

YTÜ Civil Engineering Faculty  
Civil Engineering Department/ Construction  
Management Division.

**Developing investment projects  
&  
Feasibility studies**

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# Investment Project Concept

- Investment is putting money into an asset with the expectation of capital appreciation, dividends, and/or interest earnings.
- Investment Project, is long- term allocation of funds (with or without recourse to the project's sponsor) to carry an investment idea through to its stable-income generation stage.
- Investment should create capacity which has long term life.
- The inputs of the investment should be physical resources (such as raw material, work force, capital materials)
- The investment should provide products and services to internal and external parties.



# Investment projects

- Identification of the purposes is important since it determines the investment direction and can be used as criteria in selection of the investment,
- Identification of the probable problems, and effects of these problems by performing situation analysis,
- The stages in the investment projects plan. There are three stages;
  - Determination of alternative solutions,
  - Estimation of alternatives,
  - Evaluation Stage.

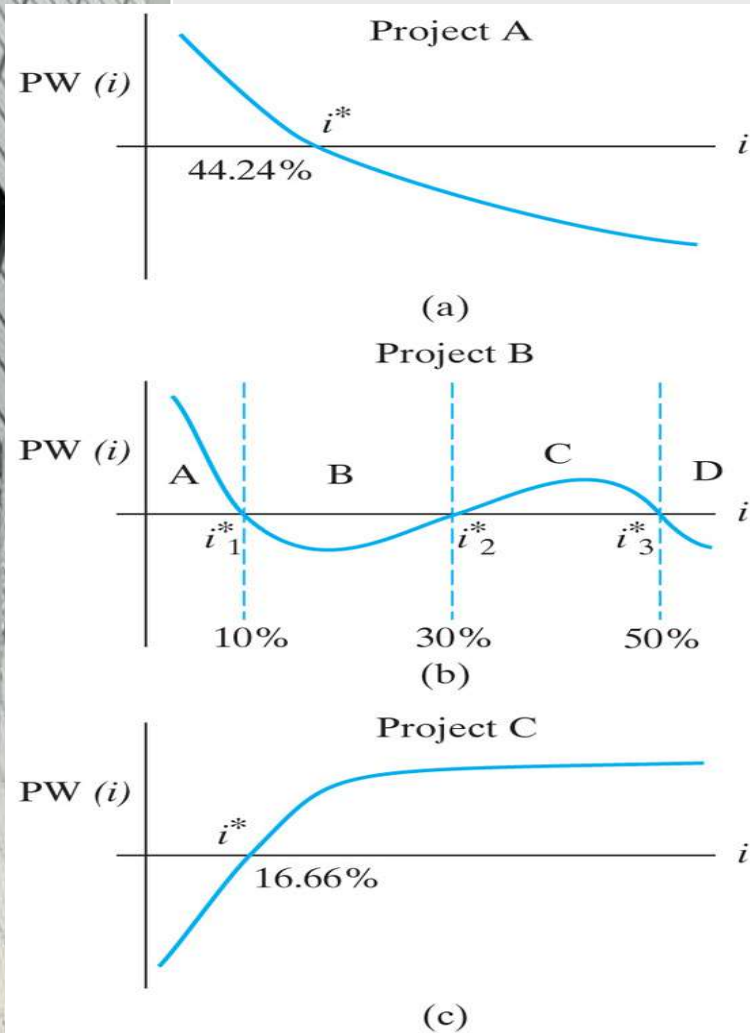


# Types of Investment

- Investments related to production:
  - Corporation Investments
  - Operation Investments
    - Repair
    - Amendment
  - Renovation investments
    - Replacement
    - Expansion
    - Preservation



# Types of the investment projects



Period n	Cash Flow		
	Project A	Project B	Project C
0	-1 000	-1 000	1 000
1	-500	3 900	-450
2	800	-5 030	-450
3	1 500	2 145	-450
4	2 000		

Proje A: Conventional Project  
 Proje B: Non-conventional  
 Project C: Conventional Debt Project



# Expectations from investment projects

- The existing capacity is **expanded** or a **new capacity** is developed.
- The investment project demands and uses physical resources from the economy such as work force, capital and natural resources.
- The investment leads to the application of production technology.
- By investment projects, the corporations can;
  - Decrease the risks,
  - Increase the economic benefits,
  - Improve the management process,
  - Develop new production opportunities in the country,
  - Prioritize the production of resources which have lowest risk level.



# Investment projects in preparation and evaluation of investment

- The dynamic effects of investments, which are basis of economic growth, on the developing economy can be summarized by considering accelerating and stimulating effects.
- The stimulating effects of the investment implies that the money spent for investments leads to much more increase in the gross domestic product of the country.



# Preparation of feasibility studies

## Purpose of feasibility studies;

- **providing optimum resource utilization.** In this perspective, the feasibility study can be considered as a guide to make appropriate investment.
- ascertain the decision of establishment of an investment,
- determination of the size and location of the company,





# Preparation of feasibility study

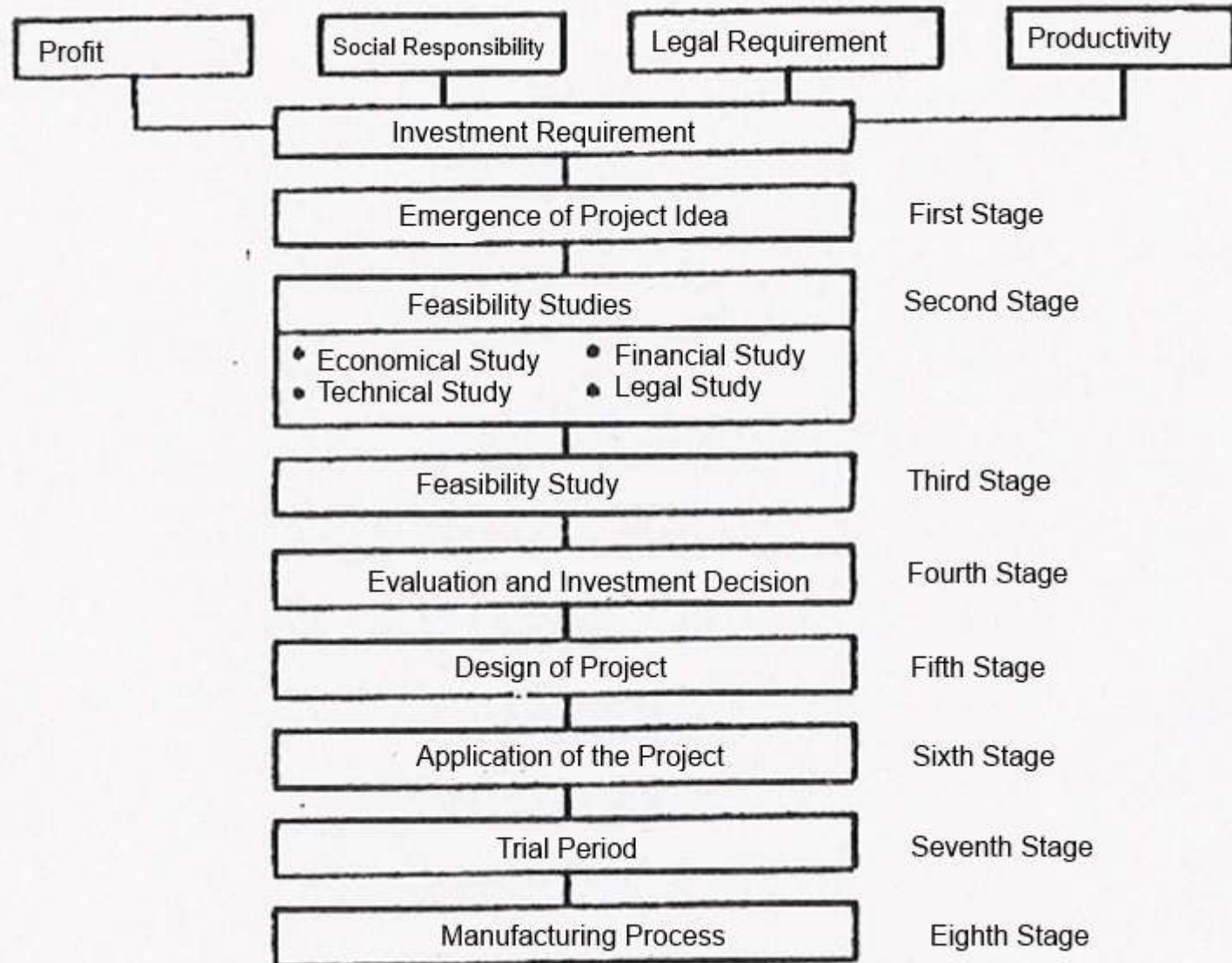
- if the investment requires internal or external funding, the feasibility study can be used as a preliminary project to convince the financial corporations,
- to present the project to the government agencies in order to satisfy governmental financial supports,
- to identify the risks emerged throughout the application of the project and taking necessary actions to eliminate the effects of these risks.



# Parts of feasibility study

- Introduction; general information about the investor and investment
- Economic Study,
- Technical Study,
- Financial Study,
- Conclusion.

# Stages in investment





# Preliminary Research in the Preparation of Investment Projects

- Identification of investment requirement,
- Materialization of the investment requirement,
- Identification of investment alternatives,
- Collection of the relevant information  
(related to the investment alternatives),
- Performing preliminary control related to investment alternatives.



# Economic Study

- Market research and demand forecasting,
  - Capacity selection,
    - Maximum Capacity
    - Normal Capacity
    - Actual Capacity
    - Optimum Capacity: The capacity where the average unit total cost is minimum
- Capacity usage ratio = Actual Capacity / Normal Capacity**
- Determination of the location of the corporation.





## **The importance of the selection of the capacity;**

- Scale economy (Decrease in the average unit cost with increasing quantity).

## **The factors which affect the capacity;**

- since the determination of the capacity depends on many factors, this is a very difficult process.



## Costs

- In order to select the appropriate capacity, the determination of cost functions obtained for different capacity usages are required.
- The cost function can be formulated as  $C=f(Q)$ ; the cost can change with the change in the quantities and prices of production factors. The effects of the costs on selection of the capacity can be varied within the time interval, in other words the effect of the cost in the short term can be different than the effect of the cost in the long term.



## Short term costs

- In this period, no change emerges in the investment structure and organization of the company. In other words, we do not expand or renovate the production facility.
- **Total Fixed costs**; do not change within a given time period, although volume may change.
- **Total Variable costs**; are the costs used for production and vary with the change of the production volume.



## Short Term costs

### Average Unit costs;

- $\text{Average Fixed costs} = \frac{\text{Total Fixed cost}}{\text{Quantity of production}}$
- $\text{Average Variable costs} = \frac{\text{Total Variable cost}}{\text{Quantity of production}}$
- $\text{Average Total costs} = \frac{\text{Total Cost}}{\text{Quantity of production}}$



## Long term costs

- These costs occur at the end of the economic life of the investment, in other words these costs are related to the replacement of the investment. All of the costs are variable costs.
- Since the technology is updated and the capacity is increased, the average unit cost decreases.





## Land Selection

- Closeness to the target market
- Closeness to the resources
- Workforce

### Methods;

- ❖ Scoring method,
- ❖ Cost comparison method,
- ❖ Benefit comparison method,
- ❖ Profit comparison method.



## **Determination of production program**

- Selection of machines and equipment
- Determination of required work force



# Technical survey

- Determination of technical design of the product,
- Selection of the production method and technology; The reason of selection, acquiring method (licence, purchasing, joint venture), the alternative technologies and their costs
- Determination of required work force, required qualified and unqualified workers, inspector and managers, training requirement, the required work force and their costs at post project and during project.
- Work Flow charts and determination of required facilities in construction site and allocation of these facilities; Determination of technical bureau, location of production and service buildings,
- Preparation of product plans; Who will conduct project activities and how they will do that and the cost of the production
- Determination of material requirements,
- Calculation of construction cost.



# Financial survey

- Calculation of the total cost of the project,
- Determination of required capital investment, total investment finance and capital structure
- Calculation of the incomes throughout the construction period
- Estimation of the total incomes and costs at the end of the project and profitability of the project
- Evaluation of the project in the financial perspective.



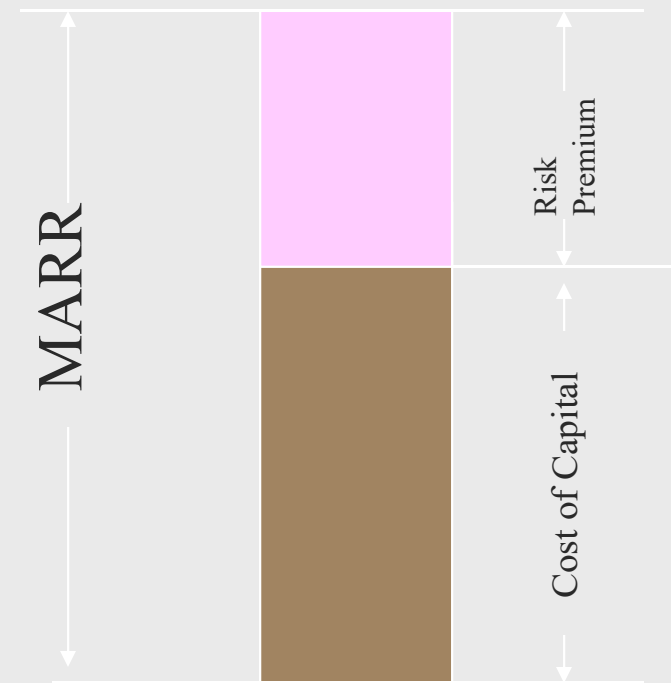
# Conclusion and demand

- The preparation of the reports related to the project according to the purposes of the stakeholders.



# Minimum attractive rate of return

- Is the rate set by an organization to designate the lowest level of return that makes an investment acceptable.
- **Cost of capital**
- **Risk premium**
  - If the risk of the project is high, the risk premium calculated for this project will also be high. In other words, the risk premium increases with increasing risk.





# Cost of capital

- **Equity financing:** the corporation uses its own funds from cash on hand, stock sales or retained earnings.
- **Debt financing:** the corporation borrows from outside sources and repays the principal and interest according to some schedule.
  - Bonds
  - Loans
  - Mortgages etc.



# Risk Premium

- Business risks
- Financial risks
- Market risks
- Interest risks etc.



## Net Present Value; NPV

- A future amount of money converted to its equivalent value now has a present worth (PW) that is always less than that of the actual cash flow. Net present value is a standard method to evaluate the long term projects.
- Net present value is obtained by adding present values of all transactions. If NPV is positive, this shows that the investment is profitable. On the other hand, if it is negative, this means that the costs of the investment are higher than the revenues of this investment. When it is calculated as zero, then this investment is at the breakeven point.



# Example 1

- Perform a present worth analysis of equal-service machines with the costs shown below, if the MARR is 10% per year. Revenues for all two alternatives are expected to be the same.

	Electric-powered	Gas-powered
First Cost	-2500	-3500
Annual operating Costs	-900	-700
Salvage value	200	350
Life, years	5	5





## Example 1

- $PW_e = -2500 - 900(P/A, 10\%, 5) + 200(P/F, 10\%, 5) = \$-5788$
- $PW_g = -3500 - 700(P/A, 10\%, 5) + 350(P/F, 10\%, 5) = \$-5936$
- The electric-powered machine should be preferred.



## Rate of Return; ROR

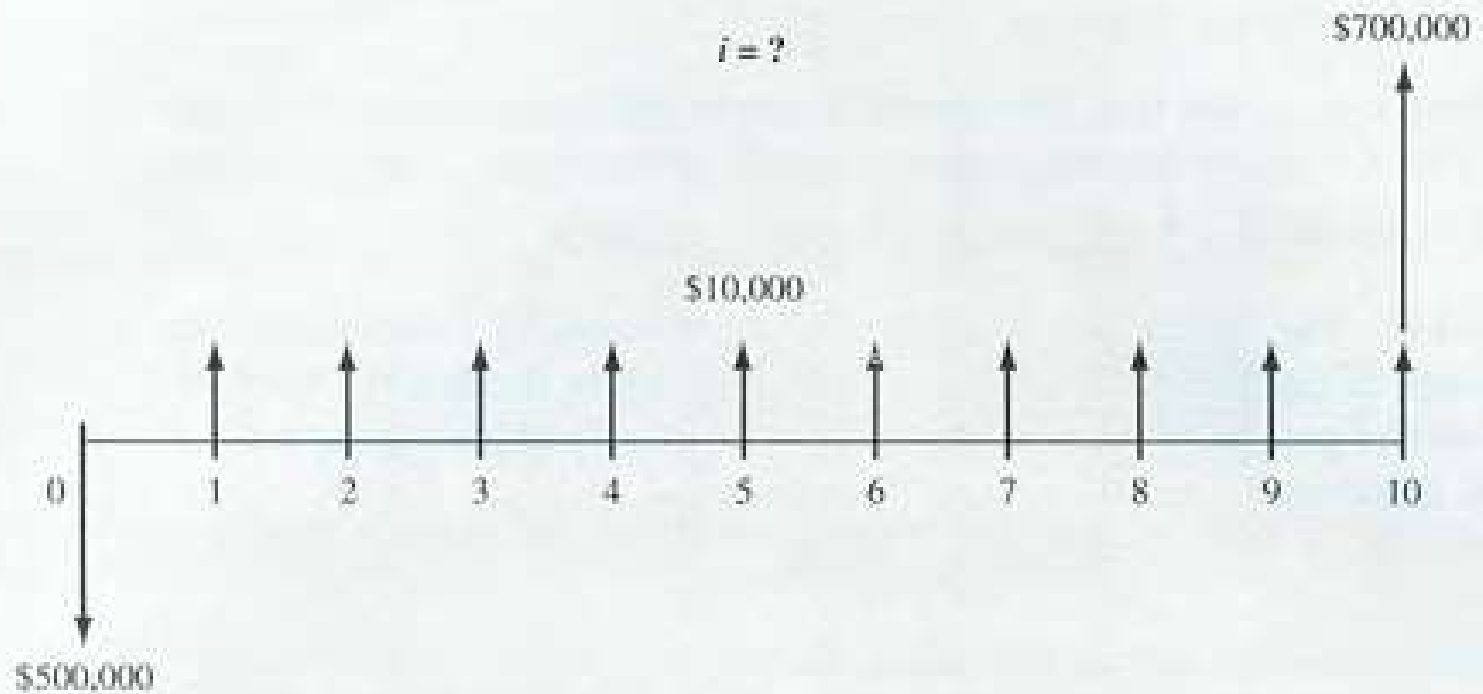
- Rate of return (ROR) is the rate paid on the unpaid balance of borrowed money, or the rate earned on the unrecovered balance of an investment, so that the final payment or receipt brings the balance to exactly zero with interest considered.
- The rate of return is expressed as a percent per period, for example,  $i = 10\%$  per year.
- ROR is an important indicator in selecting project. To determine the rate of return of a cash flow series, set up the ROR equation using either PW relations. The present worth of costs or disbursements  $PW_d$  is equated to the present worth of incomes or receipts  $PW_r$ .



## Example 2

- The HVAC engineer for a company constructing one of the world's tallest buildings (Shanghai Financial Center in the Peoples' Republic of China) has requested that \$500,000 be spent now during construction on software and hardware to improve the efficiency of the environmental control systems. This is expected to save \$10,000 per year for 10 years in energy costs and \$700,000 at the end of 10 years in equipment refurbishment costs. Find the rate of return.

# Example 2



## Example 2

$$-500000 + 10000(P/A, i\%, 10) + 700000(P/F, i\%, 10)$$

$$i\% = 5$$

$$0 = -500000 + 10000(P/A, 5\%, 10) + 700000(P/F, 5\%, 10)$$

$$0 < \$6946$$

$$-500000 + 10000(P/A, 6\%, 10) + 700000(P/F, 6\%, 10)$$

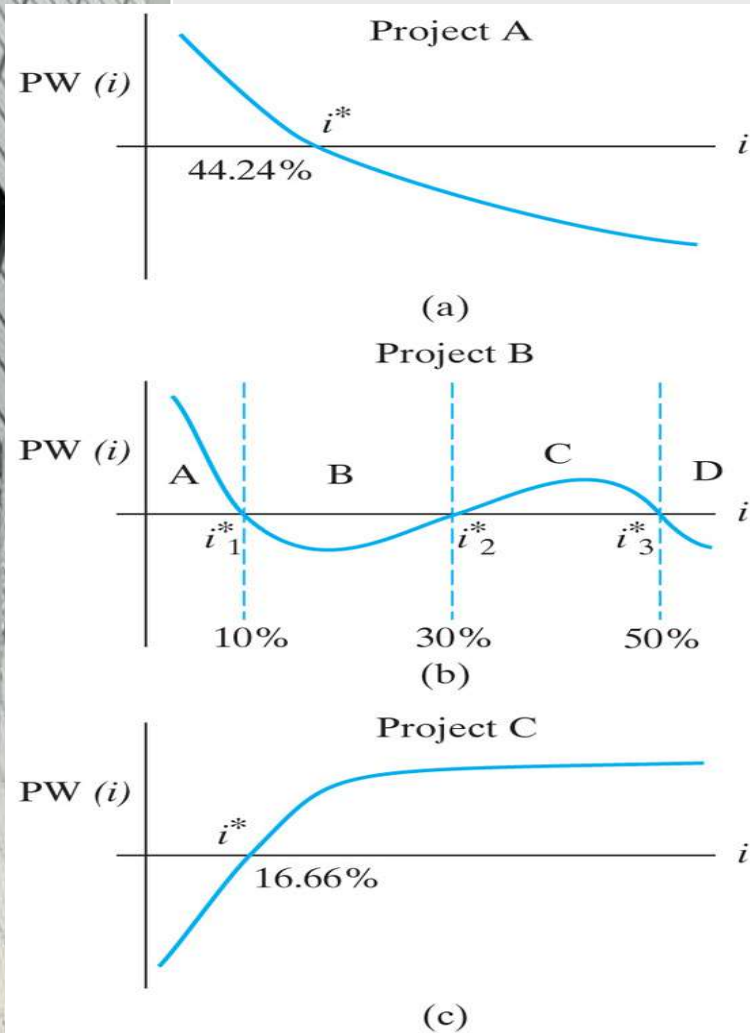
$$0 > \$-35519$$

$$i = 5 + \frac{6946 - 0}{6946 - (-35519)}$$

$$i = 5.16\%$$



# Types of the investment projects



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# Return of Investment; ROI

- A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. To calculate ROI, the benefit (return) of an investment is divided by the cost of the investment; the result is expressed as a percentage or a ratio. In the below formula "gains from investment", refers to the proceeds obtained from selling the investment of interest.
- **ROI = (gains from investment/ Investment amount) x 100**
- Return on investment is a very popular metric because of its versatility and simplicity. That is, if an investment does not have a positive ROI, or if there are other opportunities with a higher ROI, then the investment should be not be undertaken.



# Benefit / Cost Ratio

- The benefits obtained at the end of the project is divided to the costs spent for the project to determine the benefit cost ratio. It is an important indicator for the projects which have very close project duration.
  - B/C ratio is larger than one; the benefit of the project is higher than the cost of the project. For example, if the “B/C ratio is equal to 2.5 ”, the project provides benefit whose worth is 2.5 TL, and it costs only 1 TL.
  - B/C ratio is smaller than one; the benefit of the project is smaller than the cost of the project.
  - B/C ratio is equal to one; Project is at the breakeven point.



## Example 3

- Considering the great tourism potential in Antalya, the government is thinking about the construction of a second airport at a place located outside the city center in one of the villages. This project is planned to cost 1,000,000\$ in the design and 50,000,000\$ in the construction phase. The government will have to spend 500,000\$ of maintenance and operating cost with an increasing rate of 100,000\$/year. Since the farm lands in the village will be damaged, 250,000 \$/year profit gained by agriculture will be lost. On the other hand, as an alternative transportation solution and as it gives way to the tourism improvement of the region, it seems to provide 1,500,000 \$/year to the people living in Antalya region. If the analysis period is defined as 20 years by the government and  $MARR = 10\%$ , is the airport a feasible investment?

## Example 3

- $A_{\text{cost}} = 51000000 * (A/P, 10, 20) + 500000 + 100000 * (A/G, 10\%, 20) = 7143310 \text{ \$/year}$
- $A_{\text{benefit}} = 1500000 - 250000 = 1250000 \text{ \$/year}$
- $B/C = 1250000 / 7143310 = 0,17 < 1 \text{ reject}$





# Payback Period

- **Payback analysis** (also called pay-out analysis) is another form of sensitivity analysis that uses a PW equivalence relation.
- The point where the project starts to earn profit.  
(Breakeven point)
- The payback period is the time, it will take for estimated revenues and other economic benefits to recover the initial investment  $P$ . Therefore, the alternative which has shorter payback period is the better alternative.

## Example 4

- A company has two machine alternatives whose economic lives are 6 years. The price and annual income of these machines are given in the following table. According to the no return payback period, determine the alternative the company should invest.

Alternatives	Cost (TL)	Annual income (TL/yr)
Machine A	200 000	45 000
Machine B	300 000	60 000



## Example 4

- Payback Period<sub>1</sub> = 200 000/45 000 = 4.4 years
- Payback Period<sub>2</sub> = 300 000/60 000 = 5 years
- According to the payback periods, first alternative should be preferred.

## Example 5

- Compute the payback period of the following cash flow both for the no return and  $MARR = 10\%$  payback periods.

End of year	0	1	2	3	4	5	6
Cash Flow	-100	25	30	25	-10	45	45

# Example 5

Years	0	1	2	3	4	5	6
Cash Flow	-100	25	30	25	-10	45	45
PW	-100	22.73	24.79	18.78	-6.83	27.94	25.40
Cumulative present worth	-100	-77.27	-52.48	-33.70	-40.53	-12.59	12.82



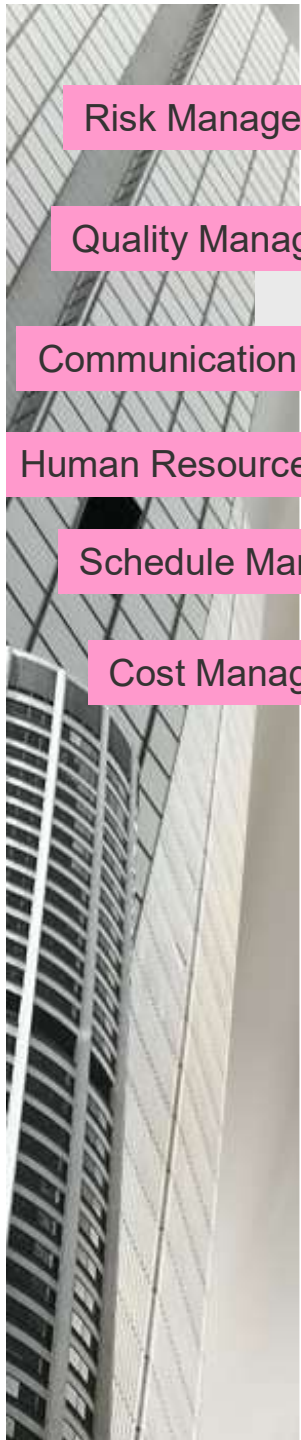


## Opportunity Cost

- An opportunity cost is the benefit foregone by choosing one opportunity instead of the next best alternative due to the limited resources of the company.
- The opportunities which are eliminated due to the limited resources are examples of this type of costs.



# Investment in Housing Sector



Risk Management

Quality Management

Communication Management

Human Resources Management

Schedule Management

Cost Management

Idea – Preliminary Feasibility study/ Targeted Market

Finding the construction field

Market research– Social, Economical and demographical studies –  
When is the right time?

Financial Analysis      Concept

Schedule / Cash Flow

Project Development

Marketing

Construction

Delivery

Service after construction

Management

Contract

Communication

Permissions



# Preliminary stages in project development;

- Evaluation of market and company,
- Evaluation of legal and political situation,  
(Strengths, Weaknesses, Opportunities, and  
Threats Analysis)
- Observe the development of the city.



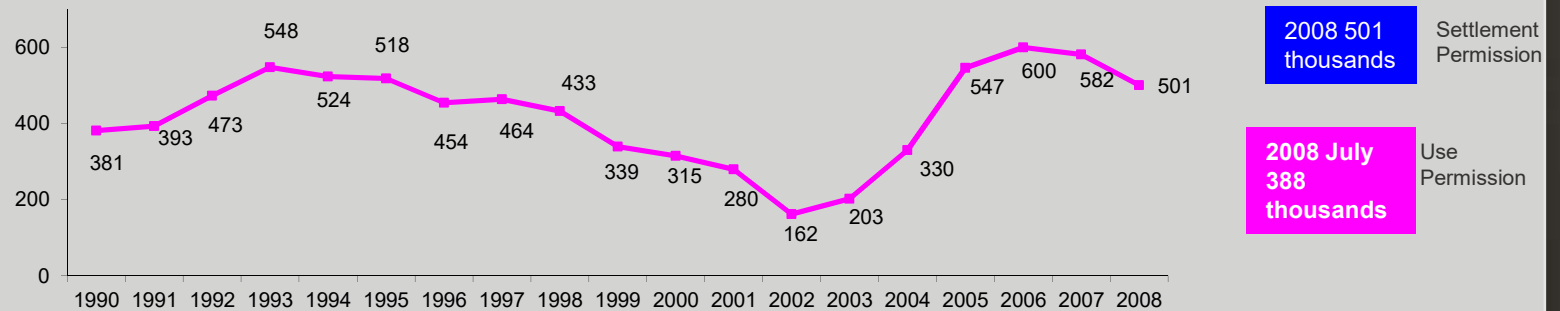
# Basic indicators in residential building market

- Residential building sector indicators;
  - Number of licences,
  - Number of settlement permission,
  - Volume of mortgage credits,
  - Number of mortgages.



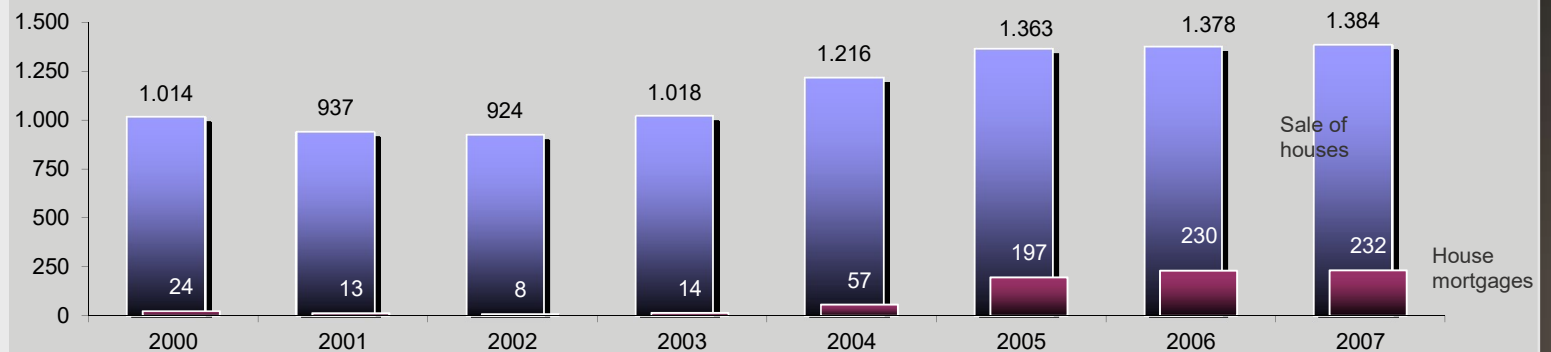
# Residential Buildings

## Housing construction (thousands) (\*)



(\*) Turkish Statistical Institute.

## Annual sale volume of houses (thousands) (\*\*)



(\*\*) General Directorate of Land Registry and Cadastre.



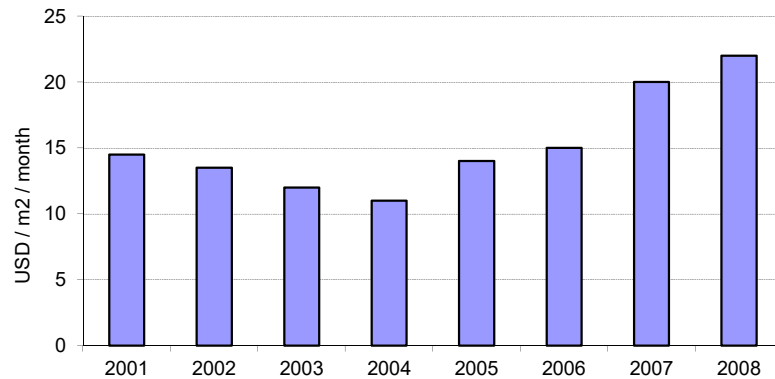
# Indicators in office buildings

- Emptiness ratio
- Used capacity
- Total stock m<sup>2</sup>
- Average rent

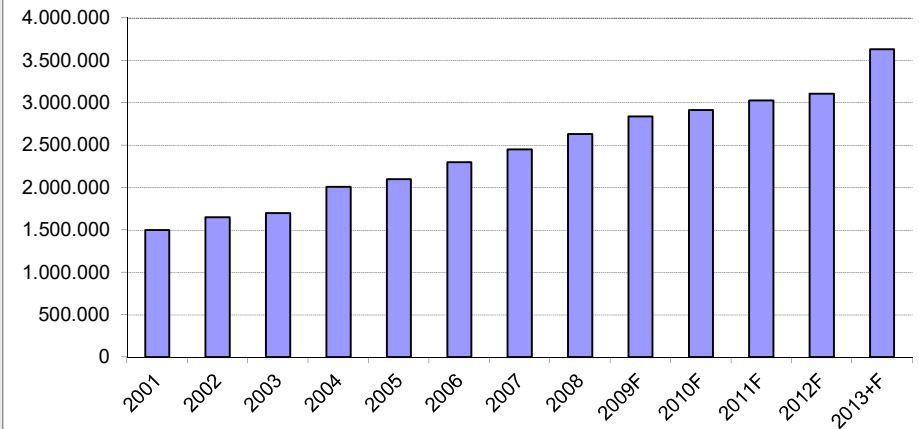
Besides, the global and local economic conditions should also be considered.

# Office

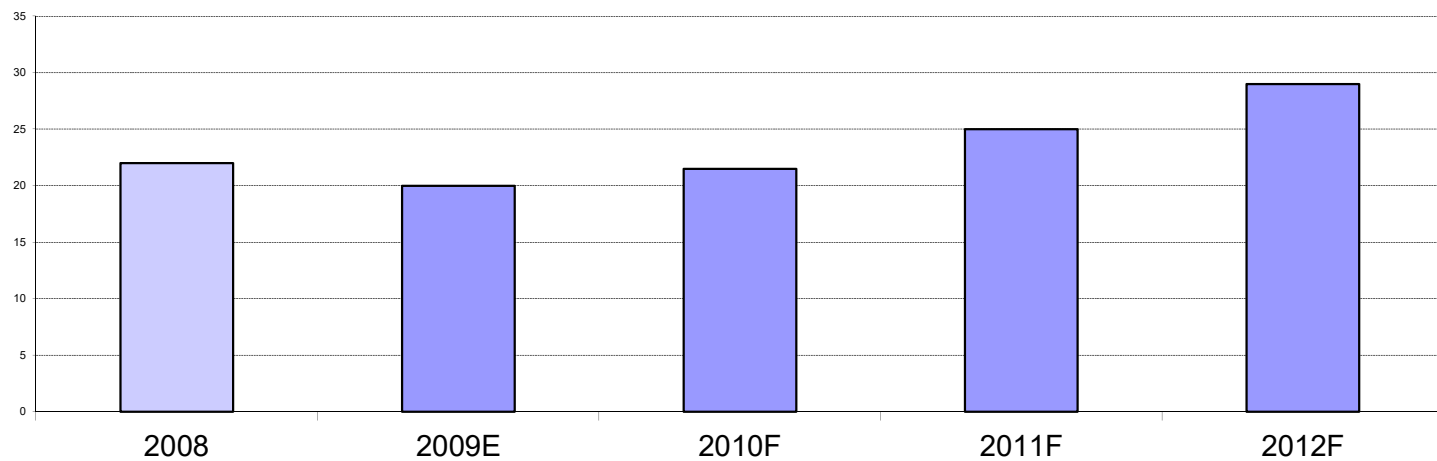
**Average rent costs of offices in Istanbul**



**Stock capacity of offices in Istanbul**



**Rent expectations of offices in Istanbul**



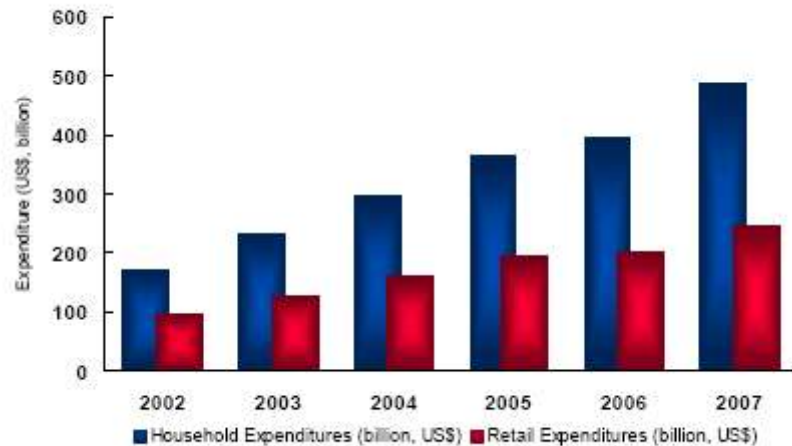


# Indicators in retail center market

- Total rentable area,
- Household consumption expenditure,
- Retail center floorspace by 1000 inhabitants,
- New retail supply,
- Types of existing retail centers.

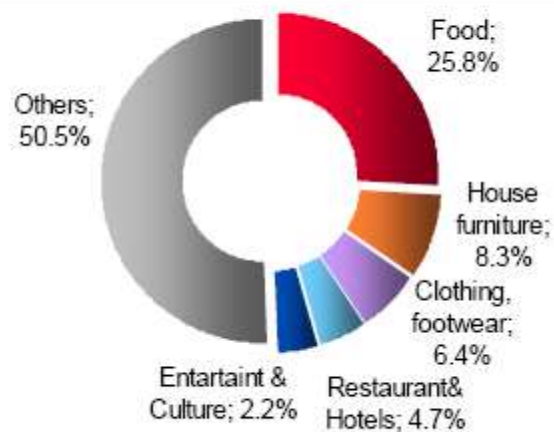
# Retail Center

**Retail Expenditures in Household Consumption**



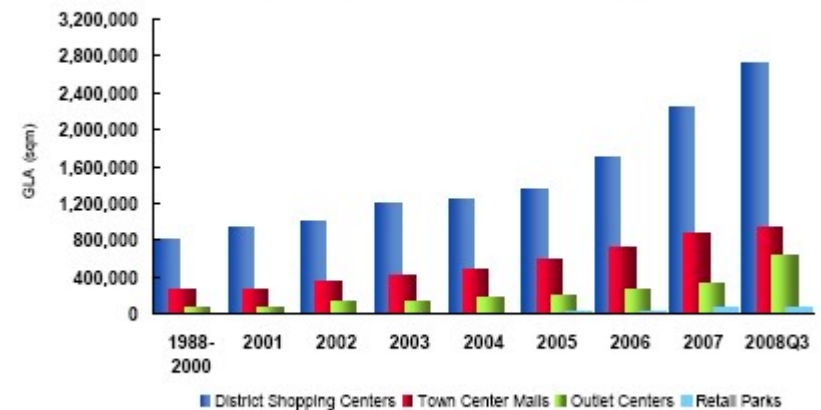
Source: TURKSTAT

**Household Consumption Expenditure (by types, 2008Q2)**



Source: TURKSTAT

**Retail Centre Supply (cumulative GLA by type)**

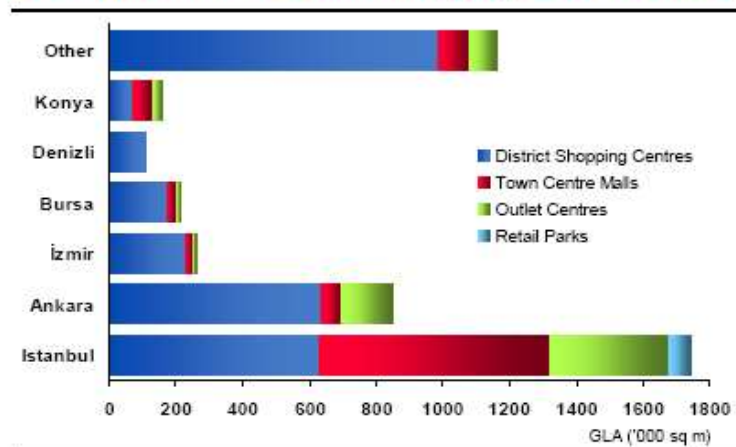


Source: DTZ Pamir&Soyuer



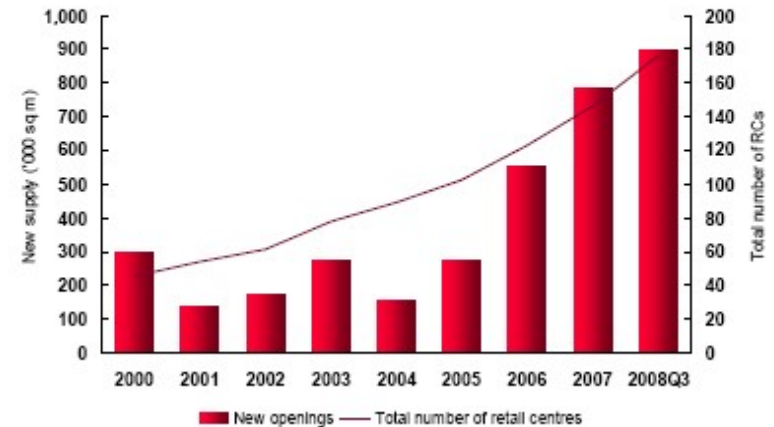
# Retail Center

Distribution of Retail Centres (by type and location)

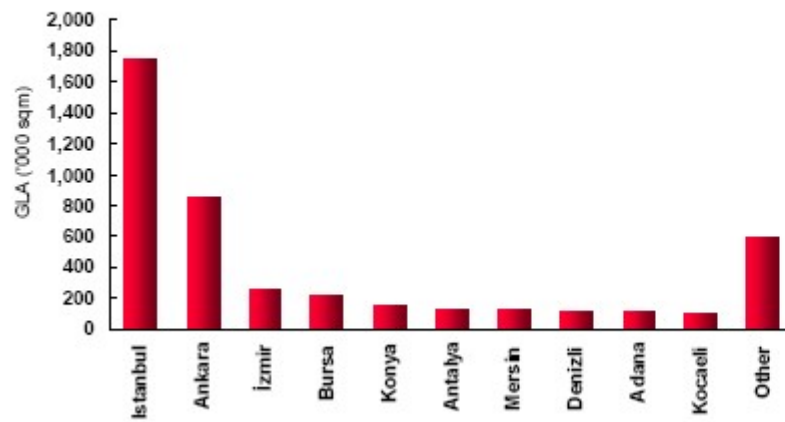


Source: DTZ Pamir&Soyuer

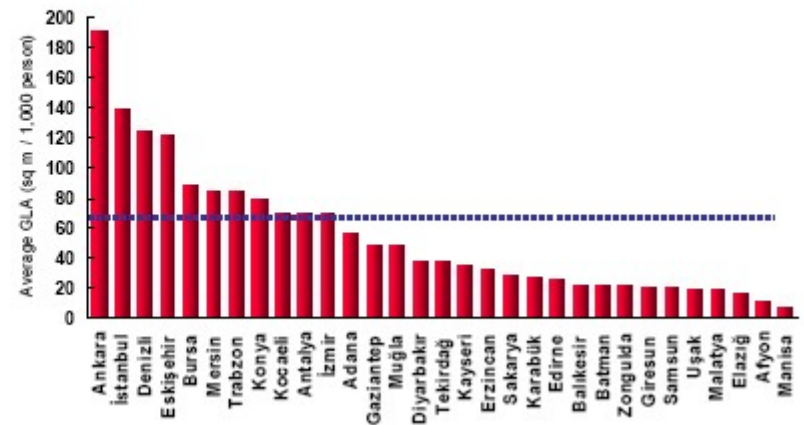
New Retail Supply



Retail Centre Supply (supply breakdown by city)



Retail Centre Supply (breakdown by retail centre floorspace GLA by 1,000 inhabitants)





# The models used in business development in housing sector

- Partnership and joint ventures
- Share the revenues
- Build-Operate-Transfer
- Build-Operate
- Leasing
- Private Public Partnerships
- Share in building structure



# Construction Conditions

- **Construction Field Area**(**Brüt İnşaat Alanı**): The total area of the floors placed between basement, mezzanine, and roof. The skylight, shaft, water table, fire ladders placed outside the building are not included, but common areas are not considered.
- **Floor area coefficient**(**Taban Alanı Kat Sayısı**): The ratio of the floor area of the construction to the area of reconstruction parcel. This shows the largest floor area of the construction on the construction field. It cannot be larger than 1.00.



# Construction Conditions

- **Total floor area coefficient**(Kat Alanı Kat Sayısı): **The ratio of the total construction area to the construction field.** The construction area cannot be exceed to the total floor area coefficient. It is stated with TAKS and the number of the floors is calculated by using these two coefficients.
- **Precedent (Emsal): The ratio of the construction area to the reconstruction parcel.** Usually, it is considered as KAKS. The height of the building is determined by considering this coefficient and  $h_{\max}$ .



# Construction Conditions

- **$H_{\max}$**  (Maksimum Yapı Yüksekliği): The maximum height of the construction
- **Floor height=  $h$** ; Usually it is taken 3 meters.



# Example 1

- The field area is  $1500\text{m}^2$
  - $\text{TAKS} = 0.2$  ,  $\text{KAKS} = 2$
  - This means that;
  - $1500 \times 0.2 = 300\text{m}^2 \rightarrow$  The floor area of the construction
  - $1500 \times 2 = 3000\text{m}^2 \rightarrow$  The total construction area
  - $3000 / 300 = 10$  floors  $\rightarrow$  Number of floors
    - A 10 storey building whose floor area is  $300\text{m}^2$  can be constructed on this field.
- if there is no contrary condition on the plan notes;**
- A 15 storey building whose floor area is  $200\text{m}^2$  can be constructed.
  - A 10 storey building whose floor area is  $200\text{m}^2$  and a 10 storey building whose floor area is  $100\text{m}^2$  can be constructed.

## Example 2

- Field area is  $2000 \text{ m}^2$
- **KAKS = Precedent = 2**,  $H_{\max} = 30\text{m}$ ,  $h = 3\text{m}$  olsun

This means that;

- $2000 \times 2 = 4000\text{m}^2$  → The total construction area
- $H_{\max} / h = 30 / 3 = 10$  Floors → number of floors
  - On this field, buildings whose total construction is  $4000\text{m}^2$ , the maximum number of floor of these buildings is 10.

**If there is no contrary condition on the plan notes and TAKS=0.25;**

- Floor area=  $0.25 \times 2000 = 500 \text{ m}^2$
- A 10 storey building whose floor area is  $300\text{m}^2$  and a 5 storey building whose floor area is  $200\text{m}^2$  can be constructed.
- A 20 storey building whose floor area is  $200\text{m}^2$  cannot be constructed.