Mission, Strategy and Project Selection

- Given that the organization has an appropriate mission statement and strategy, projects must be selected that are consistent with the strategic goals of the organization.

- Project Selection:
  - Process of evaluating individual projects or groups of projects and then choosing to implement (carry out) some of them so that the objectives of the organization will be achieved.
  - Risk is always a factor to consider during the selection process due to uncertainty about:
    - Resources required
    - Completion time of the project
    - Unforeseen (unexpected) events during implementation.

Project Selection

- Process of evaluating individual projects or groups of projects and then choosing to implement (carry out) some of them so that the objectives of the organization will be achieved.

- Choice between competing alternatives.

- Resources are always scarce, hence selection is necessary.
  - Which machine for manufacturing?
  - Which projects to bid for?
  - What mix of products?
  - Which company to merge with?
  - What services to have in a new hospital?

- Each project will have different costs, benefits, and risks.

Models

- Abstraction from reality; a simplified representation of reality or the real thing.

- Kinds of models: analog, mathematical, iconic, physical, simulation.

- Models help us make decisions; in the case of project selection, they help the decision-maker select the appropriate project.
Some criteria for project selection models:

- **Realism**: model should reflect the reality of the manager’s decision situation; it should take into account the realities of the firm’s limitations on facilities, capital, human resources, technology, etc.
- **Capability**: model should be sophisticated enough to deal with multiple time periods, simulate various situations both internal and external to the project (strikes, interest rate changes, system behavior changes, etc.)
- **Flexibility**: model should have the ability to be easily modified, or to be self-adjusting in response to changes in the firm’s environment (changes in laws, new technological advances; a change in goals of the organization)

**Ease of use**: model should be convenient, not take a long time to execute, and be easy to use and understand

**Cost**: data gathering and modeling costs should be low relative to the cost of the project

**Easy computerization**: model must be such that it must be easy and convenient to gather and store the information in a computer database, and to manipulate data in the model through use of widely available computer packages

Two basic types of project selection models:

- nonnumeric
- numeric

Both are widely used. Sometimes a combination of the two types are used.

Nonnumeric models do not use numbers as inputs; the numeric models do but the criteria being measured may be either **objective** or **subjective**

Two critically important, but often overlooked, facts about project selection models:

- models do not make decisions — people do. The manager, not the model, bears the responsibility for the decision
- all models, however sophisticated, are only partial representations of the reality they are meant to reflect. Real situations are far too complex to picture as a model. Therefore, no model can yield an optimal decision except within its own, possibly inadequate, framework.
Types of Project Selection Models - Nonnumeric

- Nonnumeric models
  - Sacred Cow: ordered by top management. No other alternative; must be done
  - The Operating Necessity: the project is required in order to keep the system operating
    - online library search system
    - EMU registration system
  - The Competitive Necessity: to achieve or maintain competitive position
    - restructure undergraduate and graduate programs to in view of declining student enrollment
    - modernize manufacturing facility
    - get a CNC (computer numerically controlled) machine to replace the old milling machine (freze tezgahi)

- The Product Line Extension: a project to develop and distribute new products. The project would be judged on the degree to which it fits the firm’s existing product line, fills a gap, strengthens a weak link
  - the new Apple Ipod which also plays video

- Comparative Benefit Model: when there are a number of possible projects but they are not easily comparable in terms of their benefits. The organization has no formal method of selecting projects; the selection committee think that some projects will benefit the firm more than others even if they have no precise way or method to define or measure “benefit”

- Q-Sort: an example of Comparative Benefit Model

Types of Project Selection Models - Numeric

- Financial models
  These models use financial attributes as the sole measure of acceptability for the project.
  - Payback Period Model
    - Payback Period = Estimated project cost/Annual savings(proceeds)
    - Measures the time it will take to recover the project investment.
    - Shorter paybacks are more desirable.
    - Emphasizes cash flows, a key factor in business.
    - Limitations of payback:
      - Ignores the time value of money.
      - Assumes cash inflows for the investment period (and not beyond).
      - Does not consider profitability.
Types of Project Selection Models - Numeric

Payback Illustration:
Assume a project costs $200,000 to implement and has annual net cash inflows of $50,000/year.

Payback period = $200,000/$50,000 = 4 years

– This method assumes that the cash inflows will persist at least long enough to pay back the investment, and it ignores any cash inflows beyond the payback period.
– The faster the investment is recovered, the less the risk to which the firm is exposed

–Average Rate of Return (ARR) Model

Average rate of Return = Average Cash Inflow / Initial Investment

To follow on the preceding example,

\[ ARR = \frac{$50,000}{200,000} = 0.25/yr. \]

Neither the payback nor the ARR is recommended for project selection, though payback period is widely used and does have a legitimate value for cash budgeting decisions. The major advantage of these models is their simplicity, but neither takes into account the time-value of money.

Net Present Value (NPV) Model

Uses management’s minimum desired rate-of-return (discount rate) to compute the present value of all net cash inflows.

– Positive NPV: the project meets the minimum desired rate of return and is eligible for further consideration.
– Negative NPV: project is rejected.

Project NPV = I₀ + \sum_{i=1}^{n} \frac{F_i}{(1 + r)^i}

where

I₀ = Initial investment (since it is an outflow, the number will be negative)

Fᵢ = net cash inflow for period i

r = required rate of return

PRESENT VALUE FORMULA EXPLANATION

To find a formula for future value, we’ll write P for your starting principal, and r for the rate of return expressed as a decimal. (So if the interest rate is 5%, r equals .05).

Your balance will grow according to the following schedule:

<table>
<thead>
<tr>
<th>Year</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Now</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>P(1 + r)</td>
</tr>
<tr>
<td>2</td>
<td>P(1 + r)^2</td>
</tr>
</tbody>
</table>

This starts to get messy in a hurry. But you can simplify it by noticing that you can keep pulling out factors of (1 + r) from each line. If you do that, the balances collapse to a simple pattern:

<table>
<thead>
<tr>
<th>Year</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Now</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>P(1 + r)</td>
</tr>
<tr>
<td>2</td>
<td>P(1 + r)^2</td>
</tr>
</tbody>
</table>

If you follow this pattern out for n years, you get the general formula for future value:

\[ FV = P(1 + r)^n \]
The formula for present value is simple; just take the formula for future value and solve for starting principal:

\[ PV = \frac{FV}{(1 + r)^n} \]

(We’re now writing PV, for “present value”, where we were writing P before. This is sort of the convention. It’s still the same quantity: it’s the principal you start out with.)

**PRESENT VALUE FORMULA EXPLANATION**

**Types of Project Selection Models - Numeric**

- Illustration

\[
\begin{align*}
I_0 &= 700,000 \, \text{\$} ; \\
F_t &= 225,000 \, \text{\$} ; \\
k &= 15\% \\

NPV &= (-700,000) + \frac{225,000}{(1 + 0.15)^1} + \frac{225,000}{(1 + 0.15)^2} + \ldots + \frac{225,000}{(1 + 0.15)^5} \\

NPV &= 54,235 \\
\end{align*}
\]

**NET PRESENT VALUE EXAMPLE**

<table>
<thead>
<tr>
<th>PROJECT A</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>TOTALS</th>
<th>FORMULA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required rate of return</td>
<td>15%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outflows</td>
<td>700,000</td>
<td>700,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,400,000</td>
<td></td>
</tr>
<tr>
<td>Inflows</td>
<td>225,000</td>
<td>225,000</td>
<td>225,000</td>
<td>225,000</td>
<td>225,000</td>
<td>1,125,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net inflows</td>
<td>225,000</td>
<td>225,000</td>
<td>225,000</td>
<td>225,000</td>
<td>225,000</td>
<td>425,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPV</td>
<td>54,235</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PROJECT B**

<table>
<thead>
<tr>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>TOTALS</th>
<th>FORMULA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required rate of return</td>
<td>15%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outflows</td>
<td>400,000</td>
<td>400,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>800,000</td>
</tr>
<tr>
<td>Inflows</td>
<td>110,000</td>
<td>110,000</td>
<td>110,000</td>
<td>110,000</td>
<td>110,000</td>
<td>550,000</td>
<td></td>
</tr>
<tr>
<td>Net inflows</td>
<td>110,000</td>
<td>110,000</td>
<td>110,000</td>
<td>110,000</td>
<td>110,000</td>
<td>150,000</td>
<td></td>
</tr>
<tr>
<td>NPV</td>
<td>31,263</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SELECT PROJECT A**

- Profitability Index
  Also known as the benefit-cost ratio.

\[
\text{PI} = \frac{\text{NPV of all future expected cash flows}}{\text{initial cash investment}}
\]

Project is selected if PI > 1; otherwise rejected. If more than one project is involved, the project with the greatest PI is selected from among those with PI > 1.
Types of Project Selection Models - Numeric

- Scoring Models
  Financial models which were presented earlier generally focus on a single decision criterion – financial impact and profitability. Projects usually have multiple criteria; therefore models have been developed to evaluate projects on multiple criteria. These models are labeled "scoring models." There are any such models; we will look at a few of these models.

Types of Project Selection Models - Numeric

- Unweighted 0 – 1 Factor Model
  - A set of relevant factors is selected by management and then listed in a preprinted form
  - One or more raters score the project on each factor, depending on whether it qualifies for an individual criterion
  - Advantage: multiple criteria for the decision process
  - Disadvantage: First one is that it assumes all criteria are of equal importance; the second disadvantage is that it allows for no gradation of the degree to which a specific project meets the various criteria
  An illustration follows on the next slide

Project ____________________________
Rater ______________________ Date ___________________

Does Not Qualify

With customers
With our industry
TOTALS

Time to break-even less than 3 years
Need for external consultants
Consistency with current line of business
Impact on company image
Impact on environmental standards
Profitability
Rate of return more than 15% after tax
Estimated annual profits more than $250,000
No increase in energy requirements
Potential market size, $
Potential market share, percent
No new facility required
No new technical expertise required
No decrease in quality of final product
Ability to manage project with current personnel
No requirement for reorganization
Impact on workforce safety

Types of Project Selection Models - Numeric

- Unweighted Factor Scoring Model
  The second disadvantage of the 0-1 factor model can be dealt with by constructing a simple linear measure of the degree to which each project being evaluated meets each of the criteria in the list.
  For example a five-point scale may be used:
  5 - very good
  4 – good
  3 – fair
  2 – poor
  1 – very poor
  3, 7, and 10 may also be used. Other variations are also used.
Types of Project Selection Models - Numeric

<table>
<thead>
<tr>
<th>Project</th>
<th>Rater</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Types of Project Selection Models - Numeric

Unweighted Factor Scoring Model

- Weighted Factor Scoring Model

\[ S_i = \sum_{j=1}^{n} s_{ij} w_j \]

where \( S_i \) = total score of the ith project
\( s_{ij} \) = score of the ith project on the jth criterion
\( w_j \) = the weight of the jth criterion

The weights may be generated by any suitable technique. One widely used technique is the ‘Delphi’ technique.