

What is Engineering Economy?

- Economic decision making for engineering systems is called **engineering economy**.
- This definition may seem restricted to engineering projects and systems only, engineering economy however is also the study of industrial economics and the economic and financial factors which influence industry.

What is Engineering Economy?

- Engineering economy is a collection of techniques that simplify comparisons of alternatives on an economic basis.
- Engineering economy is not a method or process for determining what the alternatives are.

What is Engineering Economy?

- Engineering economics begins only after the alternatives have been identified.
- If the best alternative is actually one that the engineer has not even recognized as an alternative, then all the engineering economic analysis tools will not result in its selection.

What is Engineering Economy?

Engineers are the people who are familiar with all the technicalities of machinery and production therefore they are the best judges of:

- a) the useful lives of an asset, and
- b) they also have the technical knowledge to calculate the number of units a proposed plant would produce when operational.

What is Engineering Economy?

- In today's competitive world of business it has become essential that engineers should practice financial project analysis for engineering projects and make rational decisions.

What is Engineering Economy?

- Engineering economy also includes the study of accounting practices for manufacturing concerns.
- Unique features of accounting for manufacturing concerns are process costing, batch costing, cost allocation, etc.

What is Engineering Economy?

- Engineering economy deals with justification and selection of projects.
- Many engineers work on projects which address a specified activity or a problem.
- Any decision regarding the project must be justified.

What is Engineering Economy?

- In business environments, many if not all, decisions are justified using monetary criteria such as “**profit**”.
- Such decisions are made at the managerial level and many engineers become managers in manufacturing environment.

What is Engineering Economy?

- Therefore, all engineers, regardless of their employment, should know **methods** and **tools** used in evaluation of projects.
- The purpose of engineering economy is to expose all engineering students to the methods which are widely used for evaluation of projects.

What is Engineering Economy?

- Even though, engineering economy deals mostly with selection of projects in business environment, the tools and methods can be and are used by individuals and non-profit organizations such as government, hospitals, and charitable entities, etc.

SOME EXAMPLES

Let us present few examples in different environments where engineering economy can facilitate the decision making process.

- **Business Environment:**

A small manufacturing company needs to buy a forklift truck for material handling. Two different brands, say A and B, are being considered. Which truck should be bought? The decision will probably be based on minimization of cost.

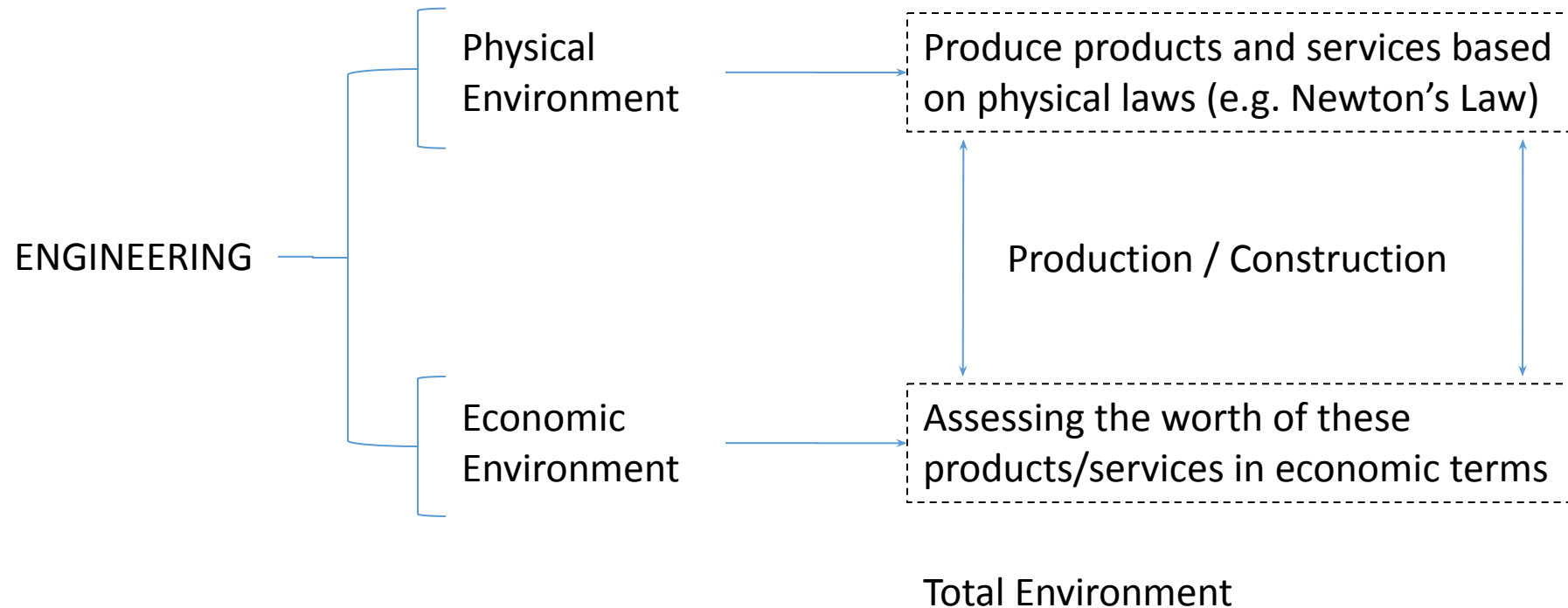
SOME EXAMPLES

- **Individuals:**

A new college graduate needs a new car. Should this new car be bought or leased? Methods from engineering economy can be used for determining the best choice.

SOME EXAMPLES

The following figure shows how engineering is composed of physical and economic components:



SOME EXAMPLES

Physical Environment:

Engineers produce products and services depending on physical laws. Physical efficiency takes the form:

$$\text{Physical (efficiency)} = \frac{\text{System output(s)}}{\text{System input(s)}}$$

SOME EXAMPLES

- **Economic Environment:**

Much less of a quantitative nature is known about economic environments -- this is due to economics being involved with the actions of people, and the structure of organizations.

$$\text{Economic (efficiency)} = \frac{\text{System worth}}{\text{System cost}}$$

SOME EXAMPLES

- Satisfaction of the physical and economic environments is linked through production and construction processes.
- Engineers need to control systems to achieve a balance in both the physical and economic environments, and within the bounds of limited resources.

Rational Decision-Making Process

1. Recognize a decision problem
2. Define the goals or objectives
3. Collect all the relevant information
4. Identify a set of feasible decision alternatives
5. Select the decision criterion to use
6. Select the best alternative



Rational Decision Making Process

Rational decision making is a complex process that contains a number of essential elements.

1.
Recognize a
decision
problem

2. Define
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3. Collect all
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Which Car to Lease?

Saturn vs. Honda

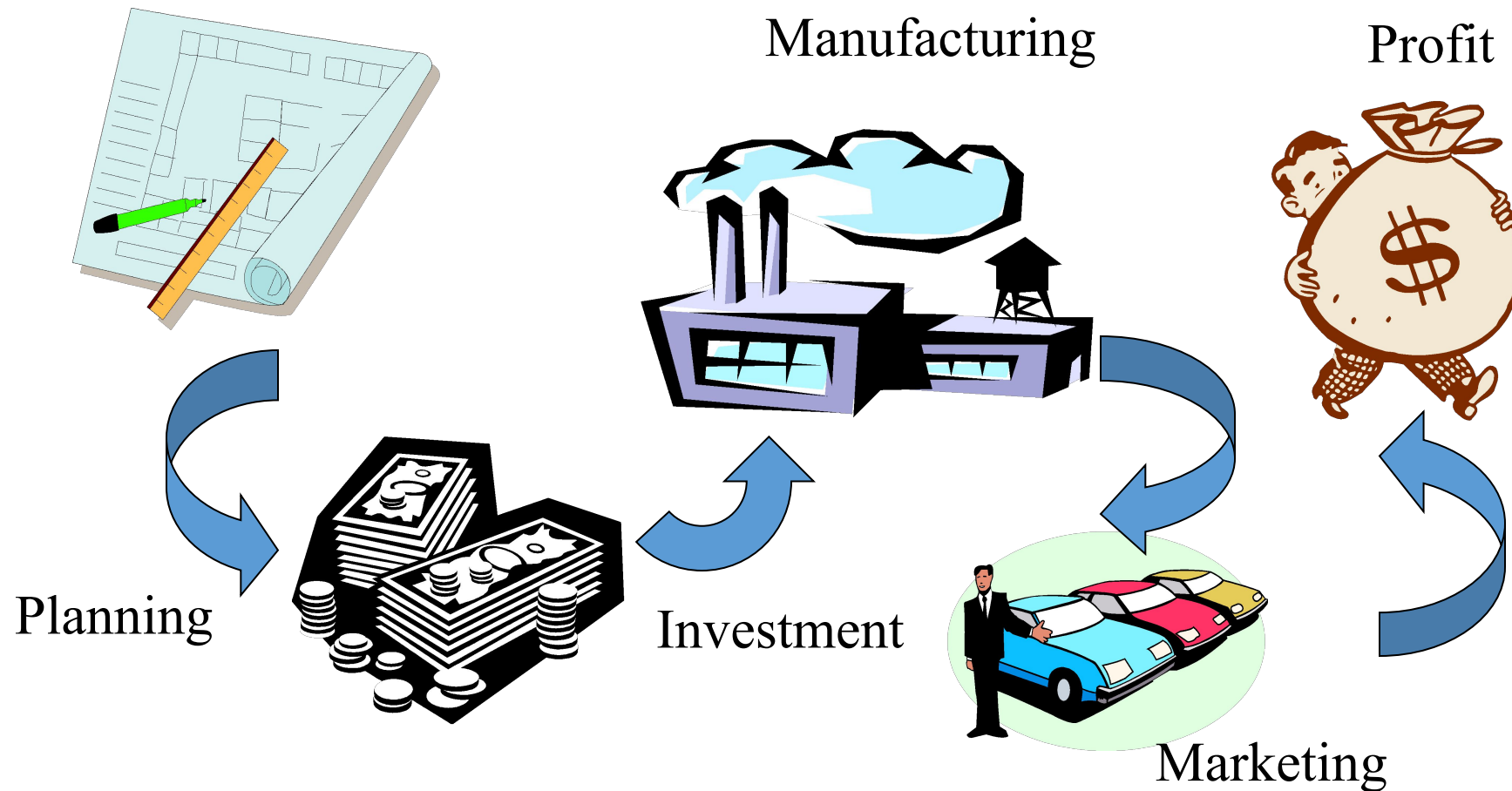
1. Recognize a decision problem  • Need a car
2. Define the goals or objectives  • Want mechanical security
3. Collect all the relevant information  • Gather technical as well as financial data
4. Identify a set of feasible decision alternatives  • Choose between Saturn and Honda
5. Select the decision criterion to use  • Want minimum total cash outlay
6. Select the best alternative  • Select Honda

Financial Data Required to Make an Economic Decision

TABLE 1.1 Financial Data for Auto Leasing: Saturn versus Honda

Auto Leasing	Saturn	Honda	Difference Saturn – Honda
1. Manufacturer's suggested retail price (MSRP)	\$15,573	\$15,810	–\$273
2. Lease length	48 months	48 months	
3. Allowed mileage	48,000 miles	48,000 miles	
4. Monthly lease payment	\$219	\$248	–\$29
5. Mileage surcharge over 36,000 miles	\$0.20 per mile	\$0.15 per mile	+\$0.05 per mile
6. Disposition fee at lease end	\$0	\$250	\$250
7. Total due at signing:			
• First month's lease payment	\$219	\$248	
• Down payment	\$1,100	\$800	
• Administrative fee	\$495	\$0	
• Refundable security deposit	<u>\$200</u>	<u>\$225</u>	
Total	\$2,014	\$1,273	+\$741
<p>• Models compared: The 2003 Saturn ION.3 with automatic transmission and A/C and the 2003 Honda Civic DX coupe with automatic transmission and A/C.</p> <p>• Disposition fee: This is a paperwork charge for getting the vehicle ready for resale after the lease end.</p>			

Engineering Economic Decisions




Predicting the Future

- Estimating a Required investment
- Forecasting a product demand
- Estimating a selling price
- Estimating a manufacturing cost
- Estimating a product life




Role of Engineers in Business

The present day Computer and Software companies (Apple Computer, Microsoft Corporation, Sun Microsystems) were all started in the late 1970s and 1980s by the young college students with engineering background.



As the business grew, they became partnerships and were eventually converted to corporations.



An Engineer should know the nature of the various business organizations, especially related with his specialization/ profession.

Types of Business Organizations

1. Proprietorships

- A business owned by one person

2. Partnerships

- A business owned by more than one person (partners) through a contract

3. Corporations

- A legal entity created under the government law

Proprietorships

Advantages

- Formed easily and inexpensively
- Earnings are taxed at owner's personal income tax, which will be lower than corporate income tax

Disadvantages

- Personal liability
- Difficult to raise capital (cannot issue stocks bonds) for business expansion

Partnerships

Advantages

- Low cost (one person's contribution is lesser)
- Ease of formation as the personal assets of all the partners stand behind the business

Disadvantages

- Each partner is liable for a business's debts
- Partnership has a limited life, as when one partner quits, partnership is to be reorganized

Corporations

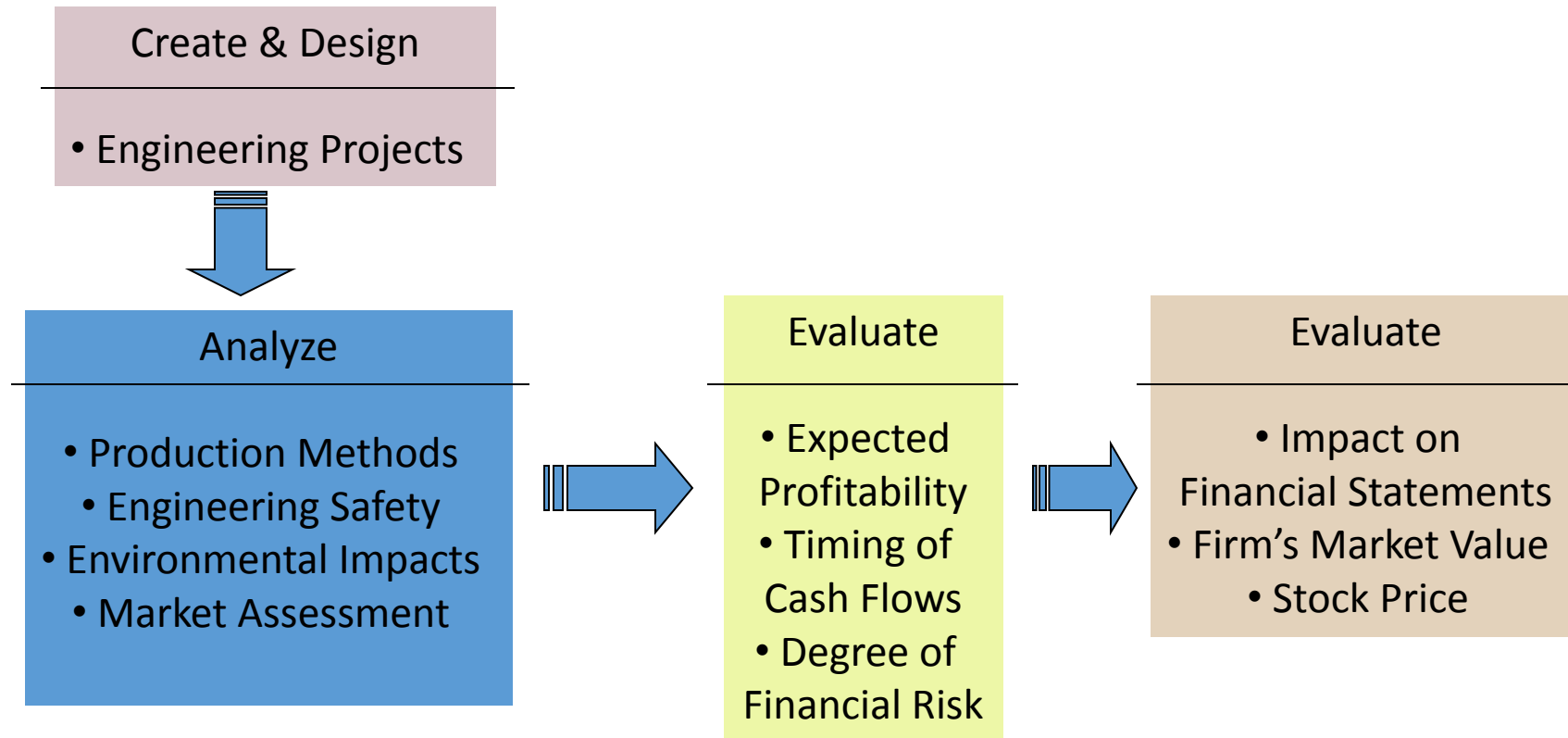
Advantages

- Can raise capital from large number of investors
- Easy transfer of ownership interest by trading shares of stock
- Personal liability is limited (to the individual investment)

Disadvantages

- Expensive
- Subject to numerous government rules and regulations

Role of Engineers in Business



FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS

PRINCIPLE 1:

A nearby penny is worth a distant dollar

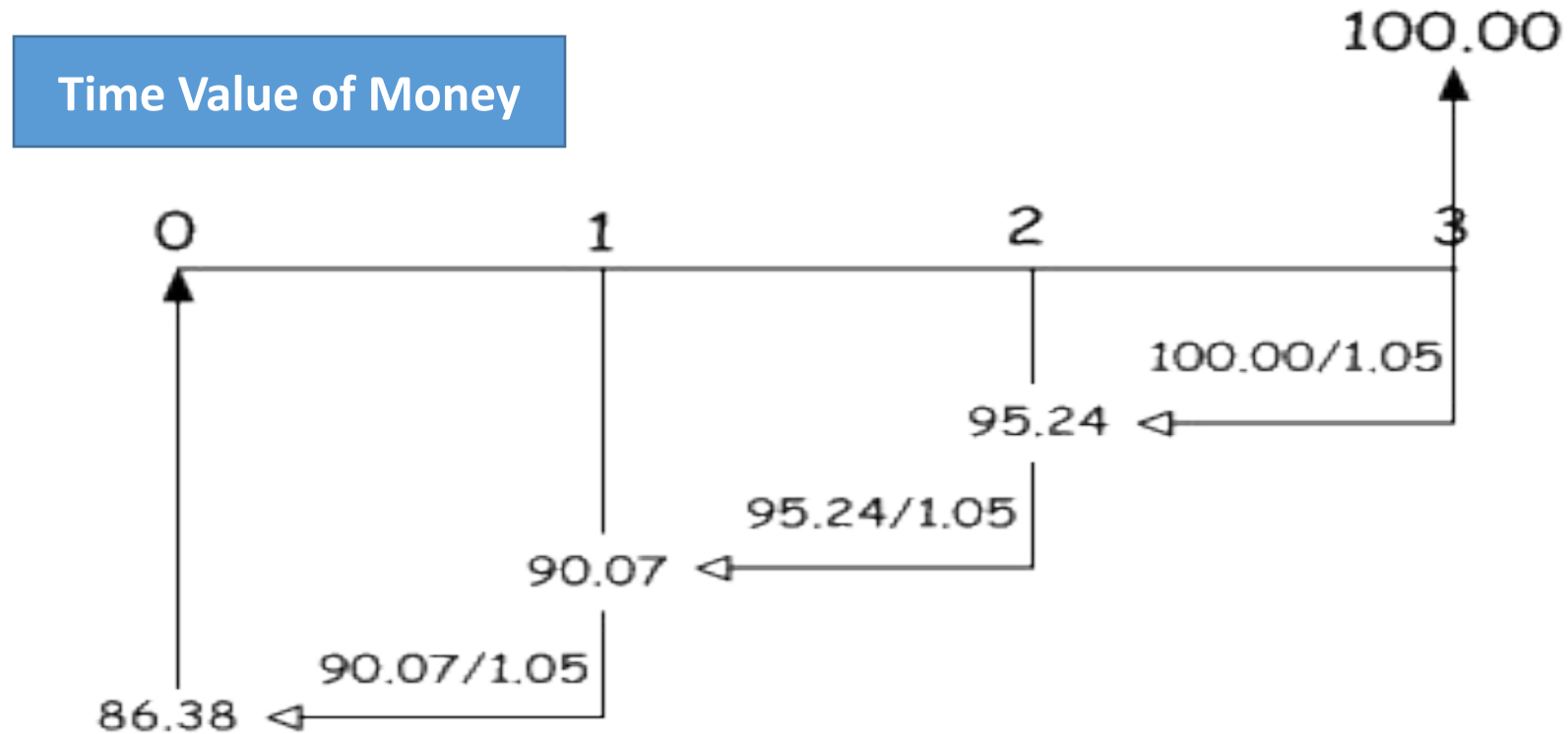
- A fundamental concept in engineering economics is that money has a time value associated with it.
- It is better to receive money earlier than later.



FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS

- If you receive \$100 now, you can invest it and have more money available six months from now.
- This concept will be the basic foundation for all engineering project evaluation.

FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS



FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS

PRINCIPLE 2:

All that counts are the differences among alternatives.

- An economic decision should be based on the *differences* among the alternatives considered.
- All that is common is irrelevant to the decision.

FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS

Option	Monthly Fuel Cost	Monthly Maintenance	Cash Outlay at Signing	Monthly Payment	Salvage Value at the End of Year 3
Buy	\$960	\$550	\$6,500	\$350	\$9,000
Lease	\$960	\$550	\$2,400	\$550	0

Irrelevant items in decision making

Differential Analysis

FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS

PRINCIPLE 3:

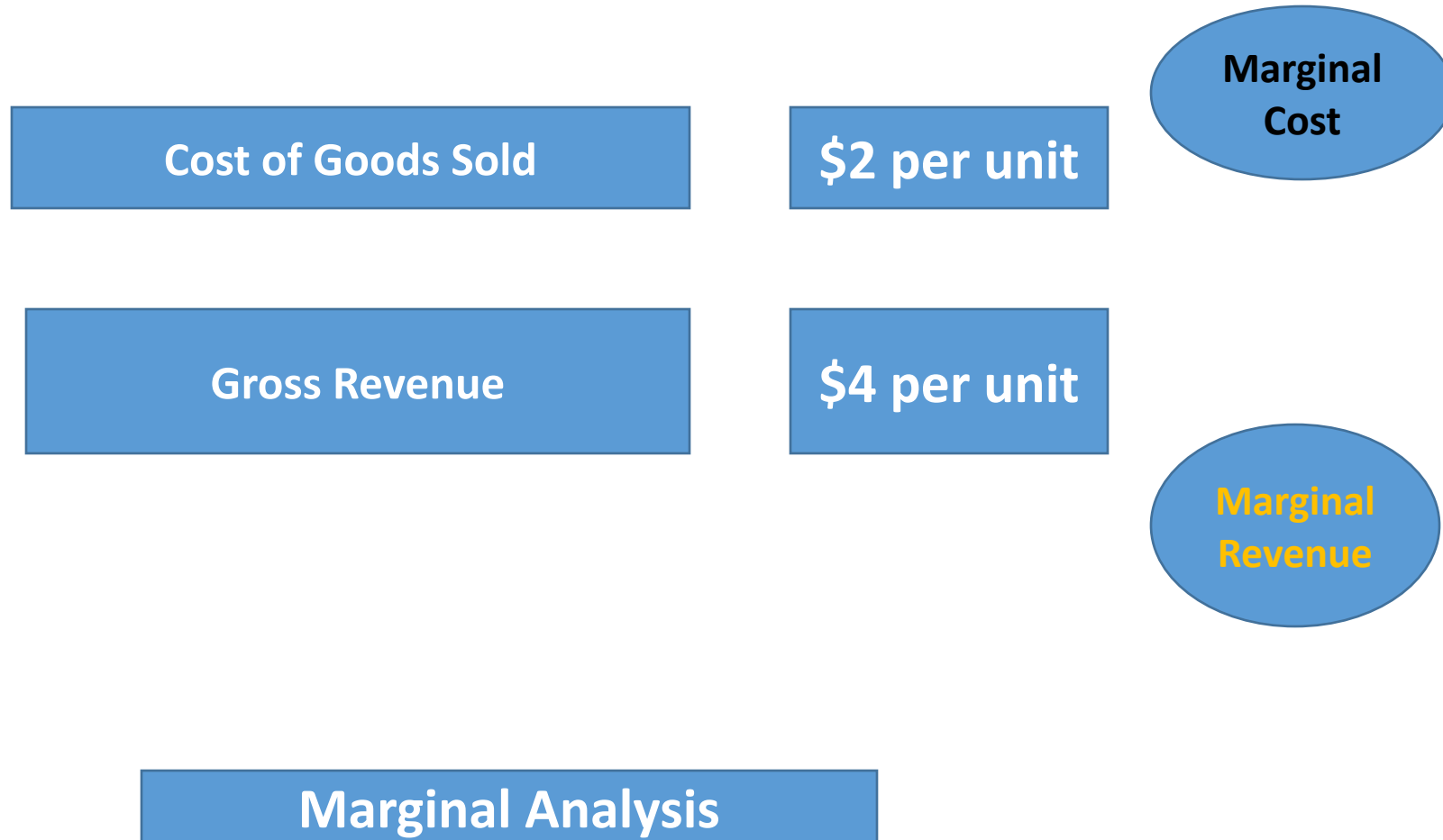
Marginal Revenue must exceed Marginal Cost.

- Each decision alternative must be justified on its own economic merits before being compared with other alternatives.
- Marginal revenue means the additional revenue made possible by increasing the activity by one unit.

FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS

- Marginal cost means that productive resources like natural resources, human resources, capital goods available to make goods and services are limited. Therefore, people can not have all the goods and services they want.
- As a result, they must choose some things and give up others.

FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS



FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS

PRINCIPLE 4:

Additional Risk is not taken without the Expected Additional Return.

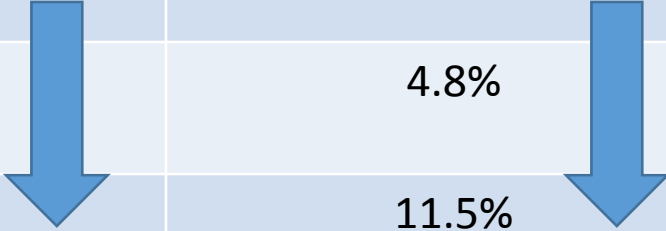
- Investors demand a minimum return that must be greater than the anticipated rate of inflation or any perceived risk.

FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS

- Expected returns from bonds and stocks are normally higher than the expected return from a savings account.

FUNDAMENTAL PRINCIPLES OF ENGINEERING ECONOMICS

Investment Class	Potential Risk	Expected Return
Savings account (Cash)	Low/None	1.5%
Bond (Debt)	Moderate	4.8%
Stock (Equity)	High	11.5%



Risk and Return Trade Off