

A STUDY OF CASH FLOW VARIATION BY
PRODUCT LIFE CYCLE STAGE AS USED
IN CAPITAL BUDGETING DECISIONS

BY

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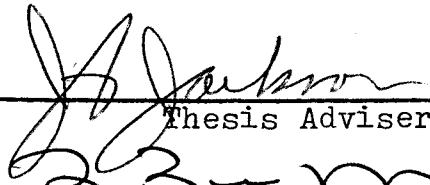
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Thesis Approved:



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PREFACE

The purpose of this study was to examine expected cash flow variations by product life cycle stages and how this information is used in capital budgeting decisions. The primary objective was to determine the compatibility, usefulness, and the current use of the product life cycle concept with the capital budgeting process. One hundred of the Fortune five hundred companies were surveyed and the resulting data was analyzed using SAS, a statistical analysis computer software package.

I wish to thank my major advisor, Dr. James Jackson for his patience and assistance through the duration of this study. In addition, my sincere thanks to my wife Pat, for her support, encouragement and assistance on this project and throughout the years of my college studies.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	1
II. LITERATURE REVIEW	3
Capital Budgeting	3
Product Life Cycle	4
Are Capital Budgeting and Product Life Cycle Concepts Compatible? . . .	7
Are Product Life Cycle Concepts A Useful Tool in Capital Budgeting	8
III. PROBLEM DEFINITION	12
IV. DATA ANALYSIS	15
Are Capital Budgeting and Product Life Cycle (PLC) Concepts Compatible? . . .	15
Is the Product Life Cycle A Useful Tool in Capital Budgeting	17
What Capital Budgeting Techniques are the Surveyed Companies Now Using	20
V. SUMMARY	23
APPENDIXES	
APPENDIX A	26
APPENDIX B	31

CHAPTER I

INTRODUCTION

Capital budgeting is a set of financial methods used by investors to determine the profitability of an investment. The capital budgeting process may include various techniques and analysis methods. The selection of a particular method or methods used by an investor will vary depend upon the investor's analysis skills and expertise.

An integral part of any capital budgeting technique is the cash flow forecast. This forecast represents the timing and amounts of cash expected to be generated by an investment. This cash forecast represents cash flowing in, as well as cash flowing out. Since the cash flow is a forecast, some uncertainty does exist. This uncertainty is the risk of an investment. Risk is usually represented in capital budgeting techniques in a discount rate. This discount rate is used to adjust the expected cash flows.

In order to help study and evaluate products and investments over a time, a technique was developed called product life cycle concept. This concept classified investment into stages representing different points in a products life. Marketing managers use the product life cycle concept to assist in making promotion and product strategy decisions.

The use of the product life cycle concept in supporting the cash flow forecast in the capital budgeting process is the central issue in this study. In specific, the purpose of this study is to examine:

1. An investment's expected cash flow variation by product life cycle stage.
2. The amount of expected cash flow variation by product life cycle stage.
3. How cash flow is forecast.
4. Techniques used in capital budgeting.
5. Desired timing of cash returns for investments.
6. Actual timing of cash returns for investments.
7. The use of the product life cycle concept in capital budgeting.
8. Sources of unexpected cash flow variation by product life cycle stages.

A questionnaire was sent to survey 100 of the 1977 Fortune magazine top 500 U.S. firms. This survey was used to gather the data for this study. The desire for information concerning expected cash flow variations led to this group of companies. Their size and number of years in existence made them a logical source for this information. Because of the number of questions asked and the use of several figures, all questionnaires were mailed.

CHAPTER II

LITERATURE REVIEW

In order to determine how capital budgeting and product life cycle concepts interface, a thorough review of existing literature is necessary. This review will focus on the following five questions:

1. What is capital budgeting?
2. What is the product life cycle?
3. Are capital budgeting and product life cycle concepts compatible?
4. Are product life cycle concepts a useful tool in capital budgeting?
5. What techniques are companies currently using in capital budgeting?

Capital Budgeting

Capital budgeting is the process of evaluating competing projects. It "involves the generation of investment proposals; the estimate of cash flows for these proposals; the evaluation of cash flows; the selection of projects based upon an acceptance criterion; and, finally the continual re-evaluation of investment projects after their acceptance". The projects may be classified into different types for analysis. Some of the different types of projects may be:

1. New products or projects.

2. Replacement of existing equipment
3. Expansion of current products or projects
4. Research and development

The most important critical aspects in capital budgeting is estimating the cash flows. The cash flows are the expected benefits from the investment and analysis techniques depend upon cash flows as input. Many of these techniques use the time-value of money concept to arrive at some predictive measure of profitability. Some of the most common capital budgeting analysis techniques are:

1. Present value method (PV)
2. Internal rate of return (IRR)
3. Payback method
4. Average rate of return

Perhaps the next most critical input in capital budgeting besides cash flows, is the assessment of investment risk. It's assumed the investor is risk adverse and thus, will select an investment of equal or greater profitability over a "riskier" investment offering the same return. The present value method (PV) and the internal rate of return (IRR) method are two analysis techniques that take risk into consideration.

Product Life Cycle

A product may be thought of as having a life. This concept of a product's life may furthermore be divided

into stages for purposes of analysis. A product's sales position and profitability may change over time and the position and profitability may change over time and the analogy to a life, or life cycle lends itself to the analysis of a product. "The product life cycle is an attempt to recognize distinct stages in the sales history of the product."²

The product life cycle is usually demonstrated graphically by plotting sales over time. The resulting curve shown in illustrated examples is similar to a curve of normal distribution.

The product life cycle curve may be divided into four stages:

1. Introduction
2. Growth
3. Maturity
4. Decline

The PLC is a useful tool for managing a product. The four stages are a means of analyzing a products situation in relation to its sales position and sales trend. For instance, a new product in the introductory stage is in a different situation in comparison to a mature product with an established market share. Products within a PLC stage would have different strategies because of the different situations. Some of the different strategies and problems between the PLC stages are:

1. Introduction Stage

--Technical problems ("working out the bugs")

--Low Production capacity due to delays
in expansion

--Delays in securing adequate dis-
tribution

--Customer's reluctance to change

2. Growth Stage

--Improve quality and add new features

--Search out new market segments to enter

--Search out new or improve distribution
channels

--Change advertising from building product
awareness to bring about production con-
viction

--re-evaluation pricing strategy

3. Maturity Stage

--Search out new markets and market
segments

--Relaunch products with quality or
feature improvements

--Style improvements

--Search for new advertising appeals

--Price cutting

--Change marketing channels

4. Decline Stage

-- Product consumes a disproportionate amount
of managements' time

- Frequent price adjustments
- Concentration on the strongest market segments
- Milking the market by cutting expenses and increasing profits until the product has to be dropped

Capital Budgeting and Product Life Cycle Concepts Compatible?

Is the use of the product life cycle (PLC) and capital budgeting concepts compatible? Would the consideration of the PLC in capital budgeting be extraneous? The description of capital budgeting by Van Horn would suggest that the ideas and concepts of PLC is already a part of capital budgeting. Van Horn described using capital budgeting analysis techniques on different project classifications. The classifications of Van Horn are paired below with the stages of the product life cycle described earlier by Kolter..

<u>Van Horn's Project Classifications</u>	<u>Kolter's Product Life Cycle Stages</u>
New Product or Project	Introduction Stage
Expansion of current project	Growth Stage
Replacement of existing equipment	Maturity Stage
-----	Decline Stage
Research and Development	-----

The description of the capital budgeting and product life cycle concepts by two noted authors, one financial and one marketing, would seem to support the idea that the two concepts are compatible.

Product Life Cycle Concepts A Useful Tool in Capital Budgeting?

In order for PLC to be useful in capital budgeting it must make the capital budgeting analysis using PLC somehow better than non-PLC analysis. This improvement in the analysis could be in several forms:

1. Improved input to capital budgeting techniques
2. Improvement of the capital budgeting techniques
3. Development of new superior capital budgeting techniques
4. Improved predictive results by the capital budgeting analysis.

A review of current literature did not produce support for items 2, 3, or 4 of the above points, but

Cornelis A deKluyver conducted a study of PLC for industrial components in the fall of 1977. His hypothesis was that the life cycle behavior is correlated with the degree of "product newness". The study quantified the PLC concept and opened the door to the study of the correlates of life cycle behavior. The results of the study are correlated with the degree of newness (innovation) these products present. The resulting hypothesis was "that the life cycle behavior is correlated with the degree of product newness"(innovation).³ Since the newness or degree of innovation of a product is a consideration in the assessment of a project's risk, and therefore part of the capital budgeting process. This refinement of the risk may improve the capital budgeting process by improving the input to capital budgeting techniques. This improvement would therefore justify the use of PLC in the capital budgeting process.

What techniques are companies currently using in capital Budgeting? If PLC is compatible and useful in capital budgeting are companies currently using this technique? A review of existing literature did not find any support that PLC was being used in capital budgeting.

J. M. Fremgen conducted a survey of current practices in capital budgeting.⁴ The survey identified "project definition and estimation of cash flows" as the most critical and difficult step. The discounted rate of return was the most common technique used. Seventy-one percent of the responding companies used this technique and 38% considered

1

his technique as the most important method. Fifty-four percent adjusted risk by requiring a higher than normal index for profitability.

Fremgen's findings were further supported in another survey done by Schall, Sudem, and Geijsbeek.⁵ Their findings are similar to Fremgen's, but with a few additional points:

1. Techniques were becoming more sophisticated.
2. Most firm's used more than one technique.
3. Forty-six percent use a weighted cost of capital.

Again product life cycle concepts were not identified as a technique being used in the capital budgeting process.

FOOTNOTES

¹James C. Van Horn, Financial Management and Policy Third Edition 1974, pp. 65-91.

²Philip Kotler, Marketing Management, Third Edition 1976, pp. 230-245.

³Cornelis A. deKluyver, "Innovation and Industrial Product " Life Cycles, California Management Review, Fall 1977.

⁴J. M. Fremgen, Capital Budgeting Practices: A Survey, Management Accounting, May 1973.

⁵Lawrence Schall, Gary Sundem, and William Geijsbeek, "Survey and Analysis of Capital Budgeting Methods", The Journal of Finance. March 1978. pp. 73-81.

CHAPTER III

PROBLEM DEFINITION

The analysis of a project is dependent upon the quality of input information used. This input information used in financial and marketing analysis, and is concerned with forecasting and analyzing project's cash flow.

Marketing research and analysis supplies such information as market share, and market acceptance. Market acceptance means the rate or amount of time it takes to obtain the expected market share. Viewed another way, market acceptance information is cash flow timing information and market share is the amount of cash flow after the initial introduction and growth periods.

Financial analysis applies financial theory of time and risk concepts to cash flow forecasts and produce expected return or current value for the project. Any improvement in the cash forecast or risk assumptions will produce corresponding improvements in the financial analysis.

Product life cycle (PLC) concepts may be used in the marketing analysis but the use of PLC in capital budgeting may depend on how the cash flow projection is

, or who makes the projection. A new product is a likely candidate for marketing research, but an expenditure on an existing plant to modernize production methods, not be subject to the same PLC concepts. The changes in cash flows, such as those experienced in introducing a new product, are reflected in the capital budgeting process. Then any uncertainty associated with the introductory stage should also be considered. The uncertainty associated with any PLC stage will be reflected in expected variations in the cash flow forecast for that PLC stage. In other words, if the risk or uncertainty of a project is different during the PLC stages the amount of expected variation in cash flow should change as a project changes PLC stages.

This resulting change in cash flow projections would be valuable in financial analysis by improving the cash flow forecast and the risk assignment to the project.

If the capital budgeting process would be improved using PLC concepts, are companies now using this technique? Do companies consider PLC concepts a useful tool, and if so how is PLC being used?

Several ways of finding out the desired information

1. Reviewing existing literature
2. Interviews with financial managers (in person or by telephone)
3. Survey companies by mail

Since the information needed is a sophisticated type of investment analysis, large companies supporting sizable financial and marketing departments, would most likely use these techniques. A survey was chosen as the best way to reach these companies because they are geographically located over the entire country and thus time and expense prohibited direct contact.

Appendix I is an example of the questionnaire used. Fortune Magazines's listings of the 500 largest companies was used in selecting the survey group. One hundred questionnaires were mailed out. Any company whose ranking was visible by five (5) was selected as part of the surveyed group.

CHAPTER IV

DATA ANALYSIS

In this chapter the returned questionnaires are analyzed to determine:

1. Are capital budgeting and product life cycle (PLC) concepts compatible?
2. Is the product life cycle a useful tool in capital budgeting?
3. What capital budgeting techniques are the surveyed companies now using?

complete statistical breakdown to each question on questionnaire is shown in Appendix B.

It is appropriate before the afore mentioned questions examined a brief look at who the responding companies . The majority of the respondents are either in the oil business and/or in the petroleum refining business. Refining is discussed here in the broad context of describing the refining of oil and gasoline as well as petro-chemical refining. See the statistical frequency for Question 1, products 1 through 11 in Appendix B for the complete listing of major products.

Capital Budgeting and Product Life Cycle Concepts Compatible

The compatibility of PLC and capital budgeting techniques

to be established or any further study and examination of this type would be questionable at best. The questionnaire results do have some evidence supporting PLC and capital budgeting compatibility. PLC is used either frequently or infrequently by 60% of the responding companies for demand forecasting of a product or service. Since the very foundation of PLC is the analysis of a particular product or service, the 60% usage suggests that PLC does have a place in the capital budgeting process.

Since the responding companies represent a group of large companies with the resources to perform any type of analysis, the use of PLC by 60% of the sample would support the conclusion that PLC is useful and does have a place in demand forecasting.

Cash flow variation is one of the most difficult items to estimate in capital budgeting techniques. The responding companies were asked to rank the causes of cash flow variation by PLC stage, as High, Medium, or Low. The rankings by PLC stage changed for the various listed reasons. The fact that the reasons for cash flow variation changed by the PLC stages indicates that PLC is compatible with capital budgeting techniques and overall process. For a complete statistical breakdown of the cash flow variation see Question 12 in Appendix B. Also, Question 12 is discussed and analyzed in further detail in the next section of this chapter.

The Product Life Cycle A Useful Tool in Capital Budgeting?

The usefulness of PLC in the capital budgeting process ; be established before it would logically become a ion part of capital budgeting. The responding companies e divided in response to the question of the use of PLC icking error in cash forecasts. Seventeen percent onded Yes, 17% responded No, and 50% did not use PLC e Question 11, Appendix B). But some contradiction may e evident here, the next question (Question 12) the res- dents answered delt with reasons for cash variation. surveyed companies were asked to rank these factors aaving a High, Medium, or Low effect in each PLC Stage. listed factors were:

Inflation

Competition

Technology Advances

Poor forecasting methods

Government Interference

Other

responses were varied depending on the factor and the Stage. For example, Inflation was ranked as a 'High' rce of cash flow variation by only 11% of the surveyed panies for Stage I of the PLC, but this figure for gh' climbed to 33% in Stage IV and for the same 2 stages 'Low' rating dropped from 33% in Stage I to 39% in ge IV. Clearly the responding companies think that the

ect of inflation on cash flows is different depending on what PLC stage the product is in.

The effect the other factors has on cash flow variation also varied by PLC stage.

Competition was a low factor in Stage I. Its' effect dually grew until Stage V, (decline stage) where it reased.

Technology advances were more of a factor in the earch and development stage than during a product's er stages of life. This would seem logical since a high k in developing a new product is a technological break- ough that would make the product obsolete before it was r introduced.

Poor forecasting methods however, was relatively constant iable over the various stages except for Stage IV, urity Stage. Perhaps the companies were finding a ure product somewhat easier to forecast than newer pro- ts or a declining product. This seems characteristic the mature product being relatively stable in its' market re.

As an influence, Government interference did not change h through the various stages of PLC.

The responding companies recognized a difference in e effect of different variables on their cash flows. Furthe e, the effects was different depending on which PLC age the product was in. This point is critical in the dlysis of PLC concepts and their usefulness in the capital

udgeting process. If PLC is useful in forecasting the cash flow effects of a particular influence such as competition or inflation, then the techniques used in capital budgeting may soon include PLC as a standard part of the process. One point that should not be overlooked is that the responding companies in this study are large and can afford the expertise needed for more complex analysis techniques.

Before the examination of the data concerning the question "Is the produce life cycle a useful tool in capital budgeting" is concluded, a brief look at one more question is appropriate. Question number 14, asked the surveyed companies how risk is incorporated into their capital budgeting system, and 94.5% of the companies used analysis technique that included the time value of money.

Although the responding companies were divided regarding the PLC reducing error in cash forecasts (Question 11), the results from Question 12 regarding the various factors influencing cash variation, indicated that the influence of different factors on cash flows changes depending on the PLC stage. Furthermore each depending on the factor, the influence may rise or decline depending on the PLC stage. This information would seem to be useful to anyone taking the time value of money in consideration during the capital budgeting process. Since 94.5% of the companies did incorporate the time value of money concept into their

capital budgeting process, one may conclude that PLC is still in the capital budgeting process even though the responding companies were split when asked this question directly.

Capital Budgeting Techniques are the Surveyed Companies Now Using?

The last area to be examined is the capital budgeting techniques now being used. Question 14 of the survey states that 94% of the surveyed companies were using some form of capital budgeting technique (s) that involve discounting the projected flow of cash. The exact breakdown of the response to Question 14 follows:

Capital Budgeting Technique	Percent Response
Payback	5.5
Discount Rate	16.6
Internal Rate of Return	5.5
Other	11.1
Payback and Discount Rate	11.1
Payback & Discount Rate & IRR	38.9
All of the above	11.1

The cash flow forecasts were exclusively the responsibility of the initiating department with 50% of the responding companies, but all of the cash flows were subject to review and adjustment by higher levels in their organizations. The companies compile and distribute a common aggregate economic outlook in 72% of the responding companies, and these economic outlooks are broken down into industry forecasts when applicable for 55% of these companies.

Specific product forecasts were next examined. The demand forecast for each product or service is a point estimate 72% of the time and a cash outflow is forecasted 66% of the time for each product. Past experience is used frequently 83.3% of the time as a technique in demand forecasting. Marketing research was used 44.4% in both the 'Used Infrequently' and 'Used Frequently' categories. The product's life cycle was used frequently only 27% of the time.

Three net cash flows are represented graphically on the questionnaire, by plotting the expected dollar amount against time (see the sample questionnaire). The first curve, A, represented an investment where the majority of the amount returned is during the early part of the investment's life. Cash flow B, is just the opposite of A. B represents a cash flow where the amount slowly grows over time until its maximum is reached then the cash flow drops quickly to almost zero. Cash flow C is bell shaped and represents an investment returning cash in an increasing manner until a maximum is reached then the cash flow declines slowly. Cash flow C's maximum is not as high as the peaks of A or B, but all three cash flows are defined as having equal net present values.

The company was asked which cash flow they would prefer. The companies were then asked what percent of their investment projects were characterized by the three cash flows. Cash flow A was preferred cash flow by 72% of the respondents. The cash flow represented by curve A represented

5% and 60% by three responding companies respectively (6.6% of total responses for each percent).

Figure 4-I is the responses of the companies of the percent of investments represented by cash flow curves B, and C.

The responses of the companies showed that given a choice, they not only were concerned with the amount of the return but also concerned with the timing of that return. This was demonstrated by the majority of the companies choosing cash flow A. Since companies are concerned with cash flow timing, PLC concepts provides another useful element in the analysis of cash flows, then the use of PLC in capital budgeting should become more commonplace among large companies.

CHAPTER V

SUMMARY

This study is a survey and examination of cash flow variation by product life cycle (PLC) and how these variations are used in capital budgeting decisions. One hundred of the Fortune five hundred companies were surveyed. The data was analyzed to determine the answers to the following questions:

1. Are capital budgeting and product life cycle (PLC) concepts compatible?
2. Is the product life cycle a useful tool in capital budgeting?
3. What capital budgeting techniques are the surveyed companies now using?

Capital budgeting and PLC concepts were found to be compatible based on the responding companies indicating that cash flow variation was different between PLC stages. Since capital budgeting forecasts are based on cash flow estimates, any improvement in the cash flow estimate should produce a corresponding improvement in capital budgeting. The compatibility of capital budgeting and PLC is further demonstrated by a 60% usage of PLC in the capital budgeting process among the responding companies.

PLC was found to be useful in the capital budgeting process even though the responding companies were split over PLC reducing error in cash forecasts. The data showed that cash flow variations did vary depending on different factors and the PLC stage. Since 94% of the responding companies used some sort of discounting of cash flows in the capital budgeting process, and if PLC is useful in determining cash flow variations, it would seem logical that PLC is a useful tool.

The large majority of the surveyed companies are using capital budgeting techniques that discount a projected cash flow. These projected cash flows are initiated in the respective product's department one half of the time, but all the cash flows were subject to a higher level review of common economic outlooks, and cash outflow forecasts were commonly used. The most prevalent demand forecasting technique was past experience. An investment that has the majority of its returns in the early stages of its life was preferred by the companies. Actual investment returns were somewhat more varied between early, normal, and late returns on investment projects.

FIGURE 4-I

of tal vestments	Curve A	Curve B	Curve C
0%	0	11%	5.5%
-19%	11%	28%	16%
-29%	16%	16%	22%
-39%	22%	22%	22%
-49%	5.5%	11%	11%
-59%	5.5%	0	22%
-69%	22%	0	0
-79%	11%	5.5%	0
-89%	0	5.5%	0
-99%	5.5%	0	0
0	0	0	0

BIBLIOGRAPHY

deKluyver, Cornelis A.; "Innovation and Industrial Product" Life Cycles, California Management Review, Fall 1977.

Fremgen, J.M.; Capital Budgeting Practices: A Survey, Management Accounting, May 1973.

Kolter, Philip; Marketing Management, Third Edition 1976, pp. 230-245.

Schall, Lawrence; Gary Sundem, and William Geijsbeek, "Survey and Analysis of Capital Budgeting Methods", The Journal of Finance, March 1978, pp. 73-81.

Van Horn, James C.; Financial Management and Policy Third Edition 1974, pp. 65-91.

APPENDIX A

EXHIBIT I

December 13, 1978

Financial Manager:

Would you please take a few minutes and complete attached questionnaire? I am a business graduate student at Oklahoma State University and the questionnaire is necessary for completion of my thesis.

The information collected in this survey can not be identified with any particular company. Because the returned questionnaires have no identity, information will be given without concern of company information being made public.

Your cooperation is appreciated.

Sincerely,



John McCormick

Return Questionnaire to:

John McCormick
D1-6 Brumley Apts.
Stillwater, OK 74074

Please list the five highest revenue producing product lines, or services of your company. 1. _____ 2. _____
 3. _____ 4. _____ 5. _____

For capital budgeting purposes are cash flow forecasts exclusively the responsibility of the initiating department?

_____ Yes _____ No

Are the cash flow forecasts subject to review and adjustment by higher levels in the organization? _____ Yes _____ No

Does your company distribute a common aggregate economic outlook to all operating divisions? _____ Yes _____ No Is it broken down into industry forecasts when applicable?

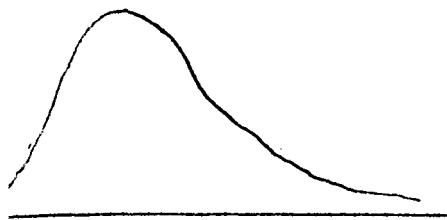
_____ Yes _____ No.

Is each element of the demand forecast (cash inflow) for each product or service shown as: a point estimate _____
 a range of values _____
 a probability distribution _____

Does a specific product or service have an expenditure (cash outflow) forecast? _____ Yes _____ No

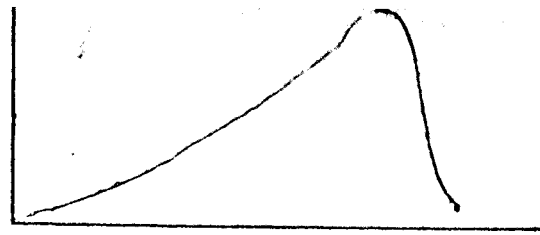
In demand (cash inflow) forecasts, how are the following procedures used?

	Not Used	Used Infrequently	Used Frequent
Market testing and sampling	_____	_____	_____
The Product Life Cycle Concept (e.g. if a product or project, is in introductory, growth, maturity or decline stage)	_____	_____	_____
Other Marketing Research Techniques	_____	_____	_____
Estimates of demand based on past experience	_____	_____	_____
Others ... Explain _____			

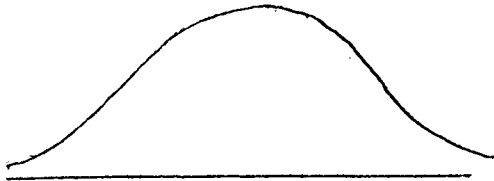


Time

B. \$



Time



Time

Assume the three above curves represent projected net cash flows for a project and also assume the net present value for above cash flows are equal.

Which cash flow would your firm usually prefer?

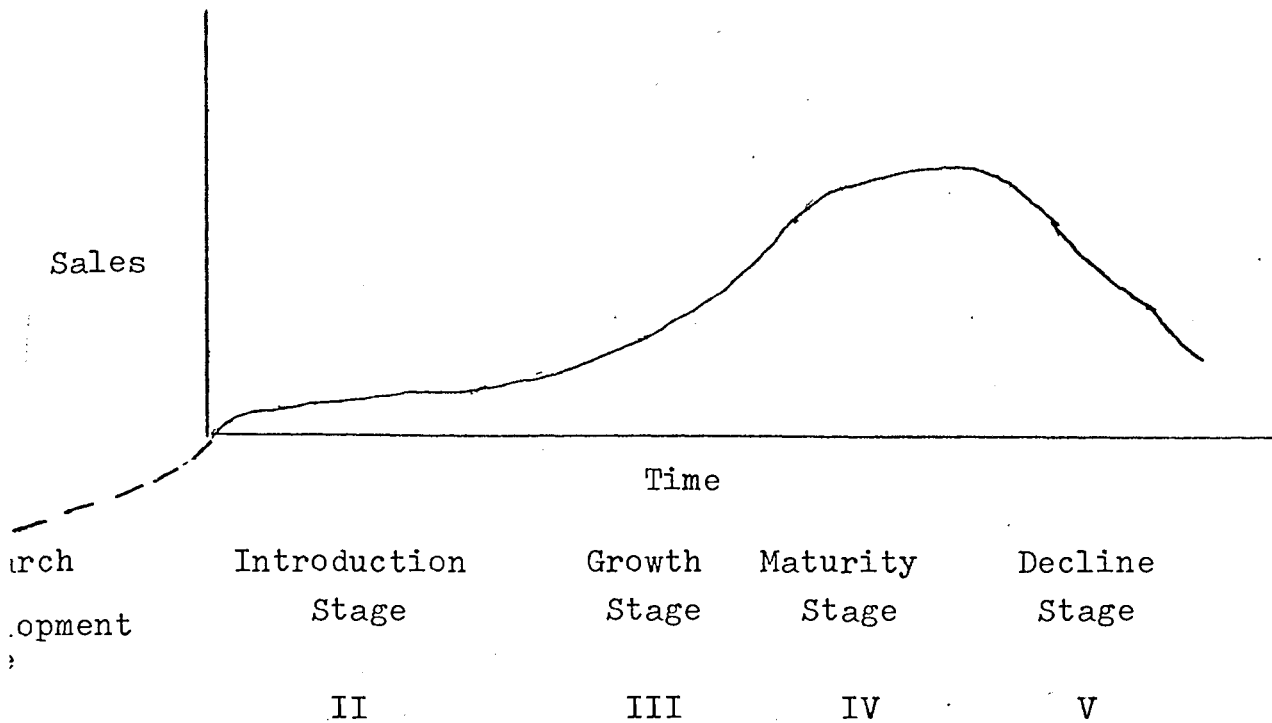
___ A.

___ B.

___ C.

Considering all investment projects your firm analyzes, what percentage of the total is characterized by

• _____ + B. _____ + C. _____ = 100%



The above figure represents the product life cycle curve with the various stages numbered.

During the last 5 years in forecasting the typical project's cash flow for the different stages, how much variation between forecasted and actual cash flows have you experienced in the stages shown here. (Estimated deviation from expected cash flow).

	Percent Deviation
Research + Development Stage	_____ %
Introduction Stage	_____ %
Growth Stage	_____ %
Maturity Stage	_____ %
Decline Stage	_____ %

Does the use of the product life cycle curve and the various stages it represents, reduce the error in your cash forecasts?

Yes No
 Do not use

Some of the possible reasons for variation in cash flow are listed below under columns of the stages of the product life cycle. Under each column rank the causes for cash variation for products in that stage. Use High, Medium, Low to show the level of difficulty experienced.

Stages in Product Life Cycle

	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>V</u>
Inflation	_____	_____	_____	_____	_____
Competition	_____	_____	_____	_____	_____
Technology Advances	_____	_____	_____	_____	_____
Poor Forecasting Methods	_____	_____	_____	_____	_____
Government Interference	_____	_____	_____	_____	_____
Others _____	_____	_____	_____	_____	_____
Others _____	_____	_____	_____	_____	_____

At what risk first taken into account at the point where the original project was initiated?

_____ Yes

_____ No

Which of the following techniques of risk analysis is used to incorporate risk into your capital budgeting system?

_____ Payback

_____ Discount rate of cash flow (risk adjusted Rate)

_____ Internal rate of return (Use risk adjusted cutoff criterion)

_____ Other

APPENDIX B

APPENDIX B

Please list the five highest revenue producing product lines, or services of your company.

Product 1	Frequency	Percent
No answer	4	22.222%
Gasoline	1	5.556
Crude Oil	2	11.111
Chemicals	4	22.222
Refining & Petro Products	1	5.556
Consumer Products	1	5.556
Air Conditioning	1	5.556
Lawn & Garden	1	5.556
Fasteners	1	5.556
Advertising	1	5.556
Textiles	1	5.556
Product 2		
No Answer	6	33.333
Crude Oil	2	11.111
Chemicals	2	11.111
Plastics	1	5.556
Consumer Products	1	5.556
Nat. Gas Pipeline & Trans.	1	5.556

Product 2 cont.	Frequency	Percent
Glass Manif	1	5.556
Appliances	1	5.556
Engineered Components	1	5.556
Circulation	1	5.556
Wallpaper & Home Furnishings	1	5.556
Product 3		
No Answer	9	50.000
Natural Gas Liquids	1	5.556
Chemicals	1	5.556
Refining & Petro Products	1	5.556
Consumer Products	2	11.111
Construction & Farm Equipment	1	5.556
Coated Metal	1	5.556
Environmental Control Equipment	1	5.556
Industrial Gases	1	5.556
Product 4		
No Answer	12	66.667
Natural Gas	2	11.111
Consumer Products	1	5.556
Auto Parts	1	5.556
Machinery (Process)	1	5.556
Natural Resources, Mining	1	5.556
Product 5		
No Answer	12	66.667
Natural Gas Liquids	1	5.556

Product 5 cont.	Frequency	Percent
Copper	1	5.556
Chemicals	1	5.556
Consumer Products	1	5.556
Machinery	1	5.556
Retail	1	5.556

- For capital budgeting purposes are cash flow forecasts exclusively the responsibility of the initiating department?

	Frequency	Percent
Yes	9	50.000
No	9	50.000

- Are the cash flow forecasts subject to review and adjustment by higher levels in the organization?

	Frequency	Percent
Yes	18	100.00

- Does your company distribute a common aggregate economic outlook to all operating divisions?

Part 1	Frequency	Percent
Yes	13	72.222
No	5	27.778

Is it broken down into industry forecasts when applicabl

Part 2		
Yes	10	55.556
No	5	27.778
No Answer	3	16.667

- i. Is each element of the demand forecast (cash inflow) for each product or service shown as:

	Frequency	Percent
Point Estimate	13	72.222
Range of Values	1	5.556
Probability Distribution	2	11.111
Point Estimate & Range of Values	1	5.556
Point Estimate & Probability Distribution	1	5.556

- ii. Does a specific product or service have an expenditure (cash outflow) forecast?

	Frequency	Percent
Yes	14	77.778
No	4	22.222

- iii. In demand (cash inflow) forecasts, how are the following procedures used?

Marketing Test	Frequency	Percent
Not Used	7	38.889
Used Infrequently	6	33.333
Used Frequently	4	22.222
No Answer	1	5.556
Product Life Cycle		
Not Used	6	33.333
Used Infrequently	6	33.333
Used Frequently	5	27.778
No answer	1	5.556

continued.	Frequency	Percent
Marketing Research		
Not Used	1	5.556
Used Infrequently	8	44.444
Used Frequently	8	44.444
No Answer	1	5.556

Past Experience

Not Used	1	5.556
Used Infrequently	2	11.111
Used Frequently	15	83.333

- Which cash flow would your firm usually prefer?

Cash Flow Patterns	Frequency	Percent
Curve A	13	72.222
Curve C	5	27.778

- Considering all investment projects your firm analyzes, what percentage of the total is characterized by:

	Answer	Frequency	Percent
Curve A	10	2	11.111
	20	2	11.111
	25	1	5.556
	30	1	5.556
	33	3	16.667
	40	1	5.556
	50	1	5.556
	60	3	16.667
	65	1	5.556
	75	2	11.111
	90	1	5.556

continued	Answer	Frequency	Percent
Curve B	0	1	5.556
	5	1	5.556
	10	4	22.222
	15	1	5.556
	20	2	11.111
	25	1	5.556
	30	1	5.556
	33	3	16.667
	40	2	11.111
	70	1	5.556
	80	1	5.556

Curve C

0	1	5.556
10	2	11.111
15	1	5.556
20	4	22.222
30	1	5.556
33	3	16.667
40	2	11.111
50	4	22.222

9. During the last 5 years in forecasting the typical project's cash flow for the different stages, how much variation between forecasted and actual cash flows have you experienced in the stages shown here?

Research & Development
Stage 1

0	1	5.556
10	2	11.111

10. continued	Answer	Frequency	Percent
Research & Development			
Stage 1 cont.	33	13	72.222
	50	1	5.556
	100	1	5.556
Introduction			
Stage 2			
	10	1	5.556
	20	1	5.556
	25	1	5.556
	30	1	5.556
	33	13	72.222
	100	1	5.556
Growth			
Stage 3			
	15	1	5.556
	20	1	5.556
	25	1	5.556
	30	1	5.556
	33	13	72.222
	50	1	5.556
Maturity			
Stage 4			
	10	3	16.667
	20	1	5.556
	25	1	5.556
	33	13	72.222

	Answer	Frequency	Percent
ecline Stage 5	10	1	5.556
	25	1	5.556
	30	2	11.111
	33	13	72.222
	75	1	5.556

1. Does the use of the product life cycle curve and the various stages it represents, reduce the error in your cash forecasts?

	Frequency	Percent
Yes	3	16.667
No	3	16.667
Do Not Use	9	50.000
No Answer	3	16.667

12. Some of the possible reasons for variation in cash flow are listed below under columns of the stages of the product life cycle. Under each column rank the causes for cash variation for products in that stage. Use High, Medium, Low, to show the level of difficulty experienced.

Inflation Stage I	Frequency	Percent
High	2	11.111
Medium	1	5.556
Low	6	33.333
No Answer	9	50.000

Inflation Stage II	Frequency	Percent
High	2	11.111
Medium	4	22.222
Low	3	16.667
No Answer	9	50.000
Inflation Stage III		
High	4	22.222
Medium	4	22.222
Low	1	5.556
No Answer	9	50.000
Inflation Stage IV		
High	6	33.333
Medium	4	22.222
Low	1	5.556
No Answer	7	38.889
Inflation Stage V		
High	5	27.778
Medium	4	22.222
Low	1	5.556
No Answer	8	44.444
Competition Stage I		
High	2	11.111
Low	7	38.889
No Answer	9	50.000
Competition Stage II		
High	3	16.667
Medium	4	22.222

	Frequency	Percent
Competition Stage II cont.		
Low	4	22.222
No Answer	7	38.889
Competition Stage III		
High	4	22.222
Medium	6	33.333
No Answer	8	44.444
Competition Stage IV		
High	5	27.778
Medium	5	27.778
No Answer	8	44.444
Competition Stage V		
High	4	22.222
Medium	4	22.222
Low	2	11.111
No Answer	8	44.444
Technology Advance Stage I		
High	3	16.667
Medium	4	22.222
Low	4	22.222
No Answer	8	38.889
Technology Advance Stage II		
High	1	5.556
Medium	4	22.222
Low	4	22.222
No Answer	9	50.000

	Frequency	Percent
Technology Advance Stage III		
High	0	0.000
Medium	7	38.889
Low	2	11.111
No Answer	9	50.000
Technology Advance Stage IV		
High	2	11.111
Medium	7	38.889
Low	1	5.556
No Answer	8	44.444
Technology Advance Stage V		
High	3	16.667
Medium	5	27.778
Low	2	11.111
No Answer	8	44.444
Poor Forecasting Methods Stage I		
High	3	16.667
Medium	3	16.667
Low	4	22.222
No Answer	8	44.444
Poor Forecasting Methods Stage II		
High	3	16.667
Medium	6	33.333
Low	1	5.556
No Answer	8	44.444
Poor Forecasting Methods Stage III		
High	4	22.222

	Frequency	Percent
Poor Forecasting Methods Stage III cont.		
Medium	5	27.778
Low	2	11.111
No Answer	7	38.889
Poor Forecasting Methods Stage IV		
High	2	11.111
Medium	5	27.778
Low	3	16.667
No Answer	8	44.444
Poor Forecasting Methods Stage V		
High	4	22.222
Medium	4	22.222
Low	2	11.111
No Answer	8	44.444
Government Interference Stage I		
High	2	11.111
Medium	4	22.222
Low	4	22.222
No Answer	8	44.444
Government Interference Stage II		
High	3	16.667
Medium	3	16.667
Low	3	16.667
No Answer	9	50.000

	Frequency	Percent
Government Interference Stage III		
High	1	5.556
Medium	6	33.333
Low	3	16.667
No Answer	8	44.444
Government Interference Stage IV		
High	2	11.111
Medium	5	27.778
Low	3	16.667
No Answer	8	44.444
Government Interference Stage V		
High	2	11.111
Medium	5	27.778
Low	4	22.222
No Answer	7	38.889
Other Stage I		
Medium	1	5.556
Low	1	5.556
No Answer	16	88.889
Other Stage II		
Medium	1	5.556
No Answer	17	94.444
Other Stage III		
High	1	5.556
No Answer	17	94.444

	Frequency	Percent
Other Stage IV		
Low	1	5.556
No Answer	17	94.444
Other Stage V		
Low	1	5.556
No Answer	17	94.444

13. Is risk first taken into account at the point where the original project was initiated?

	Frequency	Percent
Yes	14	77.778
No	1	5.556
No Answer	3	16.667

14. Which of the following techniques of risk analysis is used to incorporate risk into your capital budgeting system?

Payback	1	5.556
Discount Rate	3	16.667
Internal Rate of Return	1	5.556
Other	2	11.111
Payback & Discount Rate	2	11.111
Payback & Discount Rate & Internal Rate of Return	7	38.889
All	2	11.111

VITA

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