that the 1976 capital budgeting process/criteria is just a formalization of the selection process operating in the past, and that was the underlying hypothesis of this study. The Vice President of the Technical Products Division said, "The new technique would not have changed the portfolio of class spending in the capital budget, but what it did do in 1976 was change the thinking of divisions in planning their projects, increase their time horizons and improve the quality of information contained in the capital budgeting process." Perhaps as the new system was implemented in 1976 that is an accurate conclusion. But application of the explicit guidelines for levels and class of spending by business category and matrix position produce marked changes in the total amount and class of spending composition of the capital budget, disregarding the impact of technical manpower constraints which could not be identified here.

Given that the new method is not an explicit manifestation of the implicit process selecting projects in 1974, what are the relative merits of the two techniques?

A. Evaluation--1974 Capital Budgeting Procedure

Although the old system was to consider six factors-- project type, project economics, risk, resources required (financial and human), business factors and "other" factors, it really could not adequately consider them all. The allocators were not operating from a common information base or set of selection criteria.

Project type was rather straightforward, and remained unchanged in the new system. The project economics could be evaluated on the basis of well communicated guidelines, but in fact few projects were submitted if they did not meet the minimum hurdle rates. Those few projects were submitted with no calculated returns and justified on other bases. From the projects submitted with calculated returns, there appeared to be no effort to select projects within the capital constraints in such a way that return per dollar invested was maximized. Risk considerations had to be perfunctory or very subjective since only most likely, pessimistic and optimistic returns were provided with project submissions, and there was no reference to those when projects were actually selected for the capital budget.

Evaluation of the nature of the businesses and their importance was not very objective or consistent between businesses or the different allocators. Each person had his own ideas of the important criteria and

how each business satisfied the different criteria. Reaching a common stand on business/project importance was very difficult, if not impossible to achieve. Return on Assets was not a true measure of business' contributions because of problems in calculating ROA for a single business. For example, one plant manufactures products for three divisions/five businesses. Allocation of joint costs in a way that truly reflects each business' contribution is a very real problem at Corning.

As far as resource requirements were concerned, the appropriate people were not consulted in order to determine what human resources, particularly technical manpower, were required or available.

In other words, a system was working, but it was not a common, well understood system. The selection algorithms were resident in the minds of a few key people with the result that decisions often seemed arbitrary to the outsiders. Not only was it desirable to make all the criteria explicit so that decisions could be understood, but also for decision making to be improved with selection criteria and trade-offs open and subject to better analysis.

B. Evaluation--1976 Capital Budgeting Procedure

The new capital budgeting procedure is a step in the right direction. First of all it has definite, explicit objectives--to combine the factors of available projects, resource requirements and availability, project economics and business strategy in order to select the best combination of capital projects. The process includes more people in the decision making process (three allocators, President, Vice Chairman, and the OMG), and these people are the knowledgeable people who can evaluate projects on the bases of financial considerations, opportunities, constraints and corporate/business strategy. The addition of the Vice President of Manufacturing and Engineering is critical because it closes a gap that previously blocked evaluation of the ability to implement the projects which were submitted. Another advantage of the new system is providing a common language and coherent guidelines for evaluation of businesses and projects by both the division and staff managers.

But the new system is not without flaws. The first problem is defining a business. The degree of segmentation/aggregation and along which dimensions are key questions. The problems involved with considering a Worldwide business were previously mentioned. Although it may be true that the company is providing the same

product and facing the same competitors in different geographical areas, it may not be advisable to classify the entire business in one matrix position or business category. The stages of the markets, relative strengths of the company and opportunities may be different in different regions, necessitating a combination of strategies and different kinds of capital projects in various geographical segments. (In 1976, the capital budgeting process did consider the geographical segments.)

The appropriate level of market segmentation by product is a murkier problem. The range goes from a generic product business based on the market need being fulfilled down to product line businesses. There are arguments in favor of positions all along the continuum. For example, it may be very appropriate to consider gourmet cookware separately from other types of cookware-- consumers served, distribution channels, stage of the market, etc. are very different for this line. But several Corning managers believe individual product lines should not be considered alone because they are an important, integral part of a major business. The author agrees that there are limits to the fineness of segmentation that is practical, but strongly disagrees with the aggregate viewpoint. Segmentation allows tailor-made strategy formulation. Although a small, less favorable business may not be phased out because

it is part of an important larger business, at least there can be an explicit plan for maximizing the returns for this segment. For example, cost reduction might continue for this line while the rest of the larger business is being expanded. And segmentation can identify real losing product lines that can be phased out and replaced with other lines which complete the overall business portfolio yielding a higher return.

A final question in proper segmentation is what to do with a single product line that is sold to very different end users, i.e. the markets are different. It appears that in 1976 some of the segmentation issues were considered, at least implicitly. But without common guidelines among the decision makers and a mechanism for highlighting the potential opportunities and threats in individual lines, long-term suboptimal decision making can result.

Another problem inherent with the Business Matrix approach is how to position a business unit. With four considerations in determining strength, it is doubtful all will point to the same strength position. There is a similar problem in determining stage of the market cycle. The Corporate Controller noted that it is possible to put a business in any of four contiguous boxes on the matrix and justify the position. However, in the planning process prior to capital budgeting,

agreement is reached on business matrix position with clear reasons for the positioning. As long as there is proper segmentation of businesses, this should not be a serious problem.

A couple other problems are associated with the Business Matrix determination of capital projects. First is the issue of opportunities. All the matrix and business categories indicate is the planned strategy, normally for 3-5 years; it does not indicate what the opportunities for next year are. Perhaps the bulk of capital won't be spent until three years hence, or perhaps all the opportunities are near term. The Manufacturing Manager for Consumer Products Division suggested that a long term capital budgeting approach be taken. Each business could commit to a 3-10 year plan with successive capital investments. The specific capital project budget could be conservative with reserves for new opportunities. This would require financial support and commitment to the business and corporate strategies, even in bad years.

Neither does the explicit system allow for individual business considerations. Obviously all Thrust businesses are not alike; neither are all Strong/Mature businesses alike. Flexibility must be maintained for the human judgment factor where all criteria cannot be defined.

The actual distribution of class of spending recommended by the new procedure does not seem optimal. The biggest problems are with expansion and development capital. Expansion should not be limited to businesses in the Growth stage, for that stage is characterized by relatively faster growth than the other stages. As long as there is any growth there will be occasion for plant or process expansion. This class of spending should be spread across Growing and Mature businesses, with relatively more allocated to the Growth businesses but implemented as the need or opportunity arises.

It would be reasonable to expect development spending to be limited to the Embryonic category if each new product line or development project were spun off from the Mature business and placed in the Embryonic stage. But this level of segmentation is not about to occur at Corning, and really is not advisable. It is very necessary that development continue in Mature businesses to rejuvenate the product line and remain competitive. Therefore development capital must be allocated to Growing and Mature businesses as well as Embryonic.

The financial criteria for project selection nominally remained unchanged. But in fact, they seem to be useless in the project selection process at the corporate level. Selection of projects was not limited to those above certain hurdle rates, and neither did

it strive to maximize returns. However, financial criteria do appear to serve the purpose of screening out low return projects at the division level.

It seems appropriate that financial criteria be redefined to be compatible with the business strategy approach. For example, projects for Selective businesses should be required to have higher minimum IRR's and a lower maximum payback period. Appropriate definitions of these financial criteria could better determine desirability of a medium return project for a good business vs. an extraordinary return project for a mediocre business. Similarly, it could better screen projects for a given business or business category. Such an approach could yield a much higher return portfolio of projects for a given set of business strategies.

The author also recommends eliminating the business ROA criteria from the capital budgeting process. First of all, an ROA measure based on past investment decisions is more appropriately an overall corporate performance measure. New investment decisions should be made on the basis of incremental (full cost) returns. The problems associated with joint costs, transfer prices, etc. are such that truly accurate ROA's cannot be determined for individual businesses. Although there were written guidelines on minimum current and planned business ROA, where the project was "driving" ROA and

actual project ROA, these measures were not all provided on capital budget project submissions, and ROA data available did not appear to affect project selection. So as long as the project enhances the business strategy and provides the desired IRR and payback, ROA seems unnecessary.

The last major shortfall of the capital budgeting process is the fact that it only allocates by project ~ 40-70% of the capital funds for any given year. The remainder is distributed to each of the divisions in "chunks" of discretionary funds. Two major problems are associated with this: the division can spend this money on projects for any class of spending and for any business within the control of the division. Here the businesses include businesses overlapping divisions; divisions have capital control over their plants, which often produce products for businesses in other divisions. And as long as the project involves $< \$50,000$ only division approval is required for the capital authorization. (It is not unknown for more than one Appropriation Request of $\leq \$49,000$ to be processed in the division when it is more appropriate to submit a single large project Appropriation Request which requires approval outside the division.) Even if the capital budgeting process optimizes the return/strategy/class of spending/business capital mix for projects $> \$100,000$ and closes

the gap so that actual major projects approved during the year and the capital budget are closely linked, major distortion of the project portfolio may result because of the 30-60% of capital in divisions' discretionary funds. Although it is not reasonable to require divisions to submit individual small projects at capital budgeting time, it is reasonable to allocate discretionary funds to the divisions by business, earmarked for a certain mix of class of spending, and subject to the same financial criteria (variable by matrix position or business category) as the major projects.

The new system considers financial returns (IRR) and return to technical inputs (NPV per engineer). A next generation approach might be to evaluate projects on the basis of expected return to all resources required--fixed capital, working capital, technical manpower, management manpower, research efforts and any other scarce resource employed. Another area for further development is identification of "derivative opportunities" that may result from investment in proposed projects and more objective treatment of this element in project selection.

VI. Conclusion

The hypothesis of this study has been disproved; the new capital budgeting procedure at Corning Glass Works was not operating implicitly in the past. There are two possible explanations for this; either Corning could not capture the internal algorithms of the key project selectors, or it intentionally tried to provide better criteria. I believe the latter is the case.

The old capital budgeting process was dominated by a few people and supposedly based on published financial criteria and the experience, knowledge and intuition of the decision makers. As far as explicit criteria were concerned, the old system was a subset of the new capital budgeting system. But the decisions were primarily made on the basis of unspoken guidelines.

The new system is a vast improvement over the old. It provides a common language and common guidelines for discussing and selecting projects; there are a common base of information and decision making framework which make project selection understood. And it provides a structure for discussion of whether all or the right objectives of the firm are incorporated in investment decision making, whether the "rules" are adequate or correct and a base for further evolution to an even more sophisticated and useful capital budgeting process.

A few elements of this "further evolution" have been recommended here. Concerning business considerations, several changes are called for. The level of segmentation of businesses to be used for matrix positioning and business categorization requires rethinking. Geographical segments with different market characteristics should be considered separately. The level of product aggregation should also be modified to allow special strategic/investment considerations where it is appropriate.

The capital class of spending distribution on the Business Matrix should be revamped. The distribution of cost reduction and maintenance seem quite reasonable. But expansion funds should be allocated to Mature as well as Growing businesses, and development should be spread across Embryonic, Growing and Mature businesses.

None of the formulae for level or distribution of capital by business category or matrix position should be rigidly enforced. They should be guidelines, a point of departure. Flexibility for individual business considerations and investment opportunities should be maintained.

With regard to financial selection criteria, there should be some specific changes. New IRR and payback hurdle rates should be established for individual Business Matrix position, reflecting the different levels of risk associated with business position as

well as strategy and priority. ROA should be eliminated from investment decision making.

The addition of explicit consideration of technical manpower requirements of projects , return per engineer vs. available manpower is a great step forward. This element is key to implementation of capital budget projects and allows closer linkage between actual and planned investments. The next step is to explicitly consider the availability and most profitable utilization of other resources employed.

In summary, the new capital budgeting procedure is a vast improvement over the old, but it is a base on which further improvements should be made in order to approach optimal project selection.

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APPENDIX I

CALCULATION OF PROJECT FINANCIALS

A. Internal Rate of Return (IRR)

Internal rate of return is the rate r such that

$$\sum_1 \frac{\text{cash inflow}_1}{(1+r)^1} - \frac{\text{cash outflow}_1}{(1+r)^1} = 0$$

where 1 ranges from 1 to the end of the relevant time horizon.

Calculation of IRR for Corning projects is based on net after cash inflows generated over the shortest of the following time horizons:

1. Technological life - period of time expected to elapse before the proposed capital investment is obsoleted through process improvements.
2. Product-marketing life - period of time expected to elapse before the products manufactured with the new capital equipment will be modified or obsoleted.
3. Physical life - number of years the machine is expected to be of use to the company in performing the function for which it was acquired.
4. Twenty years or 24 months if capital is for cost reduction in a business with business ROA $< 10\%$ and not projected to be $> 18\%$ in five years.

Annual cash inflow for a project is equal to net profit after taxes plus any non-cash allocation that reduced the profit figure (e.g. depreciation). Net profit is defined differently depending on the type of project being evaluated.

Net profit for cost reduction projects is really net profit after taxes resulting from expense savings. Two estimates of future variable (out of pocket) expenses for each year in the relevant time horizon are made: one without

the proposed investment and one with the new project. Included in the estimates are direct labor, indirect labor, fuel, materials, maintenance, etc. Added to the "with new investment" expense estimate is annual depreciation on new equipment; no depreciation expense is included on the "without new investment" estimate. If old equipment will be obsoleted with the new investment, its undepreciated balance will be included in the first year expense estimate for "with investment," as will any removal costs. For each year, the cost savings ("without" estimate minus "with" expense estimate) are calculated, reduced by 50% for taxes, and any depreciation included in expense is added back to provide annual cash inflows.

Net profit for expansion projects consists of net profit after taxes on additional sales volume associated with the expansion, i.e. revenue from additional sales minus variable cost and allocated overheads for the additional volume, less 50% of this amount for taxes.

If maintenance projects are to be justified on a defensive basis, either to avoid future costs or when failure to make the investment will result in losing existing sales and margin, net profit is calculated in the same manner as for a cost reduction project.

Net profit for development projects is equal to total annual revenues expected minus total costs, less 50% for taxes.

Cash outflows consist of the total capital outlay, including working capital required for the project. Working Capital is added back as a cash inflow the last year of the project. If the cash outflows are expected to extend past the first year, they are calculated for the years in which they are expected to take place.

Prior to the submission of five year plans, which precedes the capital budgeting process, the Corporate Economic Forecasting department provides divisions with economic forecasts, including relevant cost/sales price inflation indices. These are supposed to be used in estimating project cash inflows and outflows.

Calculation of IRR then consists of finding the discount rate at which discounted inflows equal discounted outflows.

B. Return on Assets (ROA)

The formula which Corning uses for ROA is:

$$\frac{\text{NPAT}}{\text{Net Fixed Assets} + \text{Inventories} + \text{A/R} - 12\% (\text{Sales})}$$

Net profit after taxes (NPAT) is the sales revenues minus variable cost minus plant overhead minus a division overhead allocation, with the result divided by 2 for an effective 50% tax rate. Excluded is any allocation of corporate overhead or interest charges.

Net fixed assets is the net book value of the business' assets, and as such biases ROA measures in favor of businesses with older, more fully depreciated assets. There are

also problems with allocating assets to individual businesses where one plant or piece of equipment produces products for more than one business. Inventories and Accounts Receivables (A/R) are straightforward except for the fact that all Accounts Receivable are managed centrally. Twelve per cent of sales is a current liability offset, an "average" number not necessarily associated with the level required for any specific business.

ROA is a calculation made for a business, not a project. And although the project selection guidelines refer to current business ROA and the "planned" business ROA five years hence, only current business ROA is provided on Appropriation Requests for final project approval.

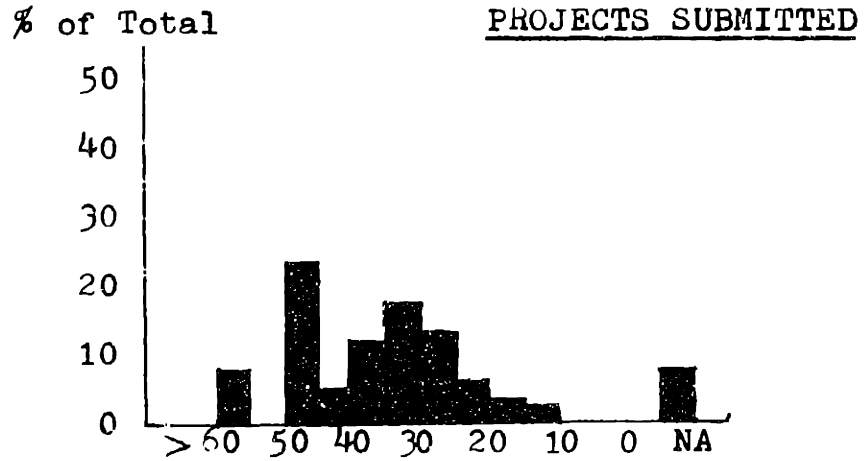
C. Payback

The payback calculation requires no discounting. Payback is simply the length of time required for cash inflows to equal the cash outflows, with these two terms defined the same way here as in IRR calculations.

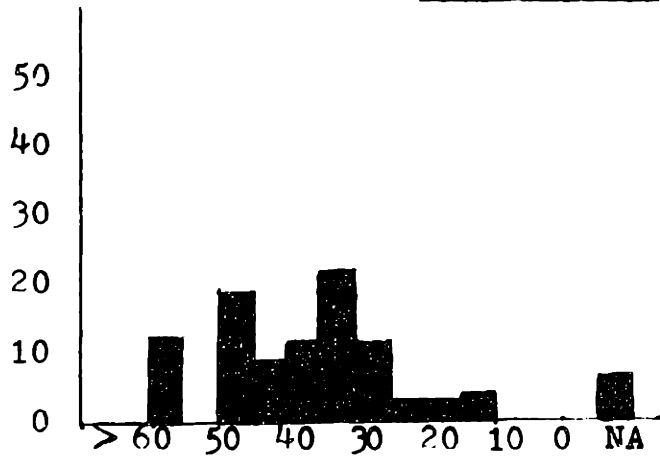
APPENDIX 2-A

DISTRIBUTION OF IRR BY NUMBER OF PROJECTS

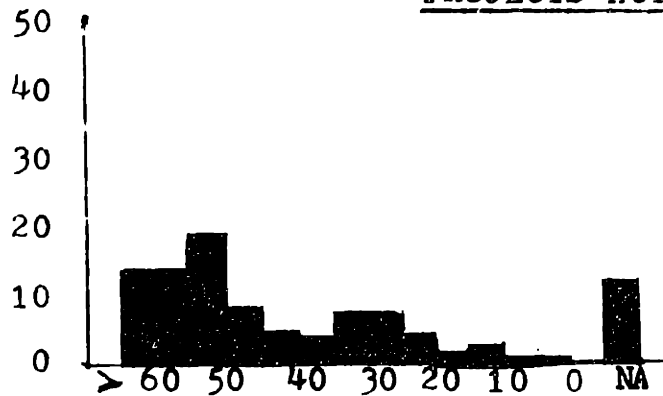
COST REDUCTION PROJECTS



CAPITAL BUDGET APPROVALS



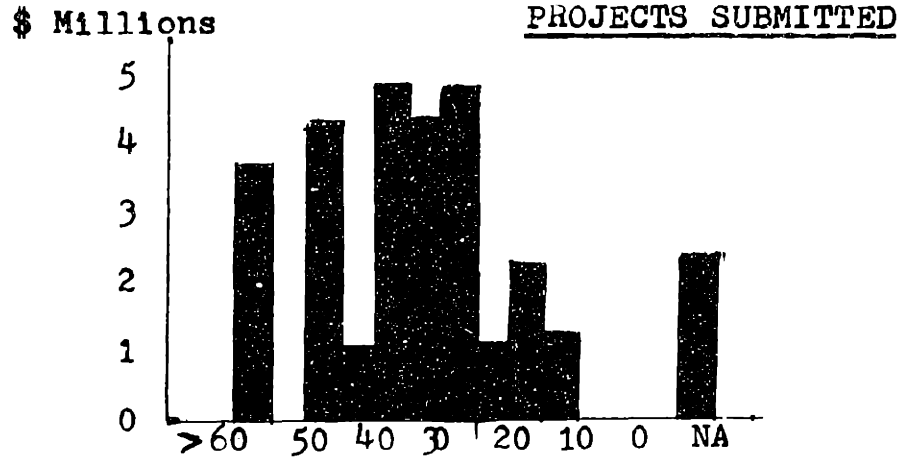
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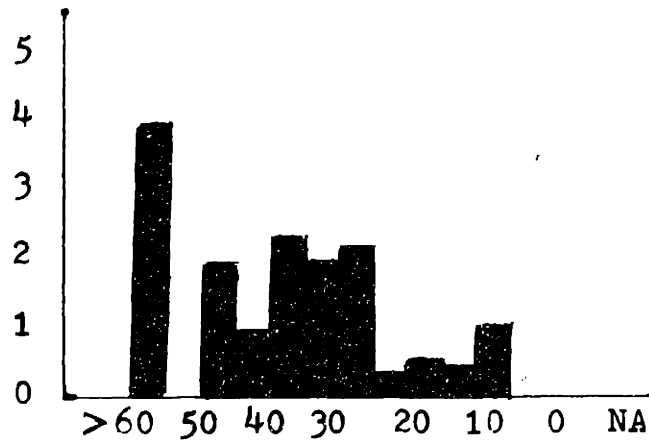
APPENDIX 2-B

DISTRIBUTION OF IRR BY CAPITAL DOLLARS

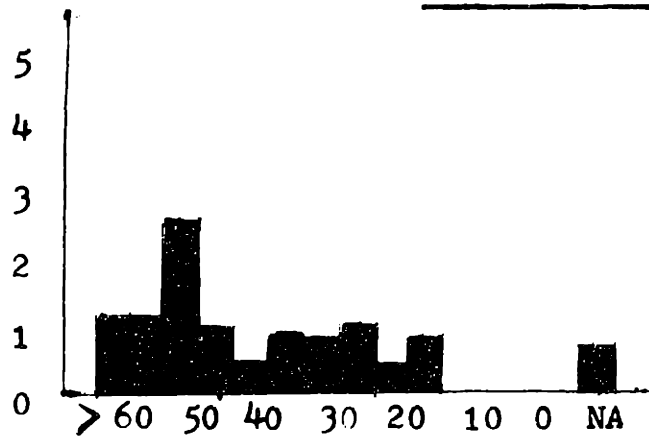
COST REDUCTION PROJECTS



CAPITAL BUDGET APPROVALS



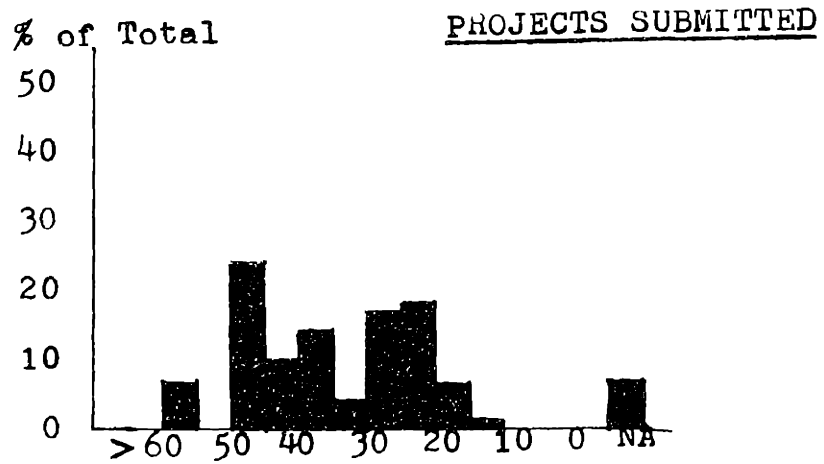
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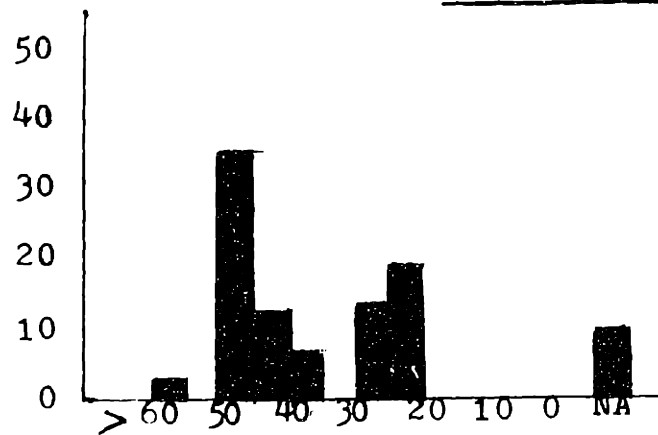
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DISTRIBUTION OF IRR BY NUMBER OF PROJECTS

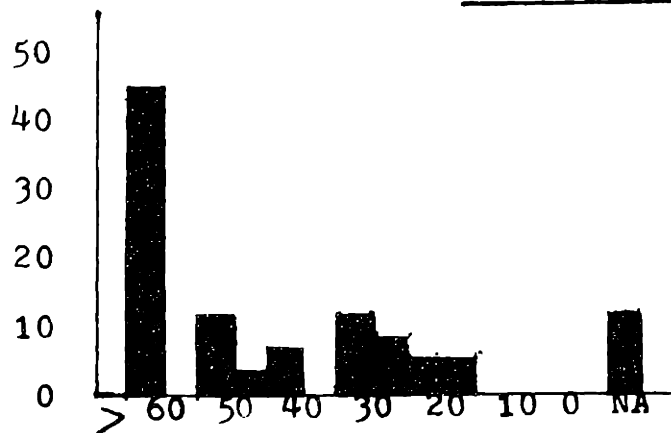
EXPANSION PROJECTS



CAPITAL BUDGET APPROVALS



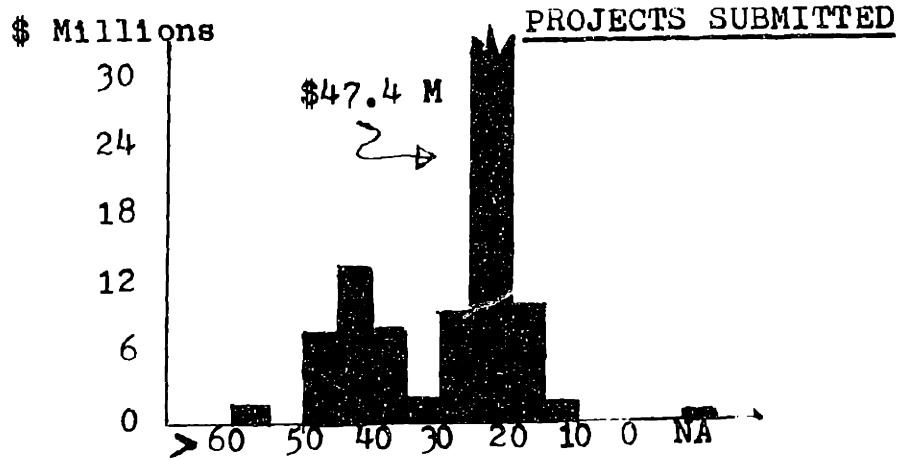
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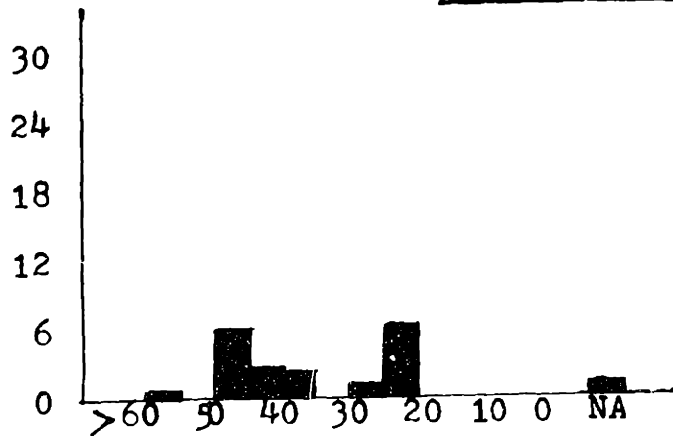
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DISTRIBUTION OF IRR BY CAPITAL DOLLARS

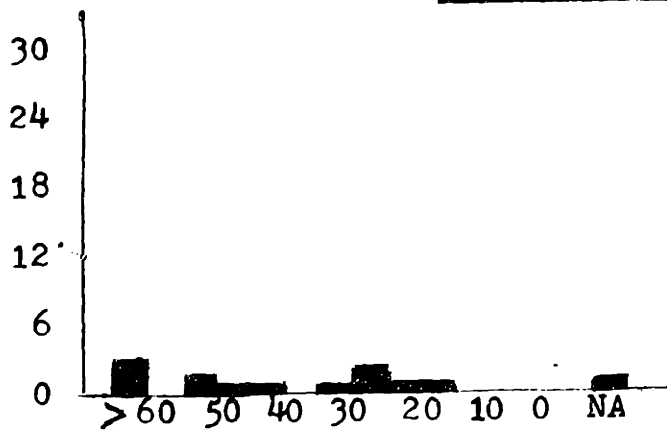
EXPANSION PROJECTS



CAPITAL BUDGET APPROVALS



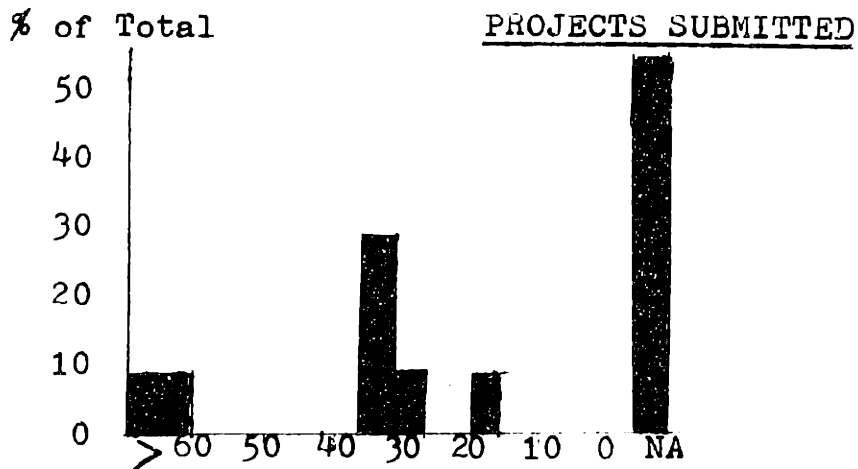
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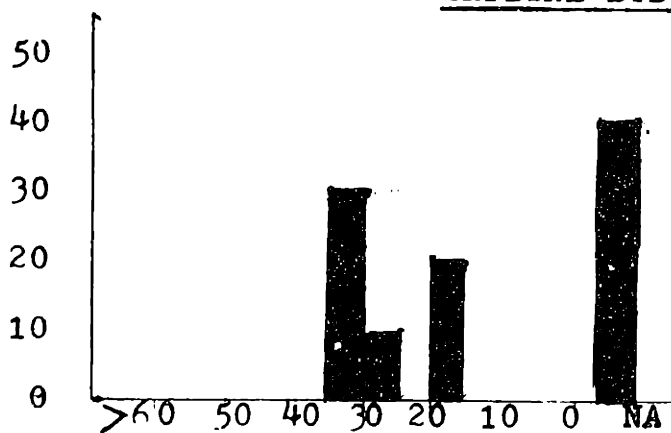
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DISTRIBUTION OF IRR BY NUMBER OF PROJECTS

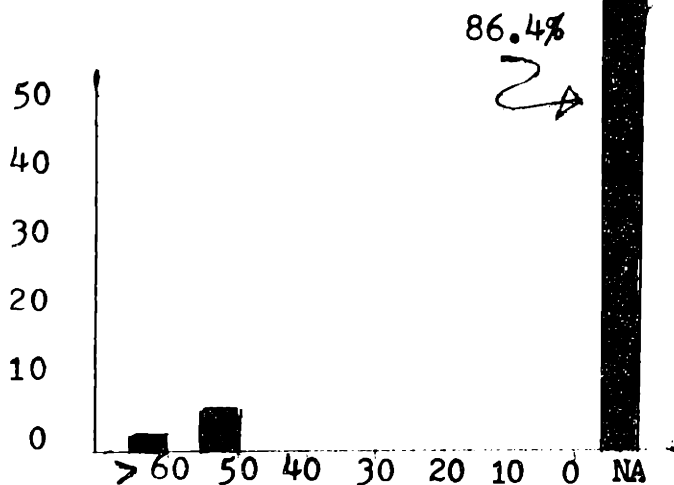
DEVELOPMENT PROJECTS



CAPITAL BUDGET APPROVALS



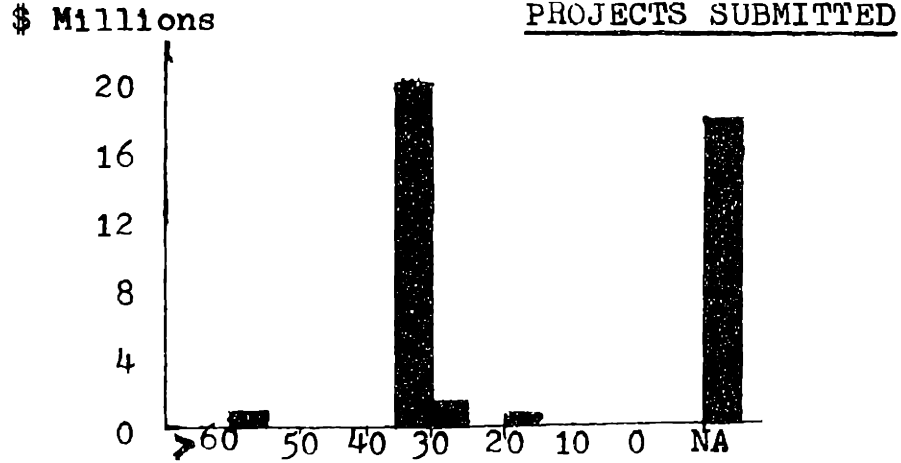
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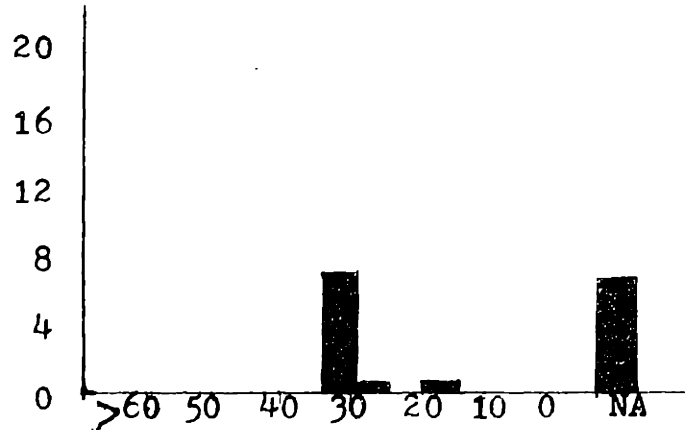
APPENDIX 4-B

DISTRIBUTION OF IRR BY CAPITAL DOLLARS

DEVELOPMENT PROJECTS



CAPITAL BUDGET APPROVALS



PROJECTS ACTUALLY APPROVED

