Quantitative Risk Assessment Tools

There are a number of different quantitative assessment tools that are available. For the Exam, you need to know about the following:

1) **Value at Risk (VaR)** measures the potential loss in value of a risky asset or event over a defined period for a given confidence interval. It is based on the assumption that the possible outcome of the event is represented by a normal distribution (bell curve). With a normal distribution, we know that 95% of the results will lie within 1.96 standard deviations of the mean, and that 99% of the results will lie within 2.57 standard deviations of the mean. Using this information, we can predict what the range of results will be with a measured level of confidence.

> Example: If the VaR on an asset is $ 100 million at a one-week, 95% confidence level, there is a only a 5% chance that the value of the asset will drop more than $ 100 million over any given week.

2) **Cash Flow at Risk** is similar to VaR, but provides a different measure. As the name implies, it measures the likelihood that cash flows will drop by more than a certain amount. Again, this is done using the measures of a normal distribution.

3) **Earnings at Risk** measures the confidence interval for the fall in Earnings during the specific period.

4) **Earnings Distributions** is a graphical representation of the probability of a level of return and the level of return itself.

5) **Earnings per Share Distributions** is a graphical representation of the probability of the amount of earnings per share (EPS) and the likelihood of each level occurring.

Question 47: The measure that provides a quantitative measure of the accuracy of the potential financial loss is:

a) Residual risk.

b) Inherent risk.

c) Risk Ranking.

d) Value at risk.

(HOCK)

Enterprise Risk Management

Note: The main source for information about ERM is the document entitled "Enterprise Risk management – Integrated Framework." This was published in 2004 by the Committee of Sponsoring Organizations (COSO). A number of other organizations also have comprehensive guidance about ERM systems. In the LOS it states that a candidate must be able to "identify and describe the critical elements of an ERM approach to risk management as outlined in one of the major conceptual frameworks (e.g., COSO, Basel II, Casualty Actuarial Society, Australian/New Zealand Risk Standard, etc.)" We have selected the COSO ERM approach as the one for our materials.

As defined by COSO,

> "Enterprise risk management is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may effect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding achievement of entity objectives."

What separates ERM from more traditional risk managements methods is that it attempts to have the organization look at the risks that face not only individual departments within an organization, but the organization (enterprise) as a whole. In the past, each individual department or division was often responsible for its own risk assessment and management. This led to some repetitive work as multiple departments did the same thing and also created gaps where an event that may have an impact on the entity as a whole was not identified as having on impact on any one individual department. ERM attempts to get the whole organization to be coordinated in its risk identification, assessment and management.

One of the elements of the entity that becomes more relevant in an ERM system is the **corporate governance** system of the entity. Because risk is now being looked at on the entity level, the corporate governance processes will be more related to the risk identification and assessment that takes place under an ERM system.

ERM assists the organization in the achievement of its objectives in four different categories:

1) **Strategic** - these are the high level goals and objectives that are aligned closely with its mission.
2) **Operations** - this includes the effective and efficient use of the resources of the company.
3) **Reporting** - this includes the reliability of the reporting that the company dies. While we may think that this focuses on the financial statement reporting of the company, it should actually include any reporting that the company does.
4) **Compliance** - this insures that the company is in compliance with all relevant laws, rules and regulations, no matter what the source of the requirement (internal or external).

The main components of the ERM system as defined by COSO are:

1) **The internal environment** is the atmosphere in the organization towards risk and risk management. It includes the risk management philosophy, the risk appetite of the company, the ethical values of the company and the environment in which they operate.
2) **Objective setting.** Before risk management can be done, the objectives and goals of the organization must be determined and established.
3) **Event identification**. Events are the internal and external events that must be identified and then classified as either a risk or an opportunity (which may need to be acted upon). (This is looked at in more detail below.)
4) **Risk assessment** is the process of analyzing and considering the potential likelihood and impact of an event. This includes looking at the inherent and residual risk of the event.

> Note: **Risk analytics** is the use of software programs to quantify and calculate the risk exposure that results from various risks. This process is dependent upon the information that is input into the system in regards to the risk event . This means that the result will be greatly influenced by the accuracy or reality of the inputs into the system.

5) **Risk response** is what the company will decide to do in respect to the risks identified. The actions include avoidance, acceptance, reduction and sharing the risk.
6) **Control activities** are all of the policies and procedures that are implemented to ensure that the risk responses are effectively carried out an implemented.
7) **Information and communication**. All of the relevant information needs to be communicated to the appropriate person in a time frame that will allow that person to carry out their duties. Communication will be upwards, downwards and across the entity.
8) **Monitoring**. The system that is in place needs to be monitored to ensure that it continues to be appropriate and properly operated.

The **benefits** of a well-developed and implemented ERM system are numerous, and will vary from business to business based on the characteristics of each business. Some of the more common benefits are:

1) An alignment of the entity's strategy and their appetite for risk,
2) An improvement in risk response decisions,
3) A reduction in the number and impact of operational surprises and losses,
4) The identification and management of multiple and cross-enterprise risks,
5) An improved ability to seize (act on) opportunities that arise, and
6) An improved utilization of capital and the resources of the company.

Event Identification Techniques

An event is an incident or occurrence emanating from internal or external sources that affects implementation of strategy or achievement of objectives. Events may have positive or negative impact, or both.

In event identification, management recognizes that uncertainties exist, but does not know whether an event will occur, or when, or its precise impact should it occur. The events that could impact a company can come from both inside the company (internally) and from outside the company (externally).

As listed in COSO Enterprise Risk Management – Integrated Framework, the following techniques are listed as event identification techniques.

- **Event inventories** – These are detailed listings of potential events common to companies within a particular industry, or to a particular process or activity common across industries.
- **Internal analysis** – This may be done as part of a routine business planning cycle process, typically via a business unit's staff meetings. Internal analysis sometimes utilizes information from other stakeholders (customers, suppliers, other business units) or subject matter expertise outside the unit (internal or external functional experts or internal audit staff). For example, a company considering introduction of a new product utilizes its own historical experience, along with external market research identifying events that have affected the success of competitors' products.
- **Escalation or threshold triggers** – These triggers alert management to areas of concern by comparing current transactions, or events, with predefined criteria. Once triggered, an event may require further assessment or an immediate response. For example, a company's management monitors sales volume in markets targeted for new marketing or advertising programs and redirects resources based on results.
- **Facilitated workshops and interviews** – These techniques identify events by drawing on accumulated knowledge and experience of management, staff, and other stakeholders through structured discussions. The facilitator leads a discussion about events that may affect achievement of entity or unit objectives. For example, a financial controller conducts a workshop with members of the accounting team to identify events that have an impact on the entity's external financial reporting objectives. By combining the knowledge and experience of team members, important events are identified that otherwise might be missed.
- **Process flow analysis** – This technique considers the combination of inputs, tasks, responsibilities, and outputs that combine to form a process. By considering the internal and external factors that affect inputs to or activities within a process, an entity identifies events that could affect achievement of process objectives. For example, a medical laboratory maps its processes for receipt and testing of blood samples. Using process maps, it considers the range of factors that could affect inputs, tasks, and responsibilities, identifying risks related to sample labeling, handoffs within the process, and personnel shift changes.

- **Leading event indicators** – By monitoring data correlated to events, entities identify the existence of conditions that could give rise to an event. For example, financial institutions have long recognized the correlation between late loan payments and eventual loan default, and the positive effect of early intervention. Monitoring payment patterns enables the potential for default to be mitigated by timely action.
- **Loss event data methodologies** – Repositories of data on past individual loss events are a useful source of information for identifying trends and root causes. Once a root cause has been identified, management may find that it is more effective to assess and treat it than to address individual events. For example, a company operating a large fleet of automobiles maintains a database of accident claims and through analysis finds that a disproportionate percentage of accidents, in number and monetary amount, are linked to staff drivers in particular units, geographies, and age bracket. This analysis equips management to identify root causes of events and take action.

Cost-Benefit Analysis In Risk Assessment and Decision Making

While in a perfect world, a company would attempt to mitigate every risk and eventually reduce the likelihood of the risk occurring to zero, it is not possible to do this. For almost all risk mitigation responses and decisions, there is a cost. The cost may be a direct dollar amount that needs to be paid, or it may be an indirect cost such as time or other opportunity costs. Because of the cost of the risk response, sometimes a company will decide that they are better off by not addressing the risk, and simply hoping that it does not occur.

This will happen when the cost of responding to the risk is greater than the amount that might be lost should the risk event. In a very basic illustration, a company would not pay $2,000 to buy an insurance policy that provides only $1,000 coverage.

This same cost-benefit analysis must be done for all risks that may be able to be reduced.

Also, the costs of the risk response and the potential loss from the event may be difficult to calculate or assess. However, the company will have to somehow determine an expected value for both the cost of the risk response and also the potential loss from the occurrence of the event.

Risk Measurement in Banks

Capital adequacy is a measurement that is usually used by banks. It assesses whether the bank has sufficient capital (assets) compared to its liabilities. Most countries monitor a Capital Adequacy Ratio for banks and use this to monitor banks and through this monitoring of the banks protect the bank's depositors. If the bank does not have sufficient capital (assets) there is the risk that they will not be able to pay their depositors when the depositors demand payment.

There are different ways in which the capital adequacy can be measured or looked at. These are:

1) **Solvency** relates to the ability of the bank to pay its long-term obligations as they come due.
2) **Liquidity** relates to the ability of the bank to pay its short-term obligations as they come due.
3) **Reserves** is the amount of cash that the bank must keep on hand in order to be able to pay its depositors.
4) **Sufficient Capital** is whether or not the bank has sufficient capital to properly protect its depositors from default.

Section D – Investment Decisions

Introduction to the Investment Decisions Section

This section makes up 20% of the CMA Part 2 exam. The whole exam will contain 100 multiple-choice questions and 2 essay questions. Topics within an examination part and the subject areas within topics may be combined in individual questions. Therefore, we cannot predict how many multiple choice questions you may get from this section, nor can we predict whether you will get any essay questions from this section. The best approach to preparing for this exam is to know and understand the concepts well and be ready for anything.

Capital budgeting is the largest topic in the Investment Decisions section. Capital budgeting refers to a group of methods used by a company to analyze possible projects to invest in. It is called "capital budgeting" because capital – whether debt, equity, or retained earnings – is a limited resource. Since management is faced with limited sources of capital, management needs a means of carefully deciding whether a particular project under consideration is one that will contribute to profits and thus to the value or wealth of the firm and its owners, the stockholders. If more than one project is under consideration, management needs to be able to identify the projects that will contribute the most to profits and value. Capital budgeting makes it possible to evaluate the different investment opportunities that are available to a company and decide which opportunities should be pursued.

Thus, capital budgeting is used to make long-term planning decisions for investments in projects. These projects could be the purchase of fixed assets or any other purchases or investments that will provide benefit for a period of time greater than one year into the future. These are long-term decisions, and they usually involve large amounts of money. Once a company has made a decision, it is generally committed to it for a great deal of time. Therefore, it is critical to the company's success that its management makes correct decisions that will be profitable and beneficial in the long run.

In this section, we will focus on the process of evaluating the different investment opportunities that are available to the company and the process of deciding which should be pursued. The process of financing these investments is covered in "Raising Capital" in Section B, and is not discussed in this section.

It is important that you feel comfortable with this section, Investment Decisions, because it is an important part of the exam. You need to be very fluent in the following areas:

- Calculating the cash flows for all of the years of a project, including the cash flows resulting from the disposal of the assets at the end of the project,
- Calculating the Depreciation Tax Shield,
- Calculating the Net Present Value,
- Calculating the Internal Rate-of-Return,
- Determining which project to invest in, and
- Calculating and using other covered methods such as the Payback Method and the Accounting Rate-of-Return.

The topic of Investment Decisions also includes Valuation, both in the context of valuing a stock and in the context of valuing a business as a potential acquisition.

Capital Budgeting Process

The firm's objective in using capital budgeting to select projects is to **maximize the value of its equity and thus, shareholder wealth.**

A new plant, new product line, new business under consideration, or other similar long-term investments are projects that might be evaluated using capital budgeting techniques. In evaluating a potential investment, capital budgeting focuses on the **entire life of the project**. It considers all expected cash inflows (including expected cash savings) as well as all expected cash outflows that should result from investing in the project.

Therefore, capital budgeting is not concerned with only one year's or one accounting period's expected results from an investment in a project. Instead, capital budgeting is a "life-cycle" or "cradle-to-grave" approach to selecting, implementing and monitoring the results of long-term investments.

The life-cycle approach accumulates all revenues and all costs for a particular project throughout the years that the project is expected to have revenues and costs. All of the revenues received during the life of the project are included. Costs include everything from the initial investment to research and development, manufacturing, and even anticipated after-sale costs, such as customer service costs and warranty costs – for as long as the project is ongoing.

When used in capital budgeting, the life-cycle approach accumulates all **expected revenues,** all **expected costs** and all of the **expected cost savings** related to the project over its entire planned life. If a decision must be made whether or not to embark upon a project, the *expected* revenues, costs and cost savings are determined using the **incremental** approach. In the incremental approach, the only cash flows **relevant** to the analysis are cash flows that would be **additional as a result of the activity**. On the other hand, if the decision calls for a choice between two or more alternatives, the **differential** approach is used, in which the only cash flows **relevant** to the analysis are those that would **differ between or among the alternatives**. The terms "incremental" and "differential" are often used interchangeably. However, they are not the same.

For instance, when using a "life-cycle" capital budgeting approach to determine whether to produce a new product, a company will first use life-cycle costing and various projected alternative **selling price/sales quantity combinations** to determine the best price to charge for the product. The selected price will be expected to maximize life-cycle operating income. Once a pricing policy is determined, the company will turn to capital budgeting techniques to determine whether the return on the project will be sufficient to make it an attractive investment.

Capital budgeting is a decision-making tool. In the capital budgeting phase, all the cash inflows, outflows and savings (such as tax savings resulting from the depreciation of the purchased assets) are evaluated. Four major capital budgeting techniques are used. The four methods offer four different ways to look at a project. All have their places in capital budgeting analysis, and we will discuss each of them in detail.

The time value of money is used in three of the methods, **Net Present Value, Internal Rate-of- Return** and **Profitability Index,** recognizing the fact that a $1,000,000 net cash inflow received next year is worth more than a $1,000,000 net cash inflow received five years from now. Therefore, to make the analysis meaningful, the expected net cash flow for each of the years over the entire life of the project is discounted to its present value at the beginning of the project's life. In a fourth method, the **Payback Method**, the future net cash inflows are compared with the net initial investment (outflow) to determine the time it will take to recoup the net initial investment, without taking the time value of money into consideration. And the final method, the **Accrual Accounting Rate-of-Return Method**, divides an **accounting** measure of net income for the project (rather than cash flow) by an **accounting** measure of investment to calculate an annual average accounting rate-of-return.

The Stages in Capital Budgeting

There are six stages that need to be followed in the process of making capital investment decisions. They are:

1) **Identification Stage** – This stage indicates which types of capital expenditure projects are necessary for the company to accomplish its organizational objectives. For instance, if the company needs to reduce expenses, it would identify projects to improve productivity and efficiency. If the company needs to increase revenues, it would look for projects to develop new markets or increase existing markets.

2) **Search Stage** – During this stage, the company explores alternative capital investments that will achieve the organizational objectives. Various technologies and other alternatives are researched.

3) **Information-Acquisition Stage** – The company then must consider the expected costs and benefits (quantitative and qualitative) of alternative capital investments. There are four main steps in determining net cash flows for the project within this stage:

   - **Determine the net investment and initial-cost cash outflow**, which are the net cash outflows associated with the increase in long-term assets needed for the project(s) under consideration, as well as the initial cash outflows for things such as advertising, employee training, and research and development.
   - Determine additional net working capital requirements, which is the increase in net current assets that will result from the investment decision. The additional net working capital that is required in the information-acquisition stage must be treated as an investment because it represents short-term assets that are not available for other purposes for the company.
   - Determine the estimated subsequent net operating cash flows for each future period that will result from using the assets that are acquired. To do this, we need to have reliable estimates of revenues and expenses and tax savings.
   - Determine the net cash flows at the end of the project relating to disposal of the long-term assets and release of working capital.

   Note: All amounts gathered for inclusion during the Information-Acquisition Stage are **net amounts**, that is, cash inflows minus cash outflows.

4) **Selection Stage** – At this stage the company chooses projects for implementation on the basis of financial analysis and nonfinancial considerations.

5) **Financing Stage** – The company obtains the necessary project funding.

6) **Implementation and Control Stage** – This is the final stage in which the project is implemented and monitored over time.

In this section we are interested largely in only the third and fourth steps from the above list. We will look at potential investments from a **purely financial viewpoint**. However, in real-world analysis of a potential project, it is important to realize that there may be non-financial considerations that will cause the company to select an investment that is not the most "profitable" (financially). Such factors can include the role of a business in a local community, media coverage and reaction to a decision that is made, or not made, or other similar items.

Note: A **post-completion audit** or **post-audit** of a capital budgeting project involves comparing the actual costs and benefits of the project with the original estimates. Post-completion audits should be done for all large projects and for all strategically important projects, regardless of size. They should also be done for a sample of smaller projects. This process lets management know how close the actual results of the project came to its original estimates. This feedback helps management to learn where their forecasts may have been off and to understand what important factors they may have omitted in their capital budgeting analysis. This can help to improve future capital budgeting analyses.

Terms Used in Capital Budgeting

In the process of capital budgeting there are a number of different types of cash flows, revenues and costs with which we need to be familiar, either to make sure that they are taken into account in, or excluded from, the decision-making process.

Avoidable Cost	An avoidable cost is one that can be avoided or eliminated by making a decision not to invest, or to cease investing. Because these costs may be different among options, they will be **relevant costs** that will need to be addressed if the costs are different among the options.
Committed Cost	The company has already agreed to and committed itself to a committed cost, even if the invoicing or delivery of the product or service has not taken place. A long-term contract (for rent, for example) is an example of a committed cost. This is similar to a sunk cost (defined later) in that it can't be changed, but it is different because the money has not yet been spent. However, it will have a future impact and therefore it needs to be recognized as a cost that needs to be covered. But if the committed cost cannot be changed by any current decision, it is not relevant to a process of deciding among alternatives currently, because it will be the same no matter which alternative is selected.
Common Cost	A common cost is shared by all of the available options or all divisions and cannot be allocated among them. Because it is the same among all options, it is **not relevant** and should not be taken into account in making a decision between any two different options.
Cost of Capital	The cost of capital is the weighted average cost of interest on debt (net of tax) and the implicit and explicit cost of equity capital. This is the minimum required rate-of-return for a project in order to not dilute (reduce) shareholders' interest. This rate is often used in net present value calculations.
Deferrable Cost, or Discretionary Cost	A deferrable cost is one that can be deferred to future periods without creating a significant impact in the current period. Marketing and training are often considered deferrable costs.
Differential Revenue, Cost or Cash Flow	A differential revenue (or differential cost, or differential cash flow) is the difference in revenue, cost, or cash flow between two alternatives. This results from choosing one option over another option. These are the important factors to consider when deciding between two options. **Differential** revenues, costs and cash flows are different from **incremental** revenues, costs and cash flows (see box below).
Fixed Cost	A fixed cost remains constant over the specified level of activity (the **relevant range**).
Opportunity Cost	An opportunity cost is a **forgone alternative** that had to be dismissed in order to achieve a goal. Opportunity cost is the cost of the "**next best alternative**" or the "**next highest valued alternative.**" It is the price of not only some other alternative that should be considered, but also the highest other opportunity that must be given up in order to achieve one project.
Imputed Cost	An imputed cost is an **opportunity cost**. This is the benefit that is given up as a result of using the company's resources elsewhere. It is the benefit of the next best option. Another definition of an imputed cost is one that is not stated and must be calculated in some way.
Incremental Revenue, Cost or Cash Flow	An incremental revenue (or incremental cost or incremental cash flow) is the additional revenue, cost or cash flow from choosing an activity over not choosing any activity. These are the important factors that need to be taken into account when deciding whether to embark upon a project. A capital budgeting analysis may use either a **differential** approach or an **incremental** approach, whichever is appropriate.
Relevant Revenues, Costs or Cash Flows	Relevant revenues, costs, or cash flows **vary** with one course of action over another. These are the important factors in a decision, because all **other** revenues, costs and cash flows are the same for all options. Relevant revenues, costs, or cash flows may be either **incremental** or **differential**.
Sunk Costs	A sunk cost is one that has already been incurred and therefore is **not a relevant cost**. Sunk costs are not taken into account in decision-making because the money has already been spent, and any new decision will not change those costs.

You need to know the definitions of all of these terms, as well as how they are used in different parts of the capital budgeting and decision-making processes.

> Note: The terms "differential" and "incremental" are different terms with different meanings, as outlined above. However, the meanings are very close – and on the exam, they may be used interchangeably. The difference between these two terms is discussed in more detail in Section C. For simplicity's sake in these materials, we will use the term "incremental" to represent both concepts.

Identifying and Calculating the Relevant Cash Flows

Before beginning a discussion of the various capital budgeting methods, we need to discuss what **the relevant cash flows** are in each of the years of the project. This is critical because almost all capital budgeting analyses will be based upon an analysis of these individual cash flows. Three of the four capital budgeting screening methods under discussion (Net Present Value, Internal Rate-of-Return and Payback Method) rely on the relevant expected cash inflows and outflows, whereas one (the Accrual Accounting Rate-of-Return Method) utilizes relevant accounting incomes and expenses.

> Note: Each of the individual cash flows is discussed first without reference to the tax effect of the cash flow. After the cash flow is discussed, the tax implications, if there are any, are then covered. It is important that you know which cash flows have an associated tax implication and which do not.

The Meaning of "Expected Cash Flow"

In capital budgeting, we use the term **expected cash flow**. That term has a specific meaning. You may recall that in the sections on Managing Financial Risk and CVP Analysis in this book, we encountered the term "expected value." An expected value is the weighted average of all of the possible values, weighted according to the probability of each one's occurring. The annual **expected cash flow** used in a capital budgeting analysis for a given year is the **expected value of the forecasted cash flows** for that year, or the weighted average of all of the possible cash flows. Several possible cash flows will be projected for each year of a project's life and probabilities will be determined for each possible cash flow for each year. The cash flow amount that will be used in the capital budgeting analysis for each year is the **expected cash flow,** or the weighted average of all the possible cash flows, weighted according to their probabilities.

All expected cash flows in a capital budgeting analysis are treated as though they are received at the *end* of the year to which they are assigned, even though in actuality, they will be received throughout the year. Therefore, if an exam question says that a particular cash flow is received at the **beginning** of a year, we treat it as if it is received at the **end** of the previous year for capital budgeting purposes.

Expected Cash Flows at the Beginning of the Project (Year 0)

These are the cash outflows and inflows that are expected to occur at Day Zero or shortly thereafter, when a new project is first implemented. They relate to the net initial investment and consist of three components:

1) **Initial investment.** This is the **cash** outflow that is used to purchase the new machinery or make the initial investment into the project. This amount needs to include any setup, testing or other related costs. Essentially, all of the costs necessary to get the project operating are included as the initial investment.

> **Tax Effect**: There is no immediate tax effect in respect to the initial investment. Any tax benefits that may arise will occur over the life of the project as the machinery or equipment is depreciated. This is covered in the section on the annual cash flows over the life of the project.

2) **Initial working capital investment.** "Working capital" is defined as total current assets less total current liabilities. When speaking of an expected increase in working capital, it means that we expect accounts receivable and inventory to increase because of the project under consideration. Raw materials inventory may need to be purchased. Accounts receivable will increase as soon as sales are made. We also expect that accounts payable related to the purchased inventory will increase. However, the increase in accounts payable will not be as large as the increases in accounts receivable and inventory. Thus, working capital will increase incrementally by the amount of the increase in current assets (accounts receivable and inventory) minus the amount of increase in current liabilities (accounts payable).

This incremental increase in working capital requires cash, needed to purchase inventory. And the increase in accounts receivable represents goods supplied or services rendered for which the company has incurred expenses, but for which it has not yet received payment. This increase in working capital is a **cash outflow** at the beginning of the project. Remember that if a new machine is replacing an old one, the initial working capital investment will be the difference between the working capital investment required to operate the new machine and the working capital investment that was required to operate the old machine. In the case of a new machine replacing an old one, the initial working capital investment would be an **incremental** amount.

Tax Effect: There is no tax effect related to working capital. Therefore, the amount that needs to be included in the capital budgeting analysis is the actual amount of the increase in working capital that the company experiences.

3) **Cash received from the disposal of the old machine.** This applies if there is an old machine to be disposed of. Cash received from the disposal of the old machine is a cash inflow and therefore **reduces the initial investment** for the new machine.

Tax Effect: When the old machine is sold, there will be a tax effect related to the gain or loss on the sale. The amount of the gain or loss is calculated as the difference between the tax basis (the asset's book value for tax purposes) of the asset and the cash received from the sale of the asset.

If there is a gain, this gain will be taxed. The effect of this is a reduction of the cash inflow by the amount of taxes paid on the gain.

If there is a loss, this loss will be deducted. The effect of this deductible loss is that the company pays less in taxes in total, which saves them money. Therefore, the loss on the disposal of the old equipment creates a cash "inflow" in the form of lower taxes. The amount of this tax savings is a cash inflow that increases the cash received from the sale of the asset for the capital budgeting calculation.

However, be aware that under U.S. tax law, capital losses are allowed on the tax return only as a reduction of capital gains from other transactions. In order to be able to use the tax benefit from the loss in the year in which the loss occurs, a company needs to have other capital gain transactions in the same year that the loss can be deducted from. A net capital loss can be carried back 3 years and forward up to 5 years as a short-term capital loss. So for this purpose, we must assume that the company has other capital gains equal to or greater than this capital loss and thus will be able to use this capital loss on its tax return to reduce those gains.

Note: The calculation of the taxable gain or loss should use the **tax basis** of the asset. The tax basis is the equipment's book value for tax purposes, which may be different from the equipment's book value for book purposes.[c] In some questions on the exam, however, the book value of the asset may be given instead of the tax basis. If only the book value is given, you should simply use the book value to calculate the gain or loss. But if both the book value and the tax basis are given, use the tax basis.

It is possible that a problem will tell you that the company's tax rate for capital gains is different from its tax rate for cash flows from operations. If that occurs, use the tax rate for capital gains to calculate the tax due on the gain.

Ongoing Annual Net Cash Flows from Operations

After the project has started, the company will have cash flows that occur on an annual basis. The annual cash flows used may be the same each year during the project, or they may be different.

The operating cash inflows may result from one or both of two sources:

1) **Increased sales.** As a result of having made this investment, the company should experience an increase in sales, which will lead to an increase in profits. The cash inflow for capital budgeting purposes is the amount of the increased profits (revenues less expenses) that result each year from this investment.

2) **Decreased operating expenses**. While this will also lead to increased profits, it comes about from the other side of the process. The new equipment may be more efficient than the old equipment and this will lead to lower operating costs. The cash inflow for capital budgeting purposes is the amount of the decreased operating expenses of the new machine compared to the old machine.

Tax Effect: The company will need to pay taxes as a result of either increased sales and profits or decreased operating costs. Therefore, the cash flows related to these items need to be reduced for the taxes that will be paid as a result.

Additionally, the company may have cash outflows in years after the initial investment is made. There are two potential sources of cash outflows in the following years:

1) **Another cash investment.** It is possible that a follow-up investment must be made after some period of time, or that there will be a capital investment that needs to be made with the equipment to maintain it after a certain number of years. These would both be treated as cash outflows for the amount that is paid in the year it is to be paid.

Tax Effect: The tax effect of additional investments will be treated in the same manner as the original investment. The tax savings will be received (and the cash inflow received) when the asset is depreciated.

2) **Further working capital investment.** The company may have another increase in its working capital later in the project's life. This will be treated in the same manner is the increase in working capital at the start of the project.

Tax Effect: As was the case with the original investment in working capital, any increase in working capital in subsequent periods also does not have a tax effect.

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[c] The tax basis of an asset is the asset's book value for tax purposes. In the U.S., many companies use a different method of calculating depreciation on their tax return than they use for book purposes. This is because the tax laws say that depreciation must be calculated a certain way on the tax return, whereas U.S. GAAP says it must be calculated a different way for financial reporting. In capital budgeting, we need to find out what effect the depreciation reported on the tax return will have on cash. Even though depreciation itself is a non-cash expense, it has an effect on the amount of tax that is due because the depreciation expense affects net taxable income. The amount of tax due is based on net taxable income, and taxes paid affect cash. Therefore, we must use the type of depreciation that will be used on the tax return in the capital budgeting analysis. So the asset's tax basis is simply its book value on the balance sheet of the tax return, calculated according to the way depreciation is calculated on the tax return.

Depreciation Tax Shield – A Cash Inflow

The most difficult recurring cash flow over the life of the asset is the cash flow that arises from the depreciation tax shield. As we have already discussed in respect to the tax effect of the initial investment in the assets, the tax effect of the asset is received as the asset is depreciated. We will now look at this depreciation tax shield in more detail.

The amount of depreciation that will be deductible for tax purposes will depend upon the depreciation method being used for **tax purposes**. For most assets, the method of tax depreciation in the U.S. is calculated using a system called MACRS (Modified Accelerated Costs Recovery System), and it is essentially based on the double declining balance method of depreciation (or the 200% declining balance method – these are two names for the same thing). **However, a problem could say that any method of depreciation is being used for tax purposes.**

If MACRS being used, the annual depreciation amount is calculated as the cost of the asset multiplied by the MACRS depreciation rate for each year the depreciation is taken. The depreciation rate is a different rate for each year, and of course depends on the number of years over which a property is depreciated. These rates will be given to you in the exam problem, but it is important that you remember to multiply this rate by the **full cost of the asset. Salvage (or residual) value is not taken into account when calculating the depreciation for the depreciation tax shield in capital budgeting regardless of which depreciation method is being used.**

Regardless of what method of depreciation is being used for tax purposes, the depreciable base for tax purposes is always 100% of the asset's cost, according to U.S. tax regulations. This is true even if the depreciation method for tax purposes is the straight-line method and not MACRS.

This amount of tax deductible depreciation will be a reduction of the company's taxable income, because depreciation expense is a tax deductible expense. The amount of tax deductible depreciation will cause an equal reduction in the company's taxable income. That will, in turn, cause a reduction in the amount of tax that will be due. This tax reduction will not represent an actual cash inflow, but it reduces the cash outflow of the company for taxes. Therefore, the amount of tax savings that occurs as a result of the depreciation expense is treated as a cash inflow for capital budgeting purposes. The amount of tax savings that results is called the **depreciation tax shield**.

The **depreciation tax shield** is calculated as follows for each year of an asset's life:

Annual Depreciation as Calculated x **Marginal tax rate**

If the new machine is replacing an old machine, the only **relevant** depreciation amount to use here is the **amount of change** in each year's depreciation expense between the new machine and the machine it will replace. Note that this amount of change in the annual depreciation expense may be different in different years of the project, since the depreciation on the old machine (if kept) might have ended before the useful life of the new machine ends.

Note: On the exam, you will be told the method of depreciation that is being used for tax purposes. Make sure you read the problem carefully to identify the method, and calculate the depreciation and the depreciation tax shield using whatever method is given. If the problem gives one depreciation method for book purposes and another method for tax purposes, **always use the method being used for tax purposes.**

Note that for tax purposes, the *entire cost* of an asset is always depreciated over its depreciable life. That means *do not subtract any salvage value from the cost* to calculate the depreciable base, regardless of what method of depreciation is being used.

If straight-line depreciation is used for tax purposes, **do not** subtract the salvage value from the cost to calculate the depreciable base, even though straight line depreciation for book purposes does require the subtraction of the salvage value. Under U.S. tax laws, 100% of an asset's cost is always depreciated, and so that is what the exam requires for depreciation calculations for tax purposes.

If you are using some of the older former CMA questions in your studies (other than those in your HOCK program), you may find that the rule of not subtracting salvage value from the cost is not being followed in some of those problems. At one time, the exam required depreciation to be calculated differently, and those old questions reflect that. **Do not be concerned about this.** It does not mean that you should calculate the depreciation that way now. The correct way to calculate depreciation has changed since those questions were released, and the ICMA will not expect problems to be solved that way on exams today. Unfortunately, some old questions are still being distributed according to the former standards, and that has confused quite a few candidates. You should calculate the depreciation on those questions the correct way. If your answer differs from the "correct" answer given, determine whether the difference is due to the fact that they subtracted the salvage value from the cost in calculating the depreciable base. If that is the only difference, then you have solved the problem correctly.

All questions in your HOCK study materials have been updated to use the currently correct depreciation calculations.

Cash Flows at the Disposal or Completion of the Project

When the project is terminated, there are number of potential cash flows related to this event. These potential cash flows are:

1) **Cash received from the disposal of equipment.** The cash that is received from the sale of any assets (equipment, machines or the investment project itself) is a cash inflow in the final year of the project.

   Tax Effect: If the sale of the assets results in a gain or loss, there will be a tax effect from this gain or loss. The gain or loss is calculated by comparing the tax basis (or book value, if the tax basis is not given) with the cash received. If there is a gain, the cash inflow will be reduced by the taxes paid on the gain. If there is a loss, the loss will be tax deductible and this tax savings will be added to the cash received from the sale to calculate the cash inflow. This tax treatment is the same as the treatment of the gain or loss on the sale of the old equipment at the start of the project.

   As with the sale of old equipment, in the event of a loss, we must assume that the company has other capital gains that it can deduct the loss from and thus will be able to use the loss to lower its tax bill.

   Again, as with the sale of the old equipment, it is possible that a problem will tell you that the company's tax rate for capital gains is different from its tax rate for cash flows from operations. If that occurs, use the tax rate for capital gains to calculate the tax due on the gain.

2) **Recovery of working capital.** The initial incremental investment and any subsequent investments in working capital are usually fully recouped at the end of the project. This is because the final accounts receivable will be collected and not replaced with other accounts receivable (for this project), the inventory associated with the project will have been sold, and all the related accounts payable paid. It is also possible for an investment in working capital to be recovered before the end of the project. Whenever working capital is recovered, it is a cash inflow in that year with no tax effect.

> **Tax Effect**: There is no tax effect related to working capital. Therefore, the amount that needs to be included in the capital budgeting analysis is the actual amount of the working capital that is recovered at the end of the project.

Note: It is very common on the exam for a question to look only at the cash flows in the final year of the project. You need to remember that there are usually two events in this type of question: 1) the sale of the assets themselves, and 2) the release of working capital. Of these, there is a tax effect only for the gain or loss on the sale of the asset. The release of working capital is not a taxable event.

In addition, there may be after-tax operating cash flows and/or a depreciation tax shield for the final year. Whether to use these or not in the answer depends on what the question asks for and what information is given. For instance, if the equipment will be fully depreciated before the final year, there will be no depreciation tax shield in the final year. And even though there may be cash flow from operations and depreciation in the final year, the question may ask only for the cash flows related to the disposition of the equipment, for example.

Question 48: Garfield, Inc. is considering a 10-year capital investment project with forecasted revenues of $40,000 per year and forecasted cash operating expenses of $29,000 per year. The initial cost of the equipment for the project is $23,000, and Garfield expects to sell the equipment for $9,000 at the end of the 10th year. The equipment depreciates over 7 years. The project requires a working capital investment of $7,000 at its inception and another $5,000 at the end of year 5. Assuming a 40% marginal tax rate, the expected net cash flow from the project in the 10th year is:

a) $32,000

b) $24,000

c) $20,000

d) $11,000

(CMA Adapted)

Question 49: Kore Industries is analyzing a capital investment proposal for new equipment to produce a product over the next 8 years. The analyst is attempting to determine the appropriate "end-of-life" cash flows for the analysis. At the end of 8 years, the equipment must be removed from the plant and will have a net book value of zero, a tax basis of $75,000, a cost to remove of $40,000, and scrap salvage value of $10,000. Kore's effective tax rate is 40%. What is the appropriate "end-of-life" cash flow related to these items that should be used in the analysis?

a) $45,000

b) $27,000

c) $12,000

d) $(18,000)

(CMA Adapted)

Other Tax Considerations

When management of a company is making an investment decision, it needs to take into account the effect that the investment will have on its state and local taxes. We have already covered the tax effect of income taxes. However, there may be other tax considerations that should be considered as well.

The company's management will need to consider available **tax concessions or reliefs** when it is comparing different options for investment. A tax concession or relief is a reduction in the tax rate that the company needs to pay (concession) or perhaps a period of time during which taxes do not need to be paid at all (relief). This can become a very complicated issue when a company has investments in different countries or tax jurisdictions in the U.S.

For example, it is common for a city, state or county to grant property or other tax concessions to a company in order to persuade the company to build an office or production facility within that region. These concessions can only be for taxes that that government levies (such as local income taxes or property taxes). This means that local governments cannot provide federal tax concessions or relief.

We are not going to focus on the numbers related to the above tax issues (different tax jurisdictions or tax concessions), but you simply need to be aware that these considerations do exist.

We will look only at the effect of income taxes on the cash flows that a company will have in relation to a particular project.

Irrelevant Cash Flows

When determining relevant cash flows, remember that **sunk costs**, such as the book value of existing equipment, are **not relevant**, because they will not change as a result of any capital budgeting project under consideration. Also, there may be overhead costs allocated to a branch, for instance, and the capital budgeting project under consideration would cause an increase in the overhead costs to be allocated to that branch. However, that is also **not relevant** unless the **total** overhead costs for the company as a whole will actually change as a result of the project. If the total overhead costs do not change but are simply allocated differently as a result of the project and this branch gets more, then other branches will get less. As long as the total overhead costs incurred will not change as a result of the project, there is no relevant increase in costs.

Example of Calculation of After-Tax Relevant Cash Flows

CMA Products, Inc. is considering the purchase of a new piece of equipment to introduce a new product line. The equipment will cost $125,000, including setup costs, installation and testing. The estimated before-tax annual cash flow from operations is $50,000, and the investment will require an initial investment in working capital of $25,000. The estimated salvage value is $10,000. CMA has an effective income tax rate of 30%.

The equipment will have an economic life of 9 years, but will be depreciated for tax purposes over 7 years using MACRS. The MACRS depreciation rates for each of the years (using the half-year convention[d]) are as follows:

Year 1	.1429
Year 2	.2449
Year 3	.1749
Year 4	.1249
Year 5	.0893
Year 6	.0892
Year 7	.0893
Year 8	.0446

The relevant after-tax cash flows are:

Net Initial Investment:

Initial investment in equipment	$(125,000) cash outflow
Initial investment in working capital	(25,000) cash outflow
Disposal of old equipment	0.00
Net Initial Investment	$(150,000)

After-tax cash flow from operations (excluding depreciation effect):

$50,000 before-tax CF × (1 - .30) = $35,000 $ 35,000 net cash inflow/yr

Depreciation Tax Shield (varies by year due to different MACRS depreciation rates):

Year 1	$125,000 × .1429 × .30 =	$5,359
Year 2	$125,000 × .2449 × .30 =	$9,184
Year 3	$125,000 × .1749 × .30 =	$6,559
Year 4	$125,000 × .1249 × .30 =	$4,684
Year 5	$125,000 × .0893 × .30 =	$3,349
Year 6	$125,000 × .0892 × .30 =	$3,345
Year 7	$125,000 × .0893 × .30 =	$3,349
Year 8	$125,000 × .0446 × .30 =	$1,671
Year 9	0	

[d] Under MACRS depreciation using the half-year convention, it is assumed that depreciable property was purchased halfway through the year in the year of purchase. The rate of depreciation for the first year in the MACRS table reflects 6 months' depreciation. Thus, there will be 6 months' depreciation taken in the final year, as well. Therefore, in this example, depreciation is actually taken for tax purposes during years 1 through 8.

After-tax cash flow from disposal at salvage value:

$10,000 - $0 tax basis = $10,000 gain

$10,000 × (1 - .30) = after-tax CF, Year 9 $7,000

Therefore, the relevant, after-tax cash flows per year are:

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Initial Investment in Equipment	(125,000)									
Working Capital Increase	(25,000)									25,000*
After-Tax CF from Operations		35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000
Depr Tax Shield		5,359	9,184	6,559	4,684	3,349	3,345	3,349	1,671	-0-
After-Tax CF from disposal										7,000
Total After Tax Cash Flows	(150,000)	40,359	44,184	41,559	39,684	38,349	38,345	38,349	36,671	67,000

* Recovery of released working capital.

Note: Any **increase in working capital** that occurs in the first year (or any other year during the project) will be a reduction of the cash inflows for that period. In this example, the increase in working capital came in Year 0. However, increases in working capital could occur in other years, as well. Note that the working capital is released in the final year of the project and becomes a cash inflow at that time.

Capital Budgeting Methods

We are now ready to use the above cash flow information in capital budgeting screening analysis, using the Payback, Net Present Value and Internal Rate-of-Return methods, as well as in ranking analysis using the Profitability Index.

In capital budgeting questions, you will need to make calculations related to different investment analysis methods and also make decisions about which investment, or investments, a company should pursue given a set of circumstances and a limited amount of money.

We will look first at the different investment analysis methods and then at the decision-making criteria.

The different methods of investment analysis that you need to be familiar with are classified as either **screening methods** or **ranking methods**.

Screening Methods

Screening methods are used to determine whether a project meets the necessary requirements to at least be a worthwhile investment. The four screening methods are:

1) Payback Period,
2) Net Present Value,
3) Internal Rate-of-Return, and
4) Accounting Rate-of-Return.

Ranking Methods

If the company is not able to invest in all the "worthwhile projects" after completing screening to separate worthwhile projects from those that are not, it uses a ranking method to prioritize the best investments. The ranking method we will discuss is called **Profitability Index** (it will be discussed in greater detail later).

NPV can be used as a ranking method as well. NPV is the best way to select a **group** of projects when the projects are of differing sizes and the amount of available capital is limited, in order to select the combination of projects that will use the maximum amount possible of the available capital and also maximize shareholder wealth.

Payback Method

Companies use the Payback Method to determine the number of periods that must pass before the **net after-tax cash inflows** from the investment equals (or "pays back") the initial investment cost. The Payback Method and its variations are **screening** methods of capital budgeting analysis - meaning we are determining only whether or not this is a good investment.

In using the Payback Method, a company usually chooses a period of time in which it wants its investments to "pay back." Projects with payback periods of less than that amount of time are candidates for further analysis, while projects with payback periods in excess of that amount of time are rejected without further consideration.

If the incoming **cash flows are constant over the life of the project**, the payback period is calculated with a simple division as follows:

$$\frac{\textbf{Initial net investment}}{\textbf{Periodic constant expected cash flow}}$$

If the **cash flows are not constant over the life of the project**, we must **add up** the cash inflows and determine — on a cumulative basis — when the inflows equal the outflows.

Example of the Payback Method

This example uses the same information that was used in the previous example about CMA Products. Here it is again:

CMA Products, Inc. is considering the purchase of a new piece of equipment to introduce a new product line. The equipment will cost $125,000 including setup costs, installation and testing. The estimated before-tax annual cash flow from operations is $50,000, and the investment will require an initial investment in working capital of $25,000. CMA has an effective income tax rate of 30%.

The equipment will have an economic life of 9 years, but will be depreciated for tax purposes over 7 years using MACRS. The estimated salvage value at the end of Year 9 is $10,000. The MACRS depreciation rates for each of the years (using the half-year convention[e]) are as follows:

Year 1	.1429
Year 2	.2449
Year 3	.1749
Year 4	.1249
Year 5	.0893
Year 6	.0892
Year 7	.0893
Year 8	.0446

We are to determine the payback period. Because the cash flows below are not constant over the life of the project, we must add up the cash inflows to determine when the inflows will equal the outflows.

[e] Under MACRS depreciation using the half-year convention, it is assumed that depreciable property was purchased halfway through the year in the year of purchase. The rate of depreciation for the first year in the MACRS table reflects 6 months' depreciation. Thus, there will be 6 months' depreciation taken in the final year, as well. Therefore, in this example, depreciation is actually taken for tax purposes during years 1 through 8.

	Year 0	Year 1	Year 2	Year 3	Year 4	Years 5-8	Year 9
Initial Investment in Equipment	(125,000)						
Working Capital Increase	(25,000)						25,000*
After-Tax Cash Flows from Operations		35,000	35,000	35,000	35,000	...	35,000
Depr Tax Shield		5,359	9,184	6,559	4,684	...	-0-
After-Tax Cash Flows from Disposal							7,000
Total After Tax Cash Flows	(150,000)	40,359	44,184	41,559	39,684	...	67,000
Cumulative Cash Inflows	(150,000)	(109,641)	(65,457)	(23,898)	15,786		

* Recovery of released working capital.

The cumulative cash flow from the project becomes positive during Year 4. Assuming that the cash flows are assumed to occur evenly throughout the year, the exact payback period is 3.6 years, calculated as follows:

Number of the project year in the final year when cash flow is negative: 3

Plus: a fraction consisting of:

Numerator = the positive value of the negative cumulative inflow amount from the final negative year: 23,898

Denominator = cash flow for the following year: 39,684

or:

$$3 + \frac{23,898}{39,684} = 3.60$$

The initial investment will be recouped after 3.6 years. Therefore, we need go no further than Year 4 in adding up the cash inflows. This ignoring of future cash flows is one of the Payback Method's major weaknesses.

Advantages of the Payback Method

1) It is **simple and easy to understand**.

2) It can be **useful for preliminary screening** when there are many proposals.

3) It can be **useful when expected cash flows in later years of the project are uncertain**. Cash flow predictions for periods far in the future are less certain than predictions for 3 - 5 years ahead.

4) It is **helpful when evaluating a high technology investment** where the company desires to recoup its initial investment quickly, before the equipment becomes obsolete.

Weaknesses of the Payback Method

1) It **ignores all cash flows beyond the payback period**. Therefore, a project that has large expected cash flows in the later part of its life could be rejected in favor of a less profitable project that has a larger portion of its cash flows in its early years.

2) It **does not incorporate the time value of money**. Therefore, interest lost while the company waits to receive money is not considered at all.

3) It **ignores the cost of capital**, so the company could accept a project for which it will pay more for its capital than the project can return.

The Payback Method can give an indication of a project's **liquidity**. Using the Payback Method can enable the company to concentrate on more liquid projects, thereby avoiding tying up capital for long periods of time (because it favors projects with short time horizons). The Payback Method can also help a company to **manage risk** in evaluating projects in, for example, politically unstable countries. If quick profits in the face of uncertain conditions are the goal, the Payback Method used with a short payback period is effective.

Discounted Payback Method

The Discounted Payback Method (also called the **breakeven time**) is an attempt to deal with the Payback Method's weakness of not considering time value of money concepts.

The Discounted Payback Method uses the present value of cash flows instead of undiscounted cash flows to calculate the payback period. Each year's cash flow is discounted using an appropriate interest rate, and then those discounted cash flows are used to calculate the payback period.

Example of Discounted Payback Method

Below is an example of the Discounted Payback Method using our same CMA Products model, with each year's cash flow discounted at 10% before calculation of the payback period:

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Years 6-8	Year 9
Net Initial Investment	(125,000)							
Working Capital Increase	(25,000)							25,000*
After-Tax Cash Flows from Operations		35,000	35,000	35,000	35,000	35,000	...	35,000
Depr Tax Shield		5,359	9,184	6,559	4,684	3,349	...	-0-
After-Tax Cash Flows from Disposal								7,000
Total After Tax Cash Flows	(150,000)	40,359	44,184	41,559	39,684	38,349	...	67,000
PV of $1 Factor for 10%	1.00000	.90909	.82645	.75132	.68301	.62092		
Discounted Cash Flow	(150,000)	36,690	36,516	31,224	27,105	23,812		
Cumulative Discounted Cash Flows	(150,000)	(113,310)	(76,794)	(45,570)	(18,465)	5,347		

*Recovery of released working capital

Note that in the above example, each annual cash flow amount is discounted separately using the present value of $1 factor for the appropriate term. The fact that the cash flows vary each year during the life of the project is one reason why this is necessary, as the present value of an annuity factor cannot be used when cash flows vary. However, there is another reason; and even if the cash flows did not vary during the period of the project, each year's cash flow would still have to be discounted individually. The reason for this is that discounted cash flow information is needed for each year of the project to determine the number of years until the initial investment is paid back. The present value of an annuity would give us only one amount: today's present value of the future cash flows. And that is not what is needed here.

The payback period will be longer under the Discounted Payback Method than it is under the Payback Method. Here, it is 4.78 years, compared with 3.6 years under the Payback Method.

$$4 + \frac{18,465}{23,812} = 4.78$$

The Discounted Payback Method overcomes the Payback Method's weakness of not accounting for the time value of money. However, the Discounted Payback Method still fails to account for cash flows after the payback period.

Note: If a question asks for the **breakeven time**, it is asking for the **Discounted Payback Period.**

Bailout Payback

The **Bailout Payback** is another variation on the Payback Period. The Bailout Payback is done in the same way as the Payback Method, but there is the recognition of the possibility that the project may be ended prematurely and the equipment sold. The after-tax salvage value of the equipment at various dates is added to the cash inflows of the project through the same dates. This is essentially including in the payback period a calculation of the cash flows that would result upon the termination of the project at various dates. Use of Bailout Payback offers the best protection if things could go wrong.

Example of Bailout Packback Method

Here is an example of a Bailout Payback calculation, using CMA Product's relevant after-tax cash flows from the above example:

> Note: It is doubtful that you would be required to complete a calculation like the following for an exam question. However, you may need to be aware of what the Bailout Payback Period is and what it is used for, and this will give you an understanding of that.

CMA Products, Inc. is considering the purchase of a new piece of equipment for the purpose of introducing a new product line. The equipment will cost $125,000, including setup costs, installation and testing. Estimated before-tax annual cash flow from operations is $50,000. The equipment will have an economic life of 9 years but will be depreciated for tax purposes over 7 years using MACRS. The estimated disposal value at the end of 9 years is $10,000. CMA has an effective income tax rate of 30%.

If CMA Products decides to get out of the project early, the following projections have been made about what the company could sell the equipment for at the end of Year 1, Year 2, Year 3, or Year 4:

End of Year 1	$70,000
End of Year 2	35,000
End of Year 3	20,000
End of Year 4	10,000

Here is the calculation of the tax basis (book value for tax purposes) and the Bailout gain/loss on the equipment if it is sold at each of the above dates, using MACRS depreciation:

	Annual MACRS Depreciation	Year-End Tax Basis	Bailout Salvage Value	Tax Basis Bailout Gain/Loss
Year 1	$125,000 × .1429 = $17,863	$107,137	$70,000	$(37,137)
Year 2	$125,000 × .2449 = $30,613	76,524	35,000	(41,524)
Year 3	$125,000 × .1749 = $21,863	54,661	20,000	(34,661)
Year 4	$125,000 × .1249 = $15,613	39,048	10,000	(29,048)

The loss for tax purposes will create a tax benefit for the company because the loss will reduce total taxable income, similar to the way that depreciation expense reduces total taxable income. Similar to the depreciation tax shield, the tax benefit from the loss is equal to the amount of the loss multiplied by the company's capital gains tax rate.

Note that under U.S. tax law, however, capital losses are allowed on the tax return only as a reduction of capital gains on other transactions. In order to be able to use the tax benefit from the loss in the year in which the loss occurs, a company needs to have other capital gain transactions in the same year that the loss can be deducted from. A net capital loss can be carried back 3 years and forward up to 5 years as a short-term capital loss. So for this purpose, we must assume that the company has other capital gains equal to or greater than this capital loss and thus will be able to use this capital loss on its tax return to reduce those gains.

Here is the calculation of the tax benefit from the loss on the bailout sale for each year and the net cash flows from the sale plus the released working capital on each of the dates:

	Bailout Gain/Loss	Tax Benefit from Loss 30%	Salvage Value	Salvage Value Plus Tax Benefit from Loss	Released Working Capital	Total CF From Bailout
Year 1	$(37,137)	$11,141	70,000	$81,141	$25,000	$106,141
Year 2	(41,524)	12,457	35,000	47,457	25,000	72,457
Year 3	(34,661)	10,398	20,000	30,398	25,000	55,398
Year 4	(29,048)	8,714	10,000	18,714	35,000	43,714

The chart below illustrates the addition of Total Cash Flow from Bailout to each of the first four years' cumulative cash flows. This addition of the total cash flow from the bailout is not cumulative, but is an adjustment **for that year only** to each year's cumulative cash flow:

	Year 0	Year 1	Year 2	Year 3	Year 4	Years 5-8	Year 9
Initial Investment in Equipment	(125,000)						
Working Capital Increase	(25,000)						25,000*
After-Tax Cash Flows from Operations		35,000	35,000	35,000	35,000	...	35,000
Depr Tax Shield		5,359	9,184	6,559	4,684	...	-0-
After-Tax Cash Flows from Disposal							7,000
Total After Tax Cash Flows	(150,000)	40,359	44,184	41,559	39,684	...	67,000
Cumulative Cash Inflows	(150,000)	(109,641)	(65,457)	(23,898)	15,786		
CF from bailout		106,141	72,457	55,398	43,714		
Cumulative cash flow each year if bailout occurs that year	(150,000)	(3,500)	7,000	31,500	59,500		

* Recovery of released working capital.

The Bailout Payback Period is 1.03 years, calculated as follows:

Number of the project year in the final year when cash flow is negative:	1.00
Plus: a fraction consisting of	
Numerator = the positive value of the negative cumulative inflow amount from the final negative year	3,500
Denominator = cash flow for the following year	44,184 + 72,457

Which equals 3,500 / 116,641 = .03

Therefore, the Bailout Payback Period is the total of 1.00 + .03, which is 1.03 years.

If CMA Products decides to "bail out" after 1.03 years, the company will have recouped its initial investment. If it waits to bail out until after 2, 3 or 4 years have gone by, it will have more than recouped its investment.

Note: This assumes that cash flows occur evenly throughout each year. If cash flows are assumed to be received at the end of each year, the bailout payback period will be 2 years.

Question 50: Fitzgerald Company is planning to acquire a $250,000 machine that will provide increased efficiencies, thereby reducing annual operating costs by $80,000. The machine will be depreciated by the straight-line method over a 5-year life with no salvage value at the end of 5 years. Assuming a 40% income tax rate, the machine's payback period is:

a) 3.13 years

b) 3.21 years

c) 3.68 years

d) 4.81 years

(CMA Adapted)

Question 51: Jasper Company has a payback goal of 3 years on new equipment acquisitions. A new sorter is being evaluated that costs $450,000 and has a 5-year life. Straight-line depreciation will be used; no salvage is anticipated. Jasper is subject to a 40% income tax rate. To meet the company's payback goal, the sorter must generate reductions in annual cash operating costs of:

a) $60,000

b) $100,000

c) $150,000

d) $190,000

(CMA Adapted)

Discounted Cash Flow Methods

Discounted cash flow (DCF) methods are **screening** methods of capital budgeting analysis. They measure all of the expected future cash inflows and outflows of a project using the time value of money concept, which is that money received today is worth more than money received in any future period. In a discounted cash flow analysis, the earlier that a project is able to generate cash inflows, the better, because cash flows received earlier in a project's life are worth more than cash flows received later. (Note: If you need to review present and future value concepts and discounting, see Appendix A in this book.)

Discounted cash flow methods focus on the actual cash inflows and outflows from the project rather than using income as the measurement basis, as in accrual accounting. This is because we are most interested in the cash return that we can obtain in the future for a cash outlay now.

When we are using discounted cash flow analysis, we always assume that all cash flows occur at the end of a year. In some instances, a problem may say that a particular cash flow occurs at the beginning of a year. If that happens, we treat the cash flow occurring at the beginning of a year as though it occurs at the end of the previous year.

Though this assumption about cash flows occurring only at the end of a year is not in line with reality, it is a necessary assumption in order to be able to use discounted cash flow techniques to determine the present value of the future cash flows. The inaccuracy introduced by this assumption is not material to the analysis being done.

There are two main DCF screening methods that we will look at in more detail below:

Net Present Value Method

The Net Present Value (NPV) method calculates the expected monetary gain or loss from a project by discounting all expected future cash inflows and outflows to the present point in time, using the required rate-of-return. A project's NPV is the present value of the project's future expected cash flows minus the proposal's initial cash outflow.

The present value of the expected future cash flows is calculated by using a discount rate that is the company's **required rate-of-return (RRR).** The required rate of return is either:

1) The return that the organization could **expect to receive in the market** for an investment of comparable risk, or

2) The **minimum rate-of-return** that the project must earn in order to justify investment of the resources.

This required rate-of-return is also called the **discount rate**, **hurdle rate**, or **opportunity cost of capital**.

Only projects with a zero or positive NPV are acceptable to a company from a financial standpoint, because the return from these projects equals or exceeds the cost of capital. If a project has a negative NPV, the project should not be undertaken. The Required Rate-of-Return chosen to discount the cash flows and compute the NPV **must be appropriate to the risk of the project.** This will be discussed in more detail later.

Internal Rate-of-Return

Internal Rate-of-Return (IRR) method calculates the interest rate (i.e., the discount rate) at which the present value of expected cash inflows from a project equals the present value of expected cash outflows. In other words, in the calculation of IRR we are calculating the **interest rate at which the NPV is equal to zero.** When evaluating the results of an IRR calculation, the IRR that is determined for the project being analyzed is compared with the required rate-of-return (RRR) for the purpose of deciding whether the project is profitable enough to undertake.

We will now look at each of these two methods in more detail.

Net Present Value (NPV) Method

The NPV of an investment or project is equal to the difference between the **present value of all future cash inflows** and the **present value of all (the initial as well as all future) cash outflows**, using the required rate-of-return (the terms "hurdle" rate, "discount rate," "cutoff rate" and "cost of capital" may all be used - you need to use the rate given in the problem) in the NPV calculations.

Thus, a project's NPV is the present value of the project's future expected cash flows minus the proposal's initial cash outflow.

In addition to the obvious cash flows of increased revenues and reduced expenses, you also need to remember the following items that are used in the calculation of net relevant cash flows from the project (discussed above):

1) Tax savings from the **depreciation tax shield**,
2) Cash proceeds from the **sale of the asset** at the end of the project,
3) The tax effect of the **gain or loss of the sale of the assets** at the end of the project life, and
4) **Working capital cash released** at the end of the project.

NPV can be calculated using a financial calculator, or it can be calculated manually using factor tables for present value of $1 or present value of an annuity. Two models of financial calculators are permitted on the CMA exams: Texas Instruments BA II Plus, and HP 10 B II. The following discussion of NPV will explain its calculation manually.

Using NPV

The general rule is that any project that has a positive NPV should be accepted, while a project with a negative NPV should be rejected. However, for various reasons such as limited funds to invest or nonfinancial factors, not all projects with positive NPVs will be acceptable. It is probably better to state that any project that has a positive NPV is a candidate for further consideration - it has passed the first screen. A project with a negative NPV should not be considered further. This will maximize shareholder wealth. When there are **limited funds to invest**, NPV is useful because it enables you to rank the various projects according to the **amount that they are expected to return**.

The questions that you are asked regarding NPV can become fairly detailed and include a lot of information. What you need to remember is that you are interested in the present value of the cash flows (both cash in and cash out) associated with this project.

As part of this, you need to remember that even though **depreciation is a non-cash expense, it does have a cash flow impact** through the reduction of the taxes payable.

NPV and Risk

As with any method in which we are forecasting future cash flows, there is always the chance that our assumptions will be incorrect. One thing that a company can do to take into account the risk of these future cash flows is to use a **higher than usual required rate-of-return** to compensate for the risk. Using a higher required rate-of-return causes the NPV to be lower.

One disadvantage or possible limitation to using NPV is that because it results in an absolute dollar amount, it does not give any rate-of-return on an investment. This absolute dollar amount can tell us whether a project's rate-of-return is higher or lower than the discount rate that was used as the required rate-of-return; but it cannot tell us the actual rate-of-return for the project.

Example No. 1 – A series of Unequal Cash Flows

Returning to our example of the CMA Product's plan to purchase a new piece of equipment and its projected cash flows over the life of the project, the NPV of the project is as follows:

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year
Net Initial Investment	(125,000)									
Working Capital Increase	(25,000)									25,00
After-Tax Cash Flows from Operations		35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,0(
Depr Tax Shield		5,359	9,184	6,559	4,684	3,349	3,345	3,349	1,671	-0-
After-Tax Cash Flows from Disposal										7,00^
Total After Tax Cash Flows	(150,000)	40,359	44,184	41,559	39,684	38,349	38,345	38,349	36,671	67,0^^
PV of $1 Factor for 10%	1.00000	.90909	.82645	.75132	.68301	.62092	.56447	.51316	.46651	.42410
Discounted Cash Flow	(150,000)	36,690	36,516	31,224	27,105	23,812	21,645	19,679	17,107	28,4
Cumulative Discounted Cash Flows	(150,000)	(113,310)	(76,794)	(45,570)	(18,465)	5,347	26,992	46,671	63,778	92,1'

*Recovery of released working capital.

The cumulative discounted cash flow at the end of the project is **$92,193** and that is the NPV of the project.

NPV is also the sum of all the discounted cash inflows and outflows from the project over its life minus the initial investment. In this case, the sum of all the discounted cash inflows from the project over its life is $242,193, while the net investment is $150,000. Thus, NPV is $242,193 - $150,000 = **$92,193**.

Since the NPV of this project is **positive**, this project is **acceptable**.

After having calculated the PV of the net cash inflows, we can now determine the Net Present Value by combining this with the initial investment that was required, which is a negative cash flow.

NPV = PV of Net Cash Inflows – the Initial Investment

Note: The initial investment amount is **not** discounted but is multiplied by 1.00000, because it is already at Year 0. It is, in a sense, already discounted, because it is at the point that all the other cash flows are being discounted to, in order to make them equivalent to the time of the initial investment. However, if additional investments are made after the initial investment, those additional investments will need to be discounted.

The above example represents a Net Present Value analysis where the operating cash flows are different for different years of the project's life. If the total operating cash flows **including the depreciation tax shield** are **the same** during every year of the project's life (the final year included) in calculating NPV, we can take a short cut and use the present value of an annuity formula to calculate the present value of the cash flows, as follows.

Example No. 2 – A Series of Equal Cash Flows

In this example, we will look at the Net Present Value calculation when all annual cash flows throughout the life of the project are equal.

AMC Petroleum, Inc., an oil wholesaler, is planning to purchase an additional tanker to haul its oil because of recent sales growth. The new truck will cost $100,000. AMC estimates the after-tax cash flow from the new truck, including the effect on cash of the depreciation tax shield, will be $20,000 per year, and the truck will last for 7 years. AMC's required rate-of-return is 10%. There is no salvage value. The company's tax rate is 40%.

The discounted cash flows are calculated as follows:

PV of Cash Inflows = PV of ordinary annuity $_{i=10\%,\ n=7}$ × $20,000

= 4.86842 × $20,000 = $97,368

NPV = $97,368 – $100,000 = **$(2,632)**

Since the NPV of the new oil tanker truck is negative, under these assumptions this project should be rejected.

> Note: The present value of an **ordinary annuity (annuity in arrears)** is used here, because cash flows are usually assumed to occur at the end of each period for the sake of convenience. This is the PV of an annuity factor that is given in tables. For most capital budgeting purposes, you should not need to adjust the factor to make it a factor for PV of an annuity due. However, if a problem were to specify that the cash flows occur at the beginning of each period, you would need to adjust the factor by using the factor for one period less and adding 1.000 to the resulting factor.

Example No. 3 – A Series of Equal Cash Flows With One Unequal Amount At the End

AMC now projects that at the end of 7 years it will be able to sell the truck for $30,000. The truck will be fully depreciated for tax purposes, so the full amount received will be taxable as a gain. Now, the cash inflow in the 7th year of the project will **not** be the same as all the other cash inflows. It will be greater by $30,000 less tax at 40%, which is $18,000. We can still use the present value of an annuity factor to find the present value of the 6 annual cash flows that **are** equal. And we can use the present value of $1 factor to find the present value of the 7th year's cash inflow.

PV of Cash Inflows, Years 1-6:

PV of ordinary annuity $_{i=10\%,\ n=6}$ × $20,000 = 4.35526 × $20,000 = $ 87,105

Plus: PV of $1 $_{i=10\%,\ n=7}$ × ($20,000 + [$30,000 × (1 – .40)]) = .51316 × $38,000 = 19,500

Equals: Discounted Cash Inflows of the project $106,605

NPV = $106,605 – $100,000 = **$6,605**

The addition of the salvage value at the termination of the project has caused the NPV to change from a negative amount to a positive amount. This project is now acceptable.

Example No. 4 – A Perpetual Annuity

What if the cash flow from the project will go on and on with no end? How do you calculate the NPV of **that** project?

This is called a "stream of perpetual cash flows," and the annual amounts may be all the same (i.e., an annuity), or they may be different. If the annual amounts are all the same, it is called a "perpetual annuity."

We will illustrate a perpetual annuity first.

Perpetua Enterprises is planning to invest $40,000 in a project which it expects to generate after-tax cash flow of $5,000 each year, beginning with Year 1, and continuing indefinitely. Perpetua's required rate of return is 10%. What is the NPV of the project?

The present value of a stream of perpetual, equal, cash flows is:

$$PV = \frac{\textbf{Annual Cash Flow}}{\textbf{Required Rate of Return}}$$

This is the same formula as is used to calculate the market value of preferred stock. It is called the Zero Growth Dividend Model.

The Present Value of a perpetual stream of $5,000 after-tax cash flows, discounted at 10%, is $5,000 ÷ .10, or $50,000. The NPV of the project, then, is $50,000 – the initial investment of $40,000, or $10,000.

Example No. 5 – A Perpetual Growing Annuity

Now, let's suppose Perpetua Enterprises expects the cash flow at the end of the first year to be $5,000; but it expects the cash flow to grow by 5% each year after that, in perpetuity. The initial investment is still $40,000, and Perpetua's required rate of return is still 10%. Now what is the NPV?

The present value of a perpetual growing annuity is:

$$PV = \frac{\textbf{Cash Flow-End of First Year}}{\textbf{Required Rate of Return – Growth Rate}}$$

You should recognize this formula as the Constant Growth Dividend Model, which is used for valuing common stock when the dividends are growing. Recall that the Constant Growth Dividend Model is:

$$P_0 = \frac{\textbf{\textit{Next} Annual Dividend (expected next period)}}{\textbf{Investors' Required Rate of Return – the Annual Future Growth rate of the Dividend}}$$

And remember that the dividend used in this model needs to be the **next** annual dividend. So when you use this model to calculate the Present Value of a growing perpetual stream of cash flows, make sure that you use as your cash flow the amount expected **at the end of the first year**.

The Present Value of this growing, perpetual stream of after-tax cash flows is $5,000 ÷ (.10 – .05), or $100,000. The NPV of the project now is $100,000 – $40,000, or $60,000.