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AN INVESTIGATION OF CAPITAL BUDGETING TECHNIQUES

A Thesis

Presented to

the School of Business

Quinnipiac College

In Partial Fulfillment

of the Requirements for the Degree

Master in Business Administration

by

Cassandra Grisby

August 1994

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Approval Page

This thesis is approved as an independent investigation by a candidate for the degree of Master of Business Administration and is acceptable as meeting the thesis requirements for this degree, but without implying the conclusion(s) reached by the candidate are necessarily the conclusions of the school.

Thesis Advisor *W. C. Clyde*

**William Clyde, Ph.D.
Professor of Finance
Quinnipiac College**

Reader *Anne Rich*

**Anne Rich, Ph.D., CPA, CMA
Chair of Accounting Department
Quinnipiac College**

Director, MBA Program *Phillip Frese*

**Phillip Frese, Ph.D.
Quinnipiac College**

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Abstract

Investigation of Capital Budgeting Theories and Practices

Cassandra Grisby

Quinnipiac College 1994

The highly competitive markets and economically challenging environments that many corporations of the 90's face, have caused the capital budgeting process to be scrutinized. This document questions the ability of the traditional capital budgeting theories and practices to meet the current needs.

Throughout the world, financial analysts agonize over the optimal capital budgeting technique to justify investments and acquisitions. This document explores the foundation for capital budgeting techniques that date back to principles as early as after World War II. Surprisingly, even with the tremendous amount of experience, research, and knowledge that surround the process, it still remains difficult. Exploring the background of the various techniques one uncovers the countless assumptions that must be made to justify desired investment outcomes. Many of these assumptions are feeble and associated with low levels of confidence. For example many techniques place great emphasis on cash flow and cost of capital estimates which can be quite risky.

The many assumptions clearly warrant an investigation of capital budgeting techniques. More importantly however, is the realization that many financial analysts remain unable to link investment decisions with corporate goals and strategies. Without the link to corporate goals, managers are less likely to

select investments that comply with the strategic direction of the company. The outdated assumptions have clearly established a need for an innovative approach for handling the changing investment needs of corporations.

The remainder of this document outlines: an introduction to capital budgeting; traditional capital budgeting techniques; non-traditional techniques; as well as a case study.

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CHAPTER 1:

CAPITAL BUDGETING CHALLENGES

THE OVERALL CHALLENGE

As the decision to invest in the future becomes a requirement rather than an option many organizations are faced with challenges within the decision making process. One key challenge for selecting capital investments is the ability to align investments with corporate goals and strategies. By connecting investments to corporate goals there is an opportunity to minimize the risk associated with the investments while attaining a greater impact. To illustrate the importance of aligning investments with goals and strategies this chapter will discuss (2) investment opportunities for James River Corporation, a fortune 500 firm which manufactures a variety of paper products.

THE JAMES RIVER CHALLENGE

James River, like many large firms relies heavily on its guiding principles communicated by the CEO in all decision making. As explained by Mr. Cutchins, Senior Vice President, General Counsel, Corporate Secretary "We at James River strive to be a Total Quality Organization in all of our endeavors". Guiding principles serve as an opportunity to reinforce the organization's overall objectives. For example one key element in the corporate strategy, which is critical when examining capital investments is the view on the use of company funds. This principle states:

Each employee is personally accountable for James River funds over which he or she has control. Anyone spending company money should always assure that James River receives

good value in return. ¹

Additionally, other guiding principles speak to safety, which is also critical when considering equipment acquisitions for manufacturing organizations like James River. As outlined in the James River Company Policy:

Work place safety and health is a paramount concern and is a condition of employment. Employees are expected to adhere to laws and regulations designed to ensure safe working conditions. Employees are responsible for working and identifying and alerting management to potential hazards and unsafe practices.²

In addition James River also outlines policies regarding compliance with external laws, conflicts of interest, outside employment, handling company records, employee equality, adherence to environmental regulations, competition, as well as and disclosure of confidential information. As a result the investment opportunities that we will discuss in this chapter illustrate the importance of goal congruence in the decision process.

JAMES RIVER CAPITAL BUDGETING OPPORTUNITIES

The following are two investment opportunities for James River Corporation. These opportunities depict the growing challenges involved in the capital budgeting decision making process.

In June of 1993, the Vice President of Finance at James River Corporation submitted an Information Resource Appropriation Request (IRAR) for personal computer upgrades for the entire Finance Department.

¹ Williams, Robert, C., "Standards of Business Conduct Policy", James River Corporation, p.5.

² Ibid.

The (IRAR) detailed the need for a \$429,655 investment to cover: software expenses, \$44,679; hardware expenses, \$300,730; start-up costs (including networking costs), \$84,246 for 90 new personal computers. ³

The need for the PC upgrade was sparked by the finance department's inability for users to share stored data, speed limitations, as well as a lack of consistency in software throughout the department. Ultimately these shortfalls foster poor information management.

However, with the approval for the state of the art personal computers the finance department expects to reap the following benefits:

- * Access to a Local Area Network (LAN) ultimately eliminating the need for hard copies
- * Access to the latest spreadsheet applications through MS Excel
- * Access to the latest word processing features through MS Word
- * Access to the most unprecedented graphics features available in Power Point
- * Improved communication through shared software
- * Capability to perform more complex analysis

Although the benefits derived from advanced computer systems seem valuable, the proposal was still subject to great scrutiny. Financial officers with authority to approve or deny such requests find themselves playing the never ending game of capital budgeting. Although many projects possess the qualities needed to add value to the respective departments, financial constraints make it impossible for every request to be approved.

On a much larger scale, the Naheola Mill Vice President, Bill Sterritt, celebrates the success of the largest capital project in James River history. The \$300 million investment has become a vital part of the integrated pulp and paper

³ Mc Garr, J. W. Personal Computer Upgrade, June, 1993, p.1(Internal James River Document).

mill's success. ⁴ The mill was producing more than 1,250 tons per day of bleached kraft pulp, which was later used to manufacture towel and tissue products and paperboard. ⁵ However, with the new chemical recovery and cogeneration facility replacing three obsolete recovery furnaces, the mill has produced an average of 1,700 tons of pulp per day. ⁶ The 5,300 ton 220 foot high unit is recognized as being the second largest unit of its type in the world. ⁷

As a result of the sizable investment, the Naheola Mill has recognized the following benefits:

- * Increased safety
- * Increased productivity
- * Improved quality
- * Reduced energy and chemical costs
- * Increased production capabilities
- * Enhanced economic viability for the mill
- * Conservation of wood resources
- * Improved environmental conditions

In looking at the two very different types of capital investments that exist within one corporation, the wide spectrum of capital budgeting challenges quickly become conceivable. Most noticeably between the two projects is probably the difference in the strategic impact on the organization. In the first project, for computer upgrades the benefits were clearly less tangible than those outlined in the mill project. It would be quite difficult to quantify how much time and paper would be saved due to the use of a LAN system; how much more efficiently tasks

⁴ "Naheola Mill Celebrates Success of Largest Capital Project in James River History", Onstream, Volume 12, Number 6, Aug./Sept. 1993, p.1.

⁵ Ibid.

⁶ Ibid.

⁷ Ibid.

were performed as a result of the Excel or Word software packages; how much communication was improved; or how much more complex the analysis was as a result of the computer upgrade. More specifically, the benefits derived from the finance department project are far more difficult to link to a particular product line, profit center, or bottom line result. However, the intangible benefits of such an investment to the finance organization would add value to almost every division, product line and profit center within James River.

On the contrary, benefits from the Naheola Mill Project are easily traceable to the Naheola Mill overall profitability and efficiency. Additionally, advanced inventory management systems available through various bar coding devices, allow for tracking of any product transfers produced in Naheola to be tracked there. As a result, the Naheola Project can quickly and accurately quantify the benefits to James River. Even more impressive is the fact that the Naheola project can accurately pinpoint which product line has been enhanced with quality development; as well as how much materials and labor have been saved as a result of the project.

In considering both projects with respect to the contributions to the corporation it becomes clear how difficult the capital budgeting process is. With limited resources much of the decision is determined based on the relevance of the project to specific goals and objectives of the corporation. Without the link to corporate goals and objectives the budgeting process is subject to differences due to individual priorities. For example, someone with a strong technical background and an appreciation for information sharing, the computer enhancement project would appear to be an easily approved and funded project. On the other hand, to someone with a strong manufacturing background, new plant equipment would be an easily approved and funded project. From the standpoint of the Director of Capital budgeting, who has the ultimate responsibility of satisfying the needs of

project managers as well as senior management, no project is easily approved or funded. Consequently, great emphasis is placed on which investments will have the greatest impact on strategic plans. Additionally, what are the risks associated with each investment? Although clearly linked to corporate goals, can the organization withstand the risks inherent in the investment?

RISK IMPLICATIONS

As a result, management seeks to find a reasonable link between capital decisions and guiding principles with respect to acceptable levels of risk. Consequently goal congruence is of growing importance to the corporation as, the decision making process intensifies. Once the link to corporate goals is made the budgeting process begins to focus on the realization of exposure to risk which adds an additional challenge to the process. By definition investment risk is: the chance or probability that the expected cash flows or return on investment is not realized or that the actual results will vary from the projected performance.⁸ However, the definition of risk takes on special meaning in respect to capital budgeting. Risk is not just the probability that certain events will occur, but also considers the magnitude of rewards and benefits as a result of the events.⁹ More specifically risk can translate into: not reaching established specifications; higher costs than anticipated; extended project life spans. Additionally, with each translation of risk come uncertainties such as: the impact of failure - Will the organization suffer a tremendous financial loss? Will they have sacrificed market share? Will they be eliminated altogether by competition?

⁸ Morrow, Vincent; Handbook of Financial Analysis for Corporate Managers, 1991, p.150.

⁹ Brigham, Eugene; Gapenski, Louis; Financial Management Theory and Practices, 6th Edition, p.43.

As the element of risk has many dimensions it also comes in several key forms which can impact an organization. The first form of risk that many analysts and senior management consider is the *financial risk* which considers the monetary cash outlays. More specifically, what is the immediate investment requirement? How much will the project or investment cost? As a result the size of the investment quite often translates into *corporate risk* exposure which is any risk that a corporation exposes itself to due to a specific project or investment. Additionally, there is *industrial risk*, which are the risks that all firms within a given industry are exposed to. For example the paper manufacturing industry has come to recognize the risks associated with increasing pulp prices. Needless to say every organization in the paper industry rests at the mercy of pulp prices in efforts to reduce costs. Beyond industrial risk is overall *environmental risk* which relates specifically to the economic conditions firms compete in. Based on varying supplier / vendor relationships economic conditions may have increasing implications. More encompassing is *project risk*, which recognizes all risks such as environmental, industrial, and corporate risks that result from a particular project or venture. As the various facets of risk become more pronounced it becomes evident that they may result in *competitive risks* in the long run. By competitive risk we refer to the implications of not taking risks as well as the counter moves of competition. The overall impact revolves around what the long run result will be in the market place. Will a particular firm gain market share? Will a particular product gain dominance in the market place? Will a competitor be forced out of the market all together? Consequently, firms begin to look at risk from a strategic standpoint. This many translate into the question of whether firms should invest during economic downturns or should they work to maintain cash flows. In doing so what are the long run implication?

Beyond the risks already mentioned is the risk of lost opportunity. By definition opportunities are situations that present themselves in times of disequilibrium. More specifically, these situations are a direct result of firms making efforts to gain a competitive advantage through investments. Lost opportunities quickly translate into opportunity costs as the benefits of investing are recognized by competition. An example of lost opportunity would be the case where several paper manufactures passed up the opportunity to invest in a device that would perforate paper towels in a way that consumers could select the towel size they needed. Several months later a major competitor purchased the device and recognized a great increase in market share as a direct result of that particular product. In the long run the firm not willing to invest is forced to acknowledge the following opportunity costs: cost of lost sales, as well cost of late starter entry in production. Consequently, organizations today are forced to find the balance between financial risks associated with investments and competitive risks of not investing in order to meet corporate goals.

With the understanding of the importance of selecting the best technique to evaluate project performance. Respectively, chapters 2 and 3 will explore traditional as well as non-traditional techniques for evaluating project performance. In an effort to make the various techniques comparable to one another we will evaluate (11) techniques according to the five attributes in exhibit I., which many organizations deem important.

TECHNIQUE COMPARISON CHART

CAPITAL BUDGETING TECHNIQUE	CAPITAL BUDGETING PROJECT COMPARISON			
	TREATMENT OF THE TIME VALUE OF MONEY	REQUIRES USE OF DISCOUNT RATES	ABILITY TO COMPENSATE FOR PROJECT DIFFERENCES (SIZE, LIFE SPAN)	TREATMENT OF DIFFERENT RISK LEVELS
PAYBACK PERIOD METHOD				
DISCOUNTED PAYBACK PERIOD				
NET PRESENT VALUE METHOD				
PROFITABILITY INDEX METHOD				
INTERNAL RATE OF RETURN				
RETURN ON ASSETS				
STRATEGIC BUNDLE MONITORING				
MADM				
HURWICZ PRINCIPLE				
CIA				
SIA				
EVA				

CHAPTER 2:

TRADITIONAL CAPITAL BUDGETING APPROACHES

II. INTRODUCTION TO TRADITIONAL CAPITAL BUDGETING TECHNIQUES

As we realize the strategic importance of goal congruence and the implications of risk in the capital budgeting process we realize the importance of selecting the proper analytical tools to measure project performance. In the following chapter we will discuss six traditional capital budgeting approaches. To illustrate the uniqueness of each technique we will use hypothetical examples for Company X. For the purpose of the discussion Company X is a manufacturer of health and beauty aids, and is located in Boston, MA. In concluding our analysis of each approach we will then be able to discuss the advantages and disadvantages of each approach while tracking their performance on the attribute appraisal matrix outlined in chapter 1.

COMPANY X

Company X, is a consumer products company located in Boston, MA. Their product line consists of a variety of health and beauty aid products such as cosmetics, fragrances, and hair care products. In 1993 the company earned a net income of \$167 million and assets of \$100 billion. The company is presently contemplating moving toward more advanced manufacturing technologies that will expedite the manufacturing process and ultimately reduce turn around time for customer orders. To accomplish these goals the company is considering purchasing a new piece of manufacturing equipment that will result in cash

outflows of \$100,000 over a four year period. The company expects to realize cash inflows of \$25,000, \$60,000, 70,000, and 80,000 respectively over the four years. In doing so various capital budgeting project will be considered to move toward their goal. For the sake of illustration assume the cost of capital for every project will be 10%. The investment for Company X will be considered under each of the following approaches:

- Payback Method
- Discounted Payback Method
- Net Present Value (NPV)
- Profitability Index (PI)
- Internal Rate of Return (IRR)
- Return on Assets (ROA)

A1. PAYBACK METHOD THEORY

The first technique we will consider is the Payback Period Method. The payback period is defined as the length of time that elapses before total cumulative after-tax inflows from the project equal the initial cash outlays for the project.¹⁰ Consequently, the project that proves to have the shortest time frame to earn back the initial investment would be the optimal choice. To illustrate the importance of the Payback Period we will use a variety of cash flows based on Company X.

¹⁰ Brigham, Gapenski, p.327.

A2. PAYBACK METHOD ILLUSTRATION
PAYBACK METHOD FOR COMPANY X

PROJECT NAME	HYPOTHETICAL CASH FLOWS AT THE END OF YEAR					
	0	1	2	3	4	TOTAL
A1	\$(100,000)	\$25,000	\$60,000	\$70,000	\$80,000	\$ 135,000
A2	\$(100,000)	\$60,000	\$25,000	\$80,000	\$70,000	\$135,000

A3. PAYBACK METHOD ADVANTAGES

In reviewing the example of the Payback Method the key advantage is that the approach focuses on the timing of cash flows. In the above example of Company X, the flows for both perspectives result in a total of \$135,000, however in scenario A2 the payback occurs at a much faster pace than in scenario A1. This technique points out the importance of knowing the liquidity of investments. This rationale can prove most helpful when using internal funding as opposed to seeking financing through other means. On the other hand, in looking to an outside financier, funding may still be denied due to the limited opportunity to earn interest on a short term investment as opposed to a long term investment.

A4. PAYBACK METHOD DISADVANTAGES

Although beneficial when analyzing financing options, the Payback Method does have its disadvantages. A major disadvantage is the failure to acknowledge the time value of money as a result of a failure to estimate the cost of capital. By ignoring the time value of money organizations risk passing up other investments by not using resources to their best advantage. Additionally, by not acknowledging the cash flows subsequent the payback period there is significant risk of not fully understanding the value of an investment and learning from that

for future investments. In considering a project that returns the initial investment in three years as opposed to a project that returns the investment in five years, the analyst is in favor of payback period of three years. However, if the timing of the five year project is when there are no current alternatives it may be a good alternative. To the contrary the three year project may present itself at a time when there are two other promising alternatives, it may not be the ideal option. Furthermore, the payback period approach makes no effort to account for any cash flows subsequent the payback of the initial investment. Suppose for example project (A) in the prior example, reaps an additional \$50,000 per year after the initial investment was returned. Whereas project (C) realizes no additional inflows, project (C) may not be the optimal alternatives. Did this method fairly assess the benefits of each project? In summary, the liquidity of an investment is always essential in financial management, however, it is not always the most important element.

A5. PAYBACK PERIOD KEY ATTRIBUTES

In summary, the Payback method falls short on most of the key attributes. First, this technique fails to consider the time value of money by neglecting to discount cash flows to present value. As a result there is a misunderstanding of project costs (in terms of the cost of capital) that can sku the analysis of an investment. In doing so projects being evaluated on the Payback Method enter into investment without a complete understanding of the risks ahead of them such as: the present value of cash flows, the potential for price increases which impact project costs, as well as the likelihood of not meeting projected cash flows. However, the technique does allow investments of different sizes to be compared. By doing so an analysts can determine the liquidity of investment opportunities whether they are small or large. What may be realized is that a larger investment

may have a quicker payback period than a smaller investment hence making it a better alternative based on liquidity.

B1. DISCOUNTED PAYBACK PERIOD METHOD THEORY

The discounted payback method, very similar to the payback method bases its analysis on the timelines of the repayment of the initial investment. The major difference between the two techniques is that the discounted payback period looks at the length of time that elapses before the present value of the cumulative cash flows just exceeds the initial cash outlay. To illustrate the difference between the two techniques we will use the example of Company X.

B2. DISCOUNTED PAYBACK PERIOD ILLUSTRATION

<u>PERIOD</u>	<u>CASH FLOWS</u>	<u>PV @</u> <u>5%</u>	<u>PV</u>
0	(\$100,000)	1	(\$100,000)
1	\$25,000	.95238	\$23,806
2	\$60,000	.90703	\$54,422
<u>3</u>	<u>\$25,204 *</u>	<u>.86384</u>	<u>\$21,772</u>
TOTALS	\$10,204	————	\$ 0

A cash flow of \$25,204 was needed to allow the investment to just meet the investment cost at the present value. In using the discounted payback period method also note that the payback time of the investment is three periods instead of four.

B3. ADVANTAGES OF THE DISCOUNTED PAYBACK PERIOD

The key advantage of using the discounted payback method instead of the payback method is that it can conceivably shorten the payback period of the

investment by creating an understanding of present value flows. Additionally, it allows for analysis of early pay-offs for investments. More specifically, firms can determine the cost of capital needed to pay an investment off early and increase the companies liquidity.

B4. DISADVANTAGES OF THE DISCOUNTED PAYBACK METHOD

The most significant disadvantage of using the discounted payback period is that, like the payback period method, does not consider the cash flows beyond the repayment of the investment. In the long run this does not allow an organization to fully understand the contribution of a particular investment.

B5. DISCOUNTED PAYBACK METHOD KEY ATTRIBUTES

Unlike the payback method, the discounted payback method ranks rather high in comparison to the key attribute elements. The discounted payback method is credited with considering the time value of money based on its effort to discount flows back to the investment is paid off. Secondly, cost of capital estimates are considered which create an understanding of project risk. Finally, like the payback method, the discounted payback method has the ability to compare projects of different sizes.

C1. NET PRESENT VALUE THEORY

The third technique we will evaluate is the Net Present Value Method (NPV). This method attempts to evaluate capital investment proposals by calculating the present value of future net cash flows discounted at the firm's cost of capital. The logic supporting the approach suggests that a NPV of zero is just adequate to repay the initial investment as well as meet the corporate return expectations. More specifically, the corporation has not recognized a financial benefit or loss as a direct result of the investment. On the other hand a positive

NPV generates more revenue than needed to cover the debt hence placing the shareholders in a profitable position. While a negative NPV, falls short of generating sufficient revenues to cover the initial investment. In falling short of the investment costs corporation and shareholders loss money on the investment.

In using the NPV method of analyzing a project or investment the project manager must realize that the approach assumes the following:

- * Capital can be borrowed or lent at the same interest rate.
- * All cash flows are recognized at a set point in time (annually, semi-annually, or quarterly).
- * The primary objective of the project manager is to maximize the wealth of the shareholders. ¹¹

C2. NET PRESENT VALUE ILLUSTRATION

To better illustrate how the (NPV) technique evaluates projects, the following example will calculate the flows described in the example of Company X.

NET PRESENT VALUE FOR COMPANY X

<u>PERIOD</u>	<u>CASH OUTFLOWS</u>	<u>CASH INFLOWS</u>	<u>PV FACTOR</u> <u>@ 10%</u>	<u>PV</u>
0	-\$100,000	0	1	-\$100,000
1	0	\$25,000	.9091	\$22,728
2	0	\$60,000	.8264	\$49,584
3	0	\$70,000	.7513	\$52,591
4	<u>0</u>	<u>\$80,000</u>	<u>.6830</u>	<u>\$54,640</u>
TOTALS	-\$100,000	\$235,000	-----	\$79,543

¹¹ Ibid.

C3. NET PRESENT VALUE ADVANTAGES

In reviewing the example, some of the advantages of using the NPV approach in capital budgeting decisions can be easily recognized. First, unlike some approaches the time value of money is taken into consideration with the use of discount rates. In other words, as the anticipated cash flows are discount at their present value analysts establish a truer understanding of whether an investment is of value or not. Another advantage is that the NPV method includes a more rigorous analysis of cash flows due to the fact that it looks at inflows beyond the payback of investment. This is especially beneficial when comparing investments that have similar or identical cash flows up to the point of repaying the initial investment. NPV unlike the Payback Method has the ability to consider all flows associated with the investment, not just until the investment is repaid. Last but not least, the NPV looks at flows in a timely fashion instead of on a per investment basis. In doing so cash flows are tracked based on predetermined time frames, and not as a lump sum investment. The end result is a better understanding of working capital and funds available for other investments. This may also be of special relevance to an organization that is strictly maintaining liquidity standards.

C4. NET PRESENT VALUE DISADVANTAGES

As with most capital budgeting techniques the NPV approach has certain disadvantages. The first disadvantage of NPV as with many other techniques is that the NPV calculation depends on a relatively accurate estimate of the cost of capital. Consequently, the process of estimating the cost of capital creates the risk of misunderstanding cash flows due to the difference between the real cost of capital and the estimated cost of capital. Consequently, an inaccurate cost of capital calculation can result in an inaccurate (NPV) for the proposed project.

Considering the (NPV) for the same machinery for Company X at a 15% cost of capital instead of a 10% cost of capital would be as follows:

NPV FOR COMPANY X (AT 15% COST OF CAPITAL)

<u>PERIOD</u>	<u>CASH OUTFLOWS</u>	<u>CASH INFLOWS</u>	<u>PV FACTOR</u>	<u>PV @ 15%</u>
0	-\$100,000	0	1	-\$100,000
1	0	\$25,000	.8696	\$ 21,740
2	0	\$60,000	.7561	\$45,366
3	0	\$70,000	.6575	\$46,025
4	<u>0</u>	<u>\$80,000</u>	<u>.5718</u>	<u>\$45,744</u>
TOTALS	-\$100,00	\$235,000	————	\$58,875

Consequently in comparison to the calculations at the 10% rate of capital there is a sizable variation in the (PV) cash flows which could drastically sway the analyst's decision. As a result, the variances in cash flows associated with different costs of capital can have a significant impact on the way the investment is viewed. Another disadvantage is that the (NPV) approach does not take into consideration the rate of return of alternative investments. As a result analysts do not know how well there next best alternative might have performed. Additionally, the (NPV) approach does not specify the probability of receiving the cash flows. Ultimately, inaccuracy of cash flows can adversely impact the final outcome of the project as well as the liquidity of the organization.

C5. NET PRESENT VALUE KEY ATTRIBUTES

Overall, when measuring the NPV technique against the key attributes outlined in chapter one, the technique is deemed a viable one. First, NPV gives considerable attention to the time value of money as by its attempt to discount cash

flows to the present value. This allows NPV technique to be credited with creating an understanding of cash flows. Additionally, it makes an effort to understand the cost of capital when estimating the present value of cash flows. In considering the time value of money and cost of capital NPV also makes an effort to understand the risk implications of investments. Unfortunately, NPV does not have the ability to compare projects of different sizes. Essentially, the inability to do so is directly related to different project lives and costs of capital that cannot be made relative to one another.

D1. PROFITABILITY INDEX THEORY

A fourth approach for analyzing capital budgeting investments is the profitability index (PI) also known as the benefits/cost ratio. This approach is based on the premise that the investment with the highest profitability index gets ranked ahead of all other investments. To illustrate how the (PI) approach is calculated we will use the Company X example.

D2. PROFITABILITY INDEX ILLUSTRATION

PROFITABILITY INDEX (PI) FOR COMPANY X

	PV FACTOR		
<u>PER.</u>	<u>CASH FLOWS</u>	<u>@ 10 %</u>	<u>PV</u>
0	-\$100,000	1.000	(\$100,000)
1	\$25,000	.9091	\$22,728
2	\$60,000	.8264	\$49,584
3	\$70,000	.7513	\$52,591
4	<u>\$80,000</u>	<u>.6830</u>	<u>\$54,640</u>
TOTALS	\$135,000	—	\$ 79,543

TOTAL PV OUTFLOWS = -\$100,000

TOTAL PV INFLOWS = \$179,543

$$PI = PV \text{ Benefits} / PV \text{ costs}^{12}$$

$$PI = \$79,543 / \$100,000$$

$$PI = -1.26$$

D3. PROFITABILITY INDEX ADVANTAGES

The primary advantage of using the PI method lies within the simplicity of calculating the results. Additionally, it serves as a basis when trying to rank several projects in order of importance. Ultimately the project with the highest profitability index is given funding first. Additionally, the PI method has the ability to compare projects of different sizes. Thirdly, the methodology of estimating the cost of capital and tracking cash flows allows the user of the technique to assess the risk of the investment as well as acknowledge the value or cost of capital required.

D4. PROFITABILITY INDEX DISADVANTAGES

On the other hand there are some disadvantages of using the PI approach. The first disadvantage is that the PI equation relies solely on determining both cash inflows and cash outflows to then calculate the present value of the two elements. In doing so this method as with many others is highly vulnerable to incorrect cash flow calculations as well as incorrect cost of capital estimates when computing the PV. However, the PI quite often has the potential to lead to the same accept / reject decisions on mutually exclusive projects as NPV and the IRR methods. This method is most useful in conjunction with another capital budgeting technique. Additionally, similar to the risks associated with the NPV are risks associated with the PI. The PI has serious potential risks of inaccurate cash flows based on the

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fact that the technique does not include a measure of likelihood of achieving the projected cash flows.

D5. PROFITABILITY INDEX KEY ATTRIBUTES

Overall in comparison to the key attributes outlined in chapter one the PI strengths lie in the ability to consider the time value of money very similar to the NPV technique by estimating the cost of capital for cash flows. Additionally, another positive is its ability to assess risk by using various discount rates when evaluating projects. Also, the PI acknowledges the timing of flows in a similar manner as the NPV technique.

E1. INTERNAL RATE OF RETURN THEORY

Yet another commonly used capital budgeting analysis technique is the Internal Rate of Return Method (IRR). (IRR) is the rate that discounts the future cash flows to a PV just equal to the initial investment.¹³

E2. INTERNAL RATE OF RETURN ILLUSTRATION

To illustrate the mechanics of the (IRR) approach we will use the example of the Company X investment. The IRR estimate below will be based on an estimate of a 15% cost of capital. If the PV of the flows is zero we will know that the IRR was in fact 15%, as the cash in-flows and cash outflows exactly equal zero.

IRR CALCULATIONS @ 15%

¹³ Ibid, p.444.

<u>End of Year</u>	<u>Cash Flows</u>	<u>@ PV of 15%</u>	<u>PV</u>
0	(\$100,000)	1	(\$100,000)
1	\$25,000	.86957	\$21,739
2	\$60,000	.75614	\$45,368
3	\$70,000	.65752	\$46,026
<u>4</u>	<u>\$80,000</u>	<u>.57175</u>	<u>\$45,740</u>
Totals	\$135,000	-----	\$58,873

The above calculations indicate that the IRR is higher than 15% based on the favorable PV amount of \$58,873. Consequently, we will attempt to determine the IRR by estimating the cost of capital to be 20%.

IRR CALCULATIONS @ 20%

<u>End of Year</u>	<u>Cash Flows</u>	<u>@ PV of 20%</u>	<u>PV</u>
0	(\$100,000)	1	(\$100,000)
1	\$25,000	.83333	\$20,833
2	\$60,000	.69444	\$41,667
3	\$70,000	.57870	\$40,509
<u>4</u>	<u>\$80,000</u>	<u>.48225</u>	<u>\$38,580</u>
Totals	\$135,000	-----	\$41,589

The above calculation indicates that the IRR for this investment is even higher than 20% as well, seeing that the present value does not just equal zero. As this process becomes an issue of trial and error we will solve the problem on a financial

calculator to save time. The steps for solving the problem on the financial calculator are as follows:

COMPANY X (IRR) CALCULATION

<u>End of Year</u>	<u>Cash Flows</u>
0	\$(100,000)
1	\$ 25,000
2	\$ 60,000
3	\$ 70,000
4	<u>\$ 80,000</u>
Totals	\$135,000

Using a financial calculator:

100,000 CHS, g, CFj initial investment
 25,000 g, CFj first cash flow amount
 60,000 g, CFj second cash flow amount
 70,000 g, CFj third cash flow amount
 80,000 g, CFj fourth cash flow amount
 Press f, IRR
IRR: 37.0798

The IRR approach receives great criticism for its inability to arrive at a single rate of return like the NPV method. From an analytical viewpoint the possibility of arriving at two or more IRRs in an effort to find the rate at which the investment just meets the initial outlay could result in indecision. Additionally, when considering several mutually exclusive projects the IRR

method will consider if the project meets the cutoff rate, and rank them accordingly.

The most significant shortcoming of IRR is that it fails to recognize how cash inflows of a project are put to use. In doing this analysts assume that they can reuse capital at the same rate of return, which may not be the case. More importantly, under the IRR approach projects get ranked based on the IRR instead of the dollar size. From a financial standpoint if a smaller investment has a higher IRR it would be chosen over an investment which might have a larger overall cash inflow. This shortfall can clearly have an adverse affect on cash flows leading one to believe that the rate or return is not the most critical factor.

E3. INTERNAL RATE OF RETURN ADVANTAGES

In reviewing the mechanics of the IRR approach a variety of key attributes stand out. Essentially, the theory allows for a ranking of projects according to their internal rate of return. The nature of the ranking allows for a prioritization of projects based on which will generate the higher rate of return. Additionally, IRR is credited with giving reasonable consideration to risk implications involved in the budgeting process. Quite uniquely under the IRR technique a cut off rate of return is established which reduces the risk associated with selecting projects. More specifically, projects not expected to reach the cut off rate are not selected. Essentially, the cut of rate requirement also serves the purpose of estimating the value of money over time. Last but not least, IRR makes an effort to track cash flows as it calculates the rate of return.

E4. INTERNAL RATE OF RETURN DISADVANTAGES

The major disadvantage to using the IRR method is that it focuses on determining the rate at which the investment is just returns the investment and may not consider flows subsequent that time.

E5. INTERNAL RATE OF RETURN KEY ATTRIBUTES

In conclusion the IRR technique does score highly among the key attributes for capital budgeting techniques. The timing of cash flows and the recognition of the time value of money are handled by the selection of hurdle rates and establishing time frames for investment returns.

F1. RETURN ON ASSET THEORY

The last traditional capital budgeting technique we will discuss is the Return on Asset (ROA) technique. The premise behind the ROA calculation is that it allows analysts to look at investments and benchmark them against others within the industry in terms of the ROA. To illustrate the ROA calculation we will use the example of the Company X investment.

F2. RETURN ON ASSET ILLUSTRATION

Return on Assets = $\frac{\text{Net Income Available to Common Shareholders}}{\text{Total Assets}}$ ¹⁴

ROA = $167,000,000 / 1,000,000,000$

ROA = 16.7%

Quite often the result of the calculation is compared to other companies within the industry a benchmark. ROA is one of many financial ratios used to access financial progress and stability. This ratio is commonly used in conjunction

¹⁴ *Ibid.* p. 882.

with: Profit Margin on Sales, Basic Earning Power (BEP), and Return on Equity (ROE), more commonly called profitability ratios.

F3. RETURN ON ASSETS ADVANTAGES

In looking at the analysis ROA calculations coupled with other profitability ratios would reap such benefits as:

- * The ability to perform direct comparisons between corporations within similar industries as a benchmark.
- * The opportunity to give great insight on liquidity, asset management, and debt management on operating results. Additionally, it offers the ability to understand project risks within reason based on industry standards (benchmarks).

F4. RETURN ON ASSET DISADVANTAGES

On the other hand, methods such as ROA and the other profitability ratios are not meant to be looked at exclusively. If used exclusively analyst may miss other important elements that will shed light on both the industry and the corporation at hand. For example, total reliance on this approach ignores the time value of money and even the importance of the timing of cash flows.

The return on asset approach however falls short in its ability to analyze projects of different sizes. This is largely due to the fact that ROA measures net income available to shareholders / total assets. More specifically, the measure of project success is based on the amount of investment which then makes differing projects incomparable.

F5. RETURN ON ASSETS KEY ATTRIBUTES

In comparison to the list of key attributes the ROA technique has significant difficulty measuring up to expectations. Unlike most traditional techniques the time value of money is not considered. Along similar lines the timing of cash flows is not addressed. However, ROA does consider the element of risk associated with the project as it serves as an indicator of liquidity, and debt management. Furthermore, as ROA allows managers to understand their level of debt it aids in meeting corporate goals pertaining to debt to asset ratios.

CONCLUSIONS

In reviewing of traditional capital budgeting techniques we come to realize the approaches derived during World War II were ideal at the time by not longer fully meet the needs of organizations today. In looking back on the traditional theories there exist several shortfalls that are applicable to each technique. For example most capital budgeting techniques base their analysis on some sort of future cash flows. Unfortunately, the future cash flows being estimated have been based on projections. Furthermore, the limited learning due to an unclear picture of the past such as cash flows and hurdle rates lay the ground work for poor decision making. Additionally, even the most renowned approaches place great emphasis on hurdle rate during the analysis process. In doing so it almost appears that significant focus is being placed on maintaining the status quo instead of challenging and moving the baseline. Most importantly, traditional capital budgeting approaches have become rigorous routines that cannot take into consideration the value of lost opportunities that result from choosing one investment over another.

To further illustrate the performance of traditional capital budgeting techniques the following recap will summarize the advantages and disadvantages of each technique.

TECHNIQUE COMPARISON CHART

CAPITAL BUDGETING TECHNIQUE	CAPITAL BUDGETING PROJECT COMPARISON			
	TREATMENT OF THE TIME VALUE OF MONEY	REQUIRES USE OF DISCOUNT RATES	ABILITY TO COMPENSATE FOR PROJECT DIFFERENCES (SIZE, LIFE SPAN)	TREATMENT OF DIFFERENT RISK LEVELS
PAYBACK PERIOD METHOD	POOR	NO	YES	NO
DISCOUNTED PAYBACK PERIOD	GOOD	YES	YES	YES
NET PRESENT VALUE METHOD	GOOD	YES	NO	YES
PROFITABILITY INDEX METHOD	GOOD	YES	NO	YES
INTERNAL RATE OF RETURN	GOOD	YES	YES	YES
RETURN ON ASSETS	POOR	NO	NO	NO

CHAPTER 3:

NON-TRADITIONAL CAPITAL BUDGETING APPROACHES

III. INTRODUCTION TO NON-TRADITIONAL TECHNIQUES

Up to this point we have discussed the several concepts pertaining to capital budgeting and the traditional approaches that have been used to meet the challenge as well as their value in terms of the assessment matrix in chapter 1. From the process we have come to experience numerous pitfalls associated with the traditional capital budgeting techniques. Most astounding is the realization that most of the traditional techniques rely in one way or another on the projected cash flows of investments. As we have seen the cash flow projections fail to consider the likelihood of the inflows to occur as projected. Experience has shown that the integrity of cash flows being in question does not allow analysts to learn from past experiences.

Additionally, the reliance on discount rates has stimulated what can be considered an acceptance of status quo. The rationale suggests that many analysts work to make their projects meet the established hurdle rates. Consequently, this encourages competition between projects to gain funding and support. The history of capital budgeting stimulate many questions such as: Is there a real effort to exceed the hurdle rate on behalf of the analysts or is their primary concern to gain support? How much manipulation of numbers takes place to assure that specific projects meet the hurdle rate? In connection with these questions one must ask if this thought process is one which will help organizations gain a competitive edge during competitive times.

As organizations select projects based on meeting predetermined hurdle rates, the fastest payback period, and the highest return on investment have come to question the value of the opportunities that are passed by. In reviewing many of the traditional techniques we come to realize that there are no provisions to measure lost opportunities, qualitative benefits, as well as strategic impacts of the investments. Consequently, we are faced with a disconnect between the projects we select and those that would have the greatest overall impact.

The numerous pitfalls that organizations find themselves victims of is a direct result of the capital budgeting techniques they use which cause them to realize that the traditional techniques have become mere rituals. As rituals the processes are being performed with the wrong focus. Consequently, through the use of such antiquated techniques we have come to strive toward project approval as oppose to competitive edges within the market place.

Most importantly, the issues surrounding traditional capital budgeting techniques are difficult, at best, to track. The inability to track the shortfalls of the techniques has translated into stifled learning on behalf of financial organizations.

To combat the pitfalls of traditional approaches much focus has been drawn to the emergence of strategic capital budgeting techniques. Some of the more innovative attempts at handling the capital budgeting decision include:

- Strategic Bundle Monitoring**
- Multi-Attribute Decision Model (MADM)**
- Hurwicz Principle**

- **Comparable Investment Approach (CIA)**
- **Strategic Investment Appraisal (SIA)**
- **Economic Value Added (EVA)**

In recent years the term "strategy" has found a place in each and every aspect of business. Essentially the term strategy is best defined as an essential plan of action critical in overall effectiveness. Within the capital budgeting decision the terms "strategy" and "strategic planning" have taken on a several very critical roles. Strategic planning within the budgeting decision acts as a game plan for corporate spending. In doing so it eliminates a great deal of subjectivity. When taken into consideration strategic budgeting acts as a set of objective rules. For example in the earlier cases studies of James River Corporation considering the new computer upgrade and the new manufacturing equipment the strategy concept is easily applicable. If for example the corporate goals emphasize cost reduction and manufacturing efficiency the equipment upgrade would be essential. On the other hand if advanced technology were the primary objective it would take precedence over all else. In this particular instance the emphasis on strategy aids in the project selection process. As a result of highly focused strategic plans capital spending overall reaches a new plateau of efficiency and control over time. Assets and revenues are optimized to the greatest advantage for the corporation. Most importantly, strategic budgeting defines and bridges the gap between strategic plans and capital investments.

In theory the concept of strategic capital budgeting addresses many of the elements neglected by traditional approaches such as: the importance of linking investments to strategic goals, selecting the right

projects as well as operational benefits of aligning expenditures with corporate goals and objectives. By acknowledging the importance of strategic goals in the budgeting process we begin to base projects around gaining competitive advantage. Additionally, by working to select the right projects we refer to focusing efforts around projects that are directly aligned with the strategic goals of the organization. Finally, by operational benefits we mean seeking investments in new machinery that will result in less wasted raw materials with less product handling to reduce damage to ultimately improve the company image.

To provide a better appreciation for the concept of strategic budgeting we will explore the six techniques previously mentioned in a way that explains the formulation of a problem, the advantages, the disadvantages, as well as how well they perform in comparison to the attributes outlined in chapter 1.

A1. STRATEGIC BUNDLE MONITORING THEORY

The first innovative approach to capital budgeting is a technique referred to as bundle monitoring. Bundle monitoring was developed in 1988 by Caterpillar, Inc.¹⁵ The premise supporting bundle monitoring is to fill the void created by post audits while enhancing the learning process from past projects. The concept was initiated to stimulate an arena of learning from past investments which no other tool afforded the opportunity to do. Ultimately, the technique sets out to establish a strategic guide when making decisions. The concept is believed to have broadened the narrow view of traditional budgeting approaches that rely solely on highly structured calculations. By definition a bundle is a

¹⁵ Bastan, Robert, C., Hendricks, James, A., Sexton, Thomas, L., Management Accounting, "Bundle Monitoring of Strategic Projects", February 1992, p.32.

homogeneous segment of work or product that has common elements.

Common elements for developing strategic bundles could include: relative size, similar processes, location, or similar strategic objective. ¹⁵

The bundling process at Caterpillar, Inc. in theory entails the following steps: ¹⁶

- 1. Determine Strategic Goals**
- 2. Determine Project Bundles**
- 3. Make an Investment Decision**
- 4. Monitor periodically the key characteristics of approved bundles.**
- 5. Evaluate bundle monitor.**
- 6. Re-forecast the key characteristics.**
- 7. Take corrective action for bundles not performing up to expectations.**

In using the bundle monitoring process great emphasis is placed on the execution of the seven key steps. First and foremost, bundling requires a firm development and understanding of strategic goals. The strategic goal serve as focus for all efforts and a guide for any poorly defined efforts. From there all projects and investments can be placed within the appropriate "bundles" or categories based on the key elements of size, process, location or objective. For example a particular bundle could have all projects that pertain to the new product lines, which works toward goals of product enhancement. Consequently, the effort results various sub categories of corporate goals and objectives. Combined each category or bundle should begin to focus on business, operational, and corporate

¹⁶ Ibid.

goals. At this point investment decisions can be made as to which projects of the various bundles should be invested in most immediately. Upon choosing a project perhaps that works toward product line enhancements the characteristics focusing the project toward product line enhancements such as new packaging or improved performance features must be monitored for their focus. In the same token bundles are monitored for their continued focus toward goals. Most importantly, throughout the process each characteristic is evaluated for alignment to goals. As need be the bundles can be fine tuned to stay within perhaps guidelines set up for product line enhancements.

Beyond the well defined steps outlined by Caterpillar, Inc. organizations are called to put certain structures in place to support the effort. Initially, a cross-functional team is formed which includes: engineers, manufacturing representatives, material handling representative, acquisition representatives, as well as business resources from marketing, finance, and accounting. As a group each member takes an active role in determining key characteristics of projects to act as criteria. As a result all aspects are being covered with sufficient consideration of the various departments. Secondly, the group calculates values for each key characteristic within each strategic bundle at various points in time. The technique acts like a tracking system for elements of critical importance to the organization. Ideally, revisions can be integrated to enhance the projects results gradually. An example of such a matrix could be as follows: ¹⁷

¹⁷ Ibid, p.35.

A2. BUNDLING MATRIX ILLUSTRATION

REVISED PROJECTIONS KEY CHARACTERISTICS	AS OF 1/94	ORIGINAL TARGET 12/94	CURRENT STATE	3/94	4/94
1. Total capital spent					
2. Start up expenses					
3. Manpower					
Direct Labor					
Indirect Labor					
Salaries					
TOTAL					
4. In-Process					
Inv. (\$)					
5. In-Process					
Days					
6. IRR					

In reviewing the above matrix, the technique is credited with tracking criteria of importance such as total capital spend and tracks spending in each area. Consequently the areas of importance are monitored at various points in time against targets.

To be successful in bundling efforts Caterpillar, Inc. stresses the importance of monitoring the criteria regularly, revisit the key characteristics for relevance, and consider the information retained from bundling efforts when taking on future projects.

A3. STRATEGIC BUNDLE MONITORING ADVANTAGES

A model such as the bundle monitoring matrix displays a variety of benefits. Its strongest advantage is that it aids in the tracking of costs back to appropriate business units and departments based on corporate strategies. This facet alone has tremendous implications for organizations suffering from excessive raw material wastes, declining product lines and high manufacturing costs. Additionally, it can provide a truer picture for

analyzing automation equipment. Quite often the mention of automation is viewed as expensive or not necessary, whereas with strategic bundle monitoring the true value of the equipment can be realized. In the long run through bundle monitoring the benefits remain above the costs due to strict tracking and monitoring that allow for corrective action where necessary. Most importantly, through the concept of bundle monitoring an organization is forced to channel its efforts to the projects and investments that meet their corporate goals and objectives.

A4. STRATEGIC BUNDLE MONITORING DISADVANTAGES

Although bundle monitoring meets many of the needs overlooked by traditional approaches it too has disadvantages. Essentially, one of the major concerns is that there is significant subjectivity associated with brainstorming and compiling project criteria. Secondly, there is concern surrounding the reduced financial number crunching that many organizations are accustomed to, such as NPV or IRR. Additionally, the technique is accused of lacking consistency in criteria from project to project

A5. STRATEGIC BUNDLE MONITORING APPRAISAL

Strategic Bundle Monitoring has several key attributes based on the appraisal matrix. First, the approach is deficient in acknowledging the time value of money. Although the approach does look at the projects at various points in time it fails to specify the present value of flows. Consequently, this creates a disconnect between the project progress and understanding its potential. Additionally, this approach fails to pinpoint the timing of cash flows. Coupled with the failure to acknowledge the time value of money, an organization is left uncertain as to the true value

of the project. Many feel such a deficiency is a direct result of minimal number crunching. However, the technique is more advanced in its ability to link projects with corporate goals as a result of the matrix. However the approach establishes some understanding of risk as it focuses on corporate goals and postpones those investments not directly impacting the goals. As a result funds are channeled toward investments having direct impacts on the organizations performance.

B1. MULTI-ATTRIBUTE DECISION MODEL (MADM)

The second innovative technique we will examine for capital budgeting decisions is the Multi-Attribute Decision Model (MADM). MADM unlike many traditional capital budgeting techniques looks to apply reasonable consideration to both quantitative and qualitative aspects of the decision process. To use the (MADM) approach an analyst must first compile a list of critical success factors for each investment. In doing so the information builds a foundation of elements with strategic importance to the organization. This list unlike most approaches may contain both financial as well as non-financial factors. As a second step the analyst must then assign a weight to each factor to arrive at a total of 100. The basis for assigning values relies on the analysts understanding and appreciation for corporate goals and objectives. At this point a confidence rating to the likelihood of success of that factor is determined. For example, if the project has a 20% chance of meeting the planned NPV it would have a confidence factor of .2. Once the analyst compiles the factors, weights their value, and assesses their likelihood of occurrence, a

score is calculated by multiply all three components. As a result the matrix created would appear as the following diagram: ¹⁸

B2. MADM CALCULATIONS

<u>Factors</u>	<u>Weights</u>	<u>Ratings</u>	<u>Confidence</u>	<u>Score</u>
<i>Quantitative</i>				
NPV	25	4	.2	20
IRR	20	3	.5	30
<i>Quantitative Non-Financial</i>				
Improved company Image	15	2	.3	18
Reduced Damage	15	2	.8	24
Quicker Delivery Time	10	1	.9	9
Higher Quality Products	10	1	.5	5
New Packaging	5	.8	.7	2.8

B3. MULTI-ATTRIBUTE DECISION MODEL ADVANTAGES

In reviewing the above matrix it becomes apparent that the MADM approach adds value to the capital budgeting process with several key advantages. The first advantage of using the MADM is that it enables analysts to consider projects of various sizes. Unlike most other techniques this approach MADM looks at a variety of "attributes" of a project to perform analysis. In doing so any project with similar attributes can then be compared on the basis of the degree of importance and likelihood of occurrence assigned. Furthermore, this methodology gives consideration to risk exposure as it not only estimates the likelihood of occurrence of that

¹⁸ Ibid., p. 61.

element but it also considers: the time value of money, acknowledges the costs of capital and timing of cash flows through the use of quantitative tools such as NPV and IRR. One of the biggest advantages is that it takes into consideration non-financial benefits that can be recognized in a project while still recognizing the quantitative dimensions as well. Quite often traditional approaches fail to consider the likelihood of attaining the estimated cash flows therefore increasing project risk. More specifically as the above example displays, the organization places great value on the reduction of damage in their process. Essentially, in the long run such a non-quantifiable factor could have a dramatic impact on increasing market share and reducing operating costs. However, a benefit of increased market share may only be attributed to a specific project with the use of a matrix such as MADM. Most importantly, MADM proves most valuable as each factor has relevance to corporate goals and objectives. As a result the organization has a fuller understanding of implications of the investment on future success. Quite often analyst have settled for pure financial benefits and ignored the non-financial benefits and later acknowledged them as after thoughts of the investment where such factors are truly critical in the decision making process. Consequently, critical factors to the organization can still be assessed.

B4. MULTI-ATTRIBUTE DECISION MODEL DISADVANTAGES

Although the technique considers many elements of value in the decision making process, it too has its disadvantages. The most significant disadvantage of the MADM is that it allows for great subjectivity on behalf of the analyst. In the above example we indicated that the analyst compiles, weighs, and rates the likelihood of each factor. In doing so the

matrix could become a sole indicator of only what that particular individual consider to be priorities within the organization. Additionally, the model also assumes that the individual understands and appreciates the organization objectives and goals. Finally, the model assumes that the individual understands the interdependency of various departments and has taken those factors into consideration in selecting the investment as well as acknowledging the benefits. Consequently, the potential subjectivity of MADM methodology may impact the value of the technique.

B5. MULTI-ATTRIBUTE DECISION MODEL APPRAISAL

In comparison to the key attributes the MADM performs considerably better than many other techniques for a variety of reasons. First and foremost, the technique considers both qualitative and quantitative dimensions. Not only does it calculate the NPV and the IRR, but it assigns values of importance of each to the calculations to accompany the qualitative dimensions being considered which reduce project risks.

C1. HURWICZ PRINCIPLE THEORY

A third innovative approach we will consider in the budgeting decision making process is the Hurwicz Principle, also referred to as the Uncertainty Approach. By definition the Hurwicz Principle is a way of approaching a highly uncertain choice with any desired mixture of pessimism and conservatism or optimism and speculation. ¹⁹ This approach similar to the MADM expresses the importance of considering non-quantifiable elements in the decision making process. The key to this

¹⁹ Ibid.

approach is that it serves as a foundation during extreme uncertainty. The technique explores two basic options: invest or do not invest. Next, it projects cash flows under each option as well as the implications if successful or not. To further illustrate the concept the diagram below will display the results: ²⁰

C2. HURWICZ PRINCIPLE ILLUSTRATION

<u>Shall we invest</u> <u>Decision</u>	<u>What happens if</u> <u>successful</u>	<u>What happens if</u> <u>unsuccessful</u>	<u>60 %</u> <u>of worst</u>	<u>40%</u> <u>of best</u>	<u>Total</u>
YES	\$20,000	\$(50,000)	\$(30,000)	\$8,000	\$(22,000)
NO	\$0	\$20,000	\$12,000	\$0	\$12,000

In the above example a 60% chance of the worst outcome was posed against a 40% chance of the best outcome. The end result indicated that if they invested in the new technology they could lose \$22,000. On the other hand if they passed up the opportunity to invest they could potentially gain \$12,000. Consequently, the worksheet is suggesting that the investment in new technology not be taken.

C3. HURWICZ PRINCIPLE ADVANTAGES

In considering the process and rationale behind the Hurwicz Principle several advantages that could be expected. One clear advantage is that the approach makes a distinct effort to compare projects of different sizes. Additionally, it works to evaluate the likelihood of occurrence of

²⁰ bid.

each project by applying varying degrees of pessimism and optimism. This facet of the principle serves as an evaluation of risk. Furthermore, it encourages analysts to recalculate the results with varying degrees of pessimism, optimism, conservatism, and speculation to build an understanding of investment sensitivity. More importantly, is the fact that the Hurwicz Principle gives analysts a starting point in considering new investments when there is extreme uncertainty. It proves to be most helpful as many organizations move toward automation and are unable to even imagine factors such as cash flows, timing of cash flows, or costs of capital as many of the traditional approaches require.

C4. HURWICZ PRINCIPLE DISADVANTAGES

As the Hurwicz Principle provides a foundation for analysis it also has its short falls. As it is an advantage to start the foundation for analysis without much other data, it still remains to be a premature tool to perform analysis. Based on the above example, the approach fails to bridge the gap between methods that give the timing of cash flows or take into consideration the time value of money. In essence this approach does not add any significant value to the process not already derived elsewhere. Granted it does provide a foundation, the foundation is not sufficient to add enough value to eliminate one of the traditional approaches hence must be followed by another technique as more information becomes available.

C5. HURWICZ PRINCIPLE KEY ATTRIBUTES

Overall the Hurwicz Principle suffers the same deficiencies as many other strategic approaches: it fails to acknowledge the time value of

money and the timing of cash flows by lumping large amounts of money together as overall results of a project's performance. However, the technique is credited with building an understanding of the risk implications by examining the financial impact of various percentages of success/failure.

D1. COMPARABLE INVESTMENT APPROACH THEORY

The fourth capital budgeting technique is the Comparable Investment Approach (CIA). In theory, the CIA works to address the deficiencies and conflicts found in the NPV and IRR calculations. The rationale surrounding the CIA is that projects cannot be fairly compared with varying project lives, return pattern, and hurdle rates. Consequently, this approach works to make all three components relative for comparison purposes. The theory is based on the following elements:

D2. COMPARABLE INVESTMENT APPROACH ILLUSTRATION

BASIS FOR CIA APPROACH

1. Cash not profits
2. The time value of money
3. Only one rate of return per project
4. Consideration for all cash flows even those subsequent the initial investment
5. Adjust for the difference in project life, return patterns, and hurdle rates
6. Consideration for reinvestment rates
7. Works in conjunction with corporate goals and objectives
8. Almost eliminates the conflicts between NPV and IRR

The CIA approach addresses several deficiencies that occur when choosing between two mutually exclusive investments such as : inconsistent return patterns, varying project life spans, inconsistent investment requirements, or return rates. To apply consistency to the varying components within the decision making process the CIA approach uses what are referred to as reinvestment vehicles and side projects. Consequently the usefulness of the CIA approach is amplified in several scenarios.

CIA SCENARIO: I

In the first scenario the CIA approach will address the existence of different return patterns. For example, if two mutually exclusive projects have a two and three year lives respectively the return patterns are usually inconsistent. In most cases the two year project will most likely begin to recognize returns prior to the three year project. As a result the CIA technique suggests occupying the proceeds from the project which recognizes returns first in a reinvestment vehicle until the second project begins to generate returns. Additionally, the same logic is applied when two mutually exclusive projects receive returns at varying times such as one project receiving proceeds at the beginning of the year and another project receiving proceeds at the end of the year. In the same light the reinvestment vehicle acts to make the return patterns consistent with one another.

CIA SCENARIO : II

The second scenario that the CIA technique addresses is when two projects are of different investment size and need to be compared. In order to make the two investments relative this technique calculates the

investment required by the first project minus the investment required by the second investment to arrive at a difference. The project with the higher investment requirement then invests the difference in a side projects. In doing so the two projects are relative in investment size and the proceeds from the side project can then be added to the proceeds from the original project if necessary.

CIA SCENARIO : III

Beyond the discrepancies that exist between return patterns, project life spans, and investment size are also discrepancies in the rate of return that projects earn. For example, if a project has a 25% IRR and a 20% cost of capital the interest rate spread would be 5%. In the same token a competing project may have a 20% IRR and a 10% cost of capital to arrive at a 10% interest rate spread. In understanding the interest rate spreads investors then have a better handle on the overall efficiency of a project and can then make reasonable judgments about which project to choose. In the above examples, it becomes evident that the project with the higher IRR is not necessarily the best investment. The investment with the 25% IRR and a 20% cost of capital can only earn a 5% margin on the investment. On the other hand the second investment only earns a 20% IRR but has a 10% cost of capital allowing the project earn a 10% margin.

D3. COMPARABLE INVESTMENT APPROACH ADVANTAGES

In retrospect the CIA approach has several key advantages that make it a viable technique for analyzing projects overall worth. First, the CIA technique works to make project comparable in four major areas: size, return rate, return pattern, and life span. These are areas which have been recognized as being deficient in the most relied upon techniques today:

NPV and IRR. The underlying factor once all variables are comparable then becomes which project ultimately has the biggest impact on increasing the wealth of the shareholders.

D4. COMPARABLE INVESTMENT APPROACH DISADVANTAGES

Like most techniques the CIA approach also has disadvantages that impact the usefulness of the technique. First and foremost, the CIA technique relies heavily upon the assumption that side projects and reinvestment vehicles are reliable and relative in risk to the core project that they were derived from. Additionally, there is great reliance that the selection of reinvestment vehicles are the best alternative for the organization and that there exists no lost opportunities. However, if there are lost opportunities, like many other techniques, CIA fails to address them. Furthermore, the technique fails to explore the implications of if a reinvestment vehicle results in a sizable loss for the core project. As a result the stability of the CIA approach still remains somewhat questionable.

D5. COMPARABLE INVESTMENT APPROACH APPRAISAL

Overall the CIA does a sufficient job in relation to the key performance criteria. Because the technique uses some of the traditional techniques such as NPV and IRR it acknowledges the time value of money and the timing of cash flows. Additionally, the risks associated with unbalanced comparisons of projects is reduced. From a different standpoint the users of the CIA are at risk of failure of side projects and

reinvestment vehicles. As side projects work to occupy available funds they also act as an additional risk above and beyond the core project risks.

E1. STRATEGIC INVESTMENT APPRAISAL THEORY

Yet another attempt to tackle the capital budgeting challenge is the Strategic Investment Appraisal (SIA) approach. SIA compounds upon many of the traditional techniques by correlating investments to the strategic goals and objectives of the organization. The basis for SIA is that it questions the competitive position of many organizations based on their commitment to advanced technology. In doing so it implies a direct correlation to investments in high technology and competitive advantage within the market place.

The SIA technique essentially consists of four major phases of implementation: making the decision; deriving benefits; compiling abstractions from the investments; and formulating a strategic planning matrix. ²¹ The first phase although elementary in thought is making the decision to move toward strategic budgeting. To do so organizations are challenged to drastically change their way of thinking especially in reference to capital budgeting and the use of resources. In other words the minutes must essentially focus on investing in advanced technologies and projects that will result in strategic benefits for the organization. This is a complete change from the rationale that organizations express that they cannot afford to invest in technology, when in actuality they cannot afford not to invest. To accomplish this change of mindset management must be

²¹ Bromwich, Michael, and Bhimami, Al; Management Accounting; "Strategic Investment Appraisal"; March 1991; p45.

able and willing to challenge the very core of the organization and any opposition they may face along the way.

Once the thought process begins to transition toward strategy implications, both management and accountants must compile a list of internal as well as external benefits to be expected from each strategic investment. In doing so the results would appear as follows:

E2. STRATEGIC INVESTMENT APPRAISAL ILLUSTRATION

SIA BENEFIT APPRAISAL

EXTERNAL BENEFITS

Diversification

- Expand the product portfolio
- Develop new products with new skills and technology
- Develop new skills in new areas

Risk Reduction

- Establish a stronger skill base
- Become better planners
- Reduce working capital and inventories
- Increased flexibility to change
- Build better controls over operations

Enhancement of Existing Products

- Enhance the company image
- Lower costs of meeting demand
- Improved quality
- Enhance fluctuating demand

On the other hand some of the internal benefits may be as follows:

INTERNAL BENEFITS

- Cost advantages
- More control over production systems
- Improved organization
- Beneficial interaction

In compiling the lists of benefits organizations not only realize the benefits of strategic investments, but they also establish a database of characteristics that potential projects and investments should have in common.

To form a synergy between the organization and the investment efforts management needs to then compile an abstraction list from the list of benefits and costs. The matrix would appear as follows:

E3. SIA ILLUSTRATION

<u>CUSTOMER BENEFITS</u>	<u>MONETARY</u>	<u>NON-MONETARY</u>
BETTER PRODUCTS		X
ENHANCED FLEXIBILITY		X
COST REDUCTIONS	X	

The above matrix breaks down the benefits and costs according to the subdivisions relative to the business taken from the list of internal and external benefits. As a result the items can then be scored on their contribution to the organization and focus toward corporate goals. In concluding the attraction the management has developed an understanding of the important element of projects and investments as well as the projected benefits to be expected whether they be monetary, non-monetary, or scored and not monetary. Now the management is prepared to develop the strategic planning matrix.

The strategic planning matrix is an aggregation of the items on the checklist that combines the strategies and benefits in an effort to build a

weighted score according to management importance. As a result the matrix would look like follows:

SIA CALCULATIONS

	Higher	Meeting customer	Enhanced
Total Strategic Benefits	<u>Reliability</u>	<u>Requirements</u>	<u>Image</u>
Better Products			
Enhanced Flexibility			
Cost Reduction			

E3. STRATEGIC INVESTMENT APPRAISAL ADVANTAGES

The key advantage to the SIA technique is the fact that it serves to determine and evaluate the links between strategies and benefits of investments and projects.

E4. STRATEGIC INVESTMENT APPRAISAL DISADVANTAGE

SIA unfortunately has significant disadvantages that hinder its usefulness. First, this technique fails to consider any elements of risk outside of not aligning investments to corporate goals and objectives. Additionally, some may argue that even aligning investments to goals may not impact risk exposure at all. Furthermore, the lack of quantifiable elements such as estimations of cash flows and cost of capital, as well as acknowledgment of the time value of money also impair its ability to analyze investments. Finally, there fails to exist a facet of the technique will allow it to be comparable to others. As displayed in many other non-

traditional techniques, certain key dimensions of projects get compared such as: the ability to generate cost savings; the ability to enhance product image or product quality to name a few. However, the technique may be deemed valuable as a secondary tool for measuring less quantifiable dimensions within projects.

E5. STRATEGIC INVESTMENT APPRAISAL - APPRAISAL

Overall, the SIA however does fall short of the key criteria for techniques. Essentially, the only requirement that SIA meets is the ability to link projects with goals and objectives. Due to the minimal calculations no consideration is given to the time value of money, risks associated with the project or the timing of cash flows.

F1. ECONOMIC VALUE ADDED THEORY

The final approach we will consider for the capital budgeting decision is the Economic Value Added (EVA) approach. EVA, unlike many techniques calculates an investments after-tax income reduces it by a weighted average cost multiplied by the total capital investment to determine economic value. When calculated properly, EVA can incorporate discipline within the decision making process by forced attention toward specific inefficiencies.

EVA is being considered the way of analyzing investments in the future. EVA has a way of determining the value of an investment on its ability to generate returns in excess of the investment. ²² Charles Peters

²² Laura Walbert; Journal of Applied Finance; "The Stern Stewart Performance 1000: Using EVA to Build Market Value"; April 1994; p110.

of Emerson believes " Its a very simple measure that steers people to look at investments on an incremental basis. You can use the measure at any level and look at different plans within your company and make some judgment about their value". ²³

The theory supporting EVA was essentially sparked by the philosophy that firms should begin to look at capital projects by each activity involved. In doing so each activity can be analyzed for its contribution to the projects success. Consequently, EVA has become recognized for serving numerous purposes within the world of capital budgeting. First, and foremost it allows for management to look at projects and investments and determine if they are valuable or not. By the term valuable a manager can determine what the costs and benefits are and equate them to the goals and objectives of the organization. In doing so the EVA approach can then used to weigh costs to benefits of each investment or project. In short EVA ultimately places shareholders and senior management on a more equal plane. Additionally, unlike any other capital budgeting technique EVA stimulates the need for understanding of operations costs, and benefits hence value. In performing the analysis required to complete the EVA calculations analysts and managers must do a variety of investigations to arrive at their figures such as: study the operation from the standpoint of throughput, output, and wastes; as well as the strengths, weaknesses, opportunities, and threats facing the organization. The uniqueness of EVA is it's ability to create a corporate understanding of operations and real profitability. To do so the approach looks to understand the "true cost of capital".

²³ Ibid; p.111.

F2. ECONOMIC VALUE ADDED ILLUSTRATION

Because the methodology for formulating the EVA example is somewhat industry specific many organizations work to understand activity based costs in order to monitor their overall value on investments. To better illustrate the process of estimating costs the following ABC Cost Benefit Chart will outline some of the costs within a manufacturing organization. ²⁴

²⁴ **Thompson, Arthur, A. Jr., and Strickland III, A.J., Strategic Management Concepts and Cases, Seventh Edition, 1993.**

TOTAL INDUSTRY ACTIVITY/COST CHAIN

SUPPLIER RELATED ACTIVITIES	MANUFACTURING RELATED ACTIVITIES				
<p>Contract Materials, Components, Parts, and In-house Logistics</p> <p>Supplement Raw Materials and Component Parts Supplies by Outsiders</p> <p>Energy</p> <p>In-house Shipping</p> <p>In-house Material Handling</p> <p>Outsourcing</p>	<p>Production Activities and Operations</p> <p>Facilities and Equipment</p> <p>Processing</p> <p>Assembly and Packaging</p> <p>Labor and Supervision</p> <p>Maintenance</p> <p>Product Design and Tooling</p> <p>Quality and Testing</p> <p>Quality and Inspection</p> <p>Inventory Management</p>	<p>Marketing and Sales Activities</p> <p>Salesforce activities</p> <p>Advertising and Promotion</p> <p>Market research</p> <p>Technical Literature</p> <p>Travel and Entertainment</p> <p>Dealer and Distributor Relations</p>	<p>Customer Service and Outbound Logistics Activities</p> <p>Service Bays</p> <p>Order Processing</p> <p>Spare Parts</p> <p>Other Outbound Logistics Costs</p>	<p>In-House Staff Support Activities</p> <p>Payroll and Benefits</p> <p>Recruiting and Training</p> <p>Internal Communications</p> <p>Computer Services</p> <p>Preventative Practices</p> <p>RAID</p> <p>Safety and Security</p> <p>Union Relations</p>	<p>General Administrative Activities</p> <p>Finance and Accounting Services</p> <p>Legal Services</p> <p>Public Relations</p> <p>Executive Services</p> <p>Interest on Borrowed Funds</p> <p>Tax-Risked Costs</p> <p>Regulatory Compliance</p>

ECONOMIC VALUE ADDED ILLUSTRATION

Once all costs are compiled the EVA approach works to calculate costs versus benefits to determine value.

THE ECONOMIC VALUE ADDED APPROACH

After tax operating profit:

Operating Income (for investment A) = \$700,000

Taxes = \$60,000

Operating Income (After Taxes) = \$640,000

The total cost of the investment is projected at \$ 4,000,000. For the intent of this example the 4,000,000 investment will be funded based on the following weighted average cost structure:

Weight Components for Capital:

Equity = 67%

Debt = 33%

Cost of Equity = 15%

Cost of Debt = 6%

Weighted Average Cost of Capital:

Equity = 67% * 15.0 = 10.05

Debt = 33 % * 6.0 = 1.98

Weighted Average % = 12.03

12.03 % * 4,000,000 = **481,200**

After Income Profit - Cost of Capital = EVA

EVA = \$640,000 - 481,200 = 158,800

In reviewing the above the organizations true cost of capital is every cost it takes to prevent a shareholder from divesting in a the

organization. As a result of the direct correlation between a positive EVA, or wealth creating investment, and high returns for shareholders is phenomenal. For many organizations EVA has become a key tool in determining compensation. EVA has also come to be recognized for the intense interest in business performance in relation to strategic goals and objectives. Many feel that it makes managers like shareholders in that it studies values, costs, and benefits of each and every operation. In very simple terms, if an investment or business sector has a positive EVA- then it is said to be creating wealth. On the other hand if an investment has a negative EVA it is destroying wealth. Consequently in its efforts EVA has three main focus points: Focus spending on highly profitable projects; focus on raising capital returns quicker than expenses; as well as maximizing the use of capital by doing more with less. ²⁴ This as a result gives new meaning to the concept of resource allocation. It calls on each and every employee to rethink decisions involving operations, expansions, projects and acquisitions.

F3. ECONOMIC VALUE ADDED ADVANTAGES

In conclusion the EVA approach has been recognized for several advantages. Most noticeable is the fact that EVA has the ability to track cash flows by closely studying project activities to estimate a basis of costs. EVA then considers the time value of money to fully understand the financial impact of the investment. Additionally the benchmarking feature of EVA also works to reduce risk associated with poor investment choices. More importantly, EVA does not allow an organization to exist in a vacuum. In other words it gets to the true value of the organization by

looking at true costs of capital in relation to equity per investment. Consequently, accountants cannot just look at interest from debt, but must consider the true costs of capital as well. During times of intense competitive forces recognizing all cost is critical to survival. Secondly, EVA is an excellent means to base compensation on due to the high correlation between EVA levels and stock prices. In doing so employees at all levels recognize the results of their contributions and are motivated by the monetary gains that the organization can receive. As organizational success gets translated into bonuses and salary increases, employees will begin to attack any and every competitor within their industry. Thirdly, EVA has the ability to impact organization's financial position even during the worst economic times and volatile stock prices because it works to improve the cost/benefit structure. Stock prices do not have to be favorable for a company to begin to look at each and every investment based on returns vs. costs and determine the value of that investment. Most importantly, as organizations begin to recognize the poor value of an advantage they can put their funding to better uses. In doing so each investment and project will add value and have a comparable advantage for the organization within the industry it competes in. Also, EVA provides a comprehensive view of all variables involved in the investment. By comprehensive the development of EVA forces accountants and manager to look at each and every cost involved in doing business. By recognizing every cost organizations know where their capital is being spent and can then concentrate on reducing and eliminating those costs. Ultimately, the result will be the direct correlation between cost reduction and higher EVA. Last but not least, EVA is very simple to calculate

once organizations realize their true costs. Therefore, less time is spent compiling numbers and more time aligning projects with goals.

F4. ECONOMIC VALUE ADDED DISADVANTAGES

Like most other capital budgeting techniques EVA has factors that will directly impact the success or failure of the investments. First, accountants and managers are challenged to fairly assess the costs and values of the organization. Inflated costs or benefits could ultimately result in failure for the organization. Secondly, EVA requires a change in corporate culture on behalf of each and every employee must concentrate on identifying and cutting costs to create an economic value. Consequently the above elements could create a sizable disadvantage for the concepts supported by EVA if not addressed at the time of implementation. Finally, EVA trusts that organizations will honestly compile their costs along the way to get a true picture.

F5. ECONOMIC VALUE ADDED KEY ATTRIBUTES

In conclusion EVA successfully meets the key attribute requirements outlined in chapter 1. More importantly, it added increased value to the decision making process by monitoring investments with corporate goals and objective. Additionally, the time value of money and timing of cash flows are considered as the technique works to understand the true cost of capital. Additionally, corporate goals are the true focus of the analysis as each project works to increase the value of the organization and the wealth of stockholders. Most importantly, EVA is successful at minimizing market risk by working to keep costs down and gaining stockholders wealth through increased efficiency.

The following chart will summarize the findings of the key attribute matrix introduced in chapter 1.

TECHNIQUE COMPARISON CHART

CAPITAL BUDGETING TECHNIQUE	CAPITAL BUDGETING PROJECT COMPARISON			
	TREATMENT OF THE TIME VALUE OF MONEY	REQUIRES USE OF DISCOUNT RATES	ABILITY TO COMPENSATE FOR PROJECT DIFFERENCES (SIZE, LIFE SPAN)	TREATMENT OF DIFFERENT RISK LEVELS
PAYBACK PERIOD METHOD	POOR	NO	YES	NO
DISCOUNTED PAYBACK PERIOD	GOOD	YES	YES	YES
NET PRESENT VALUE METHOD	GOOD	YES	NO	YES
PROFITABILITY INDEX METHOD	GOOD	YES	NO	YES
INTERNAL RATE OF RETURN	GOOD	YES	YES	YES
RETURN ON ASSETS	POOR	NO	NO	NO
STRATEGIC BUNDLE MONITORING	POOR	NO	YES	NO
MADM	GOOD	YES	YES	YES
HURWICZ PRINCIPLE	POOR	NO	YES	NO
CIA	GOOD	YES	YES	YES
SIA	POOR	NO	YES	NO
EVA	GOOD	YES	YES	YES

In concluding the analysis of the nontraditional capital budgeting techniques we are better able to understand the value that they add to the decision making process. Additionally, it enables analysts to better understand the differences between what traditional techniques offer in relation to what non-traditional techniques offer.

After reviewing each of the techniques used in capital budgeting we come to realize that all techniques have their advantages and disadvantages but few have an easy time in meeting the key criteria of techniques. However, in understanding the ability of the various techniques to meet the requirements of the criteria for viable capital budgeting techniques we are now able to make a comparative analysis of all techniques.

CHAPTER 4: **CASE STUDY**

Up to this point we have had the opportunity to develop an understanding of the challenges of capital budgeting while exploring the traditional and non-traditional capital budgeting techniques. With this foundation we are now able to take an actual capital investment and apply some of the techniques discussed in earlier chapters.

The following investment is based on the Personal Computer Upgrade for the James River Corporation Finance Department discussed in chapter 1.

JAMES RIVER BACKGROUND INFORMATION

James River Corporation is a Consumer Products Organization headquartered in Richmond, VA. The company is recognized for its wide variety of consumer and commercial paper good products. The consumer products division consists of Towel and Tissue and Foodservice Products such as: Vanity Fair Napkins; Brawny Towels; Northern Bath Tissue; Dixie Cups, Plates, and Cutlery to name a few. The commercial products on the other hand range from specialized cups, plates, and napkins for such customers as Kentucky Fried Chicken, 7 Eleven, Burger King, and McDonald's to paper towel dispensers for a variety of restaurant chains throughout the United States.

James River Corporation, like many other manufacturing companies is forced to exist in an ever changing market. One of the dynamics within the market include varying costs of manufacturing such as increasing prices of pulp used to make many of the paper products. Another major concern lies in the number of competitors within the market place. To date, there are three major competitors in the market place. With a constant struggle between competitors severe price and distribution effectiveness become critical.

PROJECT SUMMARY - SCOPE

In an effort to combat the challenges within the market place James River Corporation works to encourage a variety of projects and investments. In the balance of this chapter we will explore in-depth the case of the computer upgrade introduced in chapter 1.

The computer upgrade project required an investment of \$418,853 to be broken down as follows: \$281,585 for hardware; \$42,150 for software; \$70,925 start-up; and \$24,193 for taxes.

The PC upgrade project for the Finance organization within James River set out to enhance information management within the department. Some of the more immediate benefits include: more powerful state-of-the art systems; multi-tasking capabilities; as a result the ability to improve the decision making process. In the long term the \$418,853 investment accomplishes a variety of objectives: it will

result the PC / Software deficiencies for the next 3-5 years while fitting into the corporate communication strategy of moving toward a data highway.

Outside making the \$418,853 investment James River essentially had two alternatives. James River could choose not to invest in the new computers. As a result however, they would reduce their chances of attaining timely, accurate and consistent financial data. On the other hand they could also chosen to make a partial upgrade for a lower investment requirement. In doing so they would sacrifice LAN connections, pass up cost savings associated with buying the larger quantity, while only resolving the information needs for a shorter period of time. The decision to pursue the option of investing in new PCs was based on the following assessment of the current state:

ASSESSMENT OF CURRENT STATE

<u>Problem</u>	<u>Issue</u>	<u>Cause</u>
1. Re-keying of data	Time consuming	No data sharing
2. Confinement to office	Misuse of Time	Limited Portables
3. Limited Back Up	Data Security	No LAN
4. Printer Shortages	Poor use of Time	Too few printers
5. No toggling between functions	Inefficient PCs	Lack of windows

For the remainder of the case study we will assume that James River will pursue the investment in new PCs. In doing so the following costs will be considered:²⁶

²⁶ McGarr, p. 3.

COST BREAKDOWN

<u>Hardware</u>	<u>Units</u>	<u>Unit Costs</u>	<u>Extension</u>
1. 486 PCs	77	\$2,435	\$187,495
2. 486 Laptops	13	\$4,480	\$ 58,240
3. LAN File Server	1	\$21,000	\$ 21,000
4. Network Control Closet	99	\$ 150	\$ <u>14,850</u>
TOTAL			\$ 281,585

<u>Software</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Extension</u>
1. PC Software	99	\$ 240.00	\$23,760.00
2. LAN Auditor	99	\$ 5.75	\$ 569.00
3. Maintenance Access	25	\$ 400.00	\$10,000.00
4. License Metering Menu	99	\$ 79.00	\$ <u>7,821.00</u>
TOTAL			\$ 42,150.00

<u>Start Up Cost</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Extension</u>
1. Network Cabling	99	\$250.00	\$24,750.00
2. Training	95	\$350.00	\$33,250.00
3. File Translation	25	\$500.00	\$12,250.00
4. Installation	90	\$ 7.50	\$ <u>675.00</u>
TOTAL			\$70,925.00

Totals

Hardware	\$281,585.00
Software	\$ 42,150.00
Start Up Costs	\$ 70,925.00
Sales Tax @ 6%	<u>\$ 24,193.00</u>
Grand Total	\$418,853.00

With respect to the above cost implications James River hopes to attain the following desired state within the Finance Organization as a result of the investment in new PCs:

- ◆ **Upgraded PCs / Software for Finance Organization, which are powerful, compatible networked, and standardized.**
- ◆ **Extended memory to build larger computer models such as spreadsheet applications which will allow for quicker processing time.**
- ◆ **Software: MS Excel (spreadsheets / graphics); MS Word (Word processing); Power Point (Graphs / Presentations).**
- ◆ **LAN Connections to allow for information sharing and reduce re-keying while providing access to E-Mail.**
- ◆ **Windows environment to allow for multi-tasking within (spreadsheets, word processing, graphics, mainframe applications, and query tools).**

The above information to this point has provided us with a foundation to perform analysis and determine the impact of the investment on the organization. Throughout this document we have stressed the importance of linking corporate goals and objectives with investment decisions to have a significant impact within the market place. To better understand the implications of this investment we will explore the outcomes of four different investment techniques we've studied: Net Present Value, Internal Rate of Return, Multi-Attribute Decision Model, and Economic Value Added. The four techniques chosen to be included in this case study were selected based on their performance according to the key attribute chart found at the end of chapters two and three.

The following key calculations were derived from the project manager at James River Corporation to justify the investment in new PCs and will be used to illustrate the various techniques.

Key Financial Calculations(ON AN ANNUAL BASIS FOR 5 YEARS)

1. **Income Generated - \$20,000**
- 2.1 **On-Going Fixed Costs - \$12,000**
- 2.2 **Depreciation - \$83,771**
2. **Total On-Going Costs - \$(95,000)**
3. **Pre-tax Income (1-2) - \$(75,771)**
4. **After tax Income (3 * .6) - \$(45,463)**
5. **Cash Flows (4 - 2.2) - \$38,308**

Note **: Income generated from this investment is based on estimated savings in the following areas: \$20,000 (over the next 5 years) in paper cost as a direct result of shared data hence reduced printing: \$80,000 (over the next 5 years) in maintenance costs and consulting fees associated with repairing the old PCs.

We will not calculate the results based on the NPV methodology.

NET PRESENT VALUE CALCULATION

<u>End of Period</u>	<u>Cash Flows</u>	<u>PV FACTOR</u>	<u>PV</u>
0	\$(418,853)	1	\$(418,853)
1	\$38,308	.9090	\$34,822
2	\$38,308	.8264	\$31,658
3	\$38,308	.7513	\$28,781
4	\$38,308	.6830	\$26,164
5	<u>\$38,308</u>	<u>.6209</u>	<u>\$23,785</u>
TOTAL	\$(227,313)		\$(273,643)
NPV : \$(273,643)			

The NPV calculations suggest that the PC upgrade investment will result in a negative NPV of (\$273,643). This investment is deemed less valuable than expected. The inability of the NPV technique to account for the numerous qualitative results of the investment, make the investment appear unsuccessful or unquantifiable. However, as we understand the competitive climate that many firms compete in we realize that capital investments in new manufacturing equipment and new computers are key components to a competitive existence. Unfortunately, those factors have not be accounted for in the NPV analysis.

To add another dimension to the analysis we will calculate the project results based on the IRR methodology.

IRR CALCULATION

In an effort to conserve space the IRR calculations will be calculated on a financial calculator in the following steps:

<u>End of Year</u>	<u>Cash Flows</u>
0	\$(418,853)
1	\$38,308
2	\$38,308
3	\$38,308
4	\$38,308
5	\$38,308
Totals	\$(227,313)

Using a financial calculator the IRR calculation arrives at a result of -21.46. IRR like many traditional capital budgeting techniques views the investment based on its ability to regain a quantifiable benefit. More specifically, IRR looks at future flows of an investment just equal to the initial investment. In doing so such a perspective can never account for such benefits as increased efficiency and the ability to perform more complex analysis. Additionally, a profit sustaining investment such as this does not attempt to increase profitability. As a result, the conclusions drawn from the IRR calculation is unable to quantify a variety of key elements that would ultimately increase the rate of return hence value of the investment.

The next dimension we will consider is that of the MADM. MADM works to apply weights of importance and confidence to each element within the model. Both quantitative and non-quantitative factors have been compiled based on the corporate goals and priorities at James River Corporation.

The MADM model will be developed based on the following quantitative and non-quantitative factors:

QUANTITATIVE DIMENSIONS:

The following are estimates of NPV and IRR hurdle rates for profit sustaining investments:

1. NPV of \$0
2. IRR of 10%

NON-QUANTITATIVE DIMENSIONS:

1. Ability to share stored data
2. Access to a LAN environment
3. Access to Microsoft Excel, Word, and Powerpoint
4. Ability to perform complex analysis

MADM CALCULATIONS:

<u>Quantitative</u>	<u>Weights</u>	<u>Ratings</u>	<u>Confidence</u>	<u>Score</u>
NPV	10	3	0	0
IRR	10	2	0	0
<u>Non-Quantitative</u>				
Sharing stored data	40	4	.40	64
LAN Access	20	1	.30	6
Microsoft Access	10	1	.30	3
Complex Analysis	10	1	.10	<u>1</u>
TOTAL	100			74

In reviewing the results of the MADM analysis a variety of observations can be made. First, based on the weights assigned to each factor, the most important factor is the ability to share stored data whereas the least important factors are the ability to reach IRR and NPV hurdle rates. Second, based on the assessment of the likelihood of those results occurring, the ability to share stored data had the greatest likelihood whereas the IRR and NPV hurdle rates had the least likelihood. In adding non-quantitative criteria and likelihood of occurrence to the analysis the ability to justify the investment in new personal computers has drastically changed. By basing the decision on a list of criteria deemed important to strategic objectives as oppose to traditional IRR or NPV hurdle rates, analyst have the ability to accept or reject investments based their ability to meet MADM hurdle rates which include quantitative and non-quantitative dimension. In the above illustration, a score of 74 could conceivable surpass project hurdle rates hence justifying the investment where NPV and IRR failed to.

ECONOMIC VALUE ADDED CALCULATIONS

AFTER TAX OPERATING PROFIT:

Income = \$20,000

Tax (@ 40%) = \$8,000

Operating Income (after-tax) = \$12,000

The cost of the investment is \$418,853. The \$418,853 investment will be funded based on the following weighted average cost structure:

WEIGHT COMPONENTS FOR CAPITAL:

Equity = 67%

Debt = 33%

Cost of Equity = 10%

Cost of Debt = 6%

Weighted Average Cost of Capital:

Equity = 67% * 10.0 = 6.70

Debt = 33% * 6.0 = 1.98

Weighted Average % = 8.68

8.68% * \$418,853 = \$36,356

After Income Profit - Cost of Capital = EVA

\$12,000 - \$36,356 = \$(24,356)

Finally, the last technique we will review is the Economic Value Added technique. The EVA calculations on the other hand considers the incremental costs associated with the investment in relation to the benefits. In doing so EVA indicates that the investment will have a \$(24,356) impact, which although unfavorable, is more favorable the results of any other technique used thus far. EVA however grants analysts the opportunity to compare the findings of this profit sustaining investment to others within the industry to determine the overall value. Although it appears unsuccessful, if others within the industry recognize a EVA of (\$50,000) for a similar investment, this investment would be advantageous.

In concluding the case study with a variety of techniques several key points can be noted:

- ◆ **The type of investment (profit adding, profit sustaining) has a significant impact on the capital budgeting technique to be used.**
- ◆ **Corporate goals and objective also have an impact on the way that the results will be reviewed. In this particular example the results under two techniques cause the investment be seem questionable. On the other hand with consideration to the corporate and departmental goals of working toward a data highway the investment quickly becomes viable.**

CONCLUSIONS

The research revealed in this document has created the realization that corporate America is no longer a resting place for complacent and mediocre business practices. As a result of the enormous import and export opportunities each and every organization must create a product or service of value to its customers in the most efficient manner. To do so, companies are challenged to invest in new technologies, products, and innovations to assure their future.

From the sense of urgency placed on financial organizations firms have come to recognize the role of capital budgeting within organization's effectiveness and ability to remain competitive. From this we have learned that capital investments are not optional, but critical to maintain a competitive existence. Most importantly, the competitive edge to be recognized in capital investments result from the proper alignment with corporate goals and objectives. Recent competitive times have emphasized the value using funding where to have the greatest impact corporate goals and objectives.

Through well planned use of capital funds many organizations realize an opportunity to minimize the risks. In time the risks as we know them can be minimized to large degree. Financial and environmental risks are reduced through greater understanding of investments and their link to corporate objectives. Industrial risks can become less deviating as the organization reaps benefits associated with advances in the market place. Most importantly, the risks associated with individual projects are reduced as project managers study select projects according to their fit with corporate goals.

Consequently the strategic planning process within the capital budgeting must work toward reaching a state of safe and wise investments. However as a result of the many different perspectives on capital investments depending on the analytical tool used, there is an overwhelming need for a comprehensive capital budgeting manual to guide such decisions.

Based on the findings in this document the following chapter will propose a capital budgeting tool.

CHP 5:

A STRATEGIC CAPITAL BUDGETING ANALYSIS GUIDE

Up to this point we have learned about the challenges embedded in the capital budgeting process. As the process continues to challenge many organizations, the need for a new perspective on the capital budgeting process analysis becomes apparent. A new perspective must consist of a more comprehensive process would be two-fold: strategic planning dimension and strategic analytical tool.

STRATEGIC PLANNING DIMENSION

Throughout this document great emphasis has been placed upon the way in which capital investments are analyzed and approved. What has become quite apparent is the need for a new dimension to be added to the capital budgeting process- the strategic dimension. In viewing investments from a strategic standpoint several factors must come into play.

First, capital budgeting requires an strategic planning which considers the domino affect associated with investments. More specifically, capital investments taken on by a corporation must plan for impacts at three levels: the enterprise, the competition, and the industry levels. By an impact to the enterprise we refer to the overall performance level of the corporation and how the investment will help the corporation excel at what it does best. In the case of a manufacturing organization, a capital wise investment in new machinery can potentially allow

the firm to manufacture a higher quality product. From another perspective the same investment could place the organization in a different position in relation to competition. For example the investment in new manufacturing equipment could put competition at a disadvantage in that they can not produce relative products at a relative price. In the long run, the competitive and enterprise impacts result in an industry impact. More specifically they will impact the relative position of the organization within industry standings as a low cost and high quality producer.

STRATEGIC ANALYTICAL TOOLS

From the analytical standpoint there a several steps to be taken to insure a comprehensive analysis of proposed investments.

Step 1: Use the Multi-Attribute Decision Model to perform the analysis, which gives consideration to the quantifiable as well as non-quantifiable as discussed in chapter 3.

Step 2: Perform the necessary steps to complete the MADM analysis:

A. Select three traditional capital budgeting techniques to include in a quantitative analysis such as : NPV, IRR, Discounted Payback Period, or EVA are recommended (as outlined in chapters 2 and 3).

- B. Calculate the results of your proposed investment using at least three traditional techniques. (Please note that the traditional technique used for analysis must adequately account for: the time value of money, risk, different size investments as well as estimate cash flows.)**
- C. Compile a list of non-quantitative factors to be considered in the proposed investment. (Ideally these non-quantitative factors should match the department, division, and corporate goals of the organization)**
- D. Evaluate each quantitative and non-quantitative factor in terms of importance to the success of the project by assigning weights. (Note: the total of the weights must equal 100; quantitative dimensions should weigh between 15-30 where as non-quantitative dimensions should weigh between 1-15)**
- E. Rate each factor on a scale of 0-4 based on importance.**
- F. Assign a confidence factor to each factor in the matrix.**
- G. Calculate the score of the matrix by performing the following operation:**
- Weight * Rating * Confidence = Score**

In concluding the matrix the product is a complete chart of quantifiable and non-quantifiable factors that will impact the project performance.

- 3. Analyze the matrix in terms of the impact of the investment at the following three levels: enterprise, competition, and industry. For example a high score NPV factor would imply a high probability of meeting NPV expectations. Additionally, a high score for any of the non-quantifiable factors would imply a high probability of meeting strategic goals in those areas. From a broader perspective the company may enhance product quality at the enterprise level; Surpass competition in terms of quality and perhaps costs of manufacturing; or dominate the industry with high stock prices.**

- 4. Beyond the strategic planning phase and the strategic analysis all investments must be reviewed periodically to assure precise alignment with the goals and objectives of the organization. Such review process can be performed quarterly, semi-annually, or annually by an advisor board.**

The above steps will provide a multi-dimensional perspective on the investment process which will allow for a clearly understanding of investment

opportunities and strategic impacts. More importantly, the capital budgeting process will become a more comprehensive and useful process.

FOOTNOTES

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