Learning the Business (each driving the next)

Business strategy
- Selecting markets in which to participate and formulating strategies for competing in those markets
- Valuation
  - Analyzing the economic value of projects executed in the pursuit of that business strategy
  - Time value of money (NPV)
  - Opportunity cost of money (risk)
- Cost-benefit analysis
  - Translating measured or estimated data into monetary terms
    - ROI = \( \frac{\text{net benefits}}{\text{costs}} = \frac{\text{benefits - costs}}{\text{costs}} \)
- Metrics
  - Measuring the parameters (such as programmer time) that form the basis for cost and benefit analysis

Benefits - Costs

Benefits
% Readily quantified as $ values
% Examples:
  - increased sales
  - cost/error reductions
  - increased throughput/efficiency
  - increased margin on sales
  - more effective use of staff time

Intangible benefits
% Difficult to quantify
% Business analysts help estimate $ values
% Examples:
  - increased flexibility of operation
  - higher quality products/services
  - better customer relations
  - improved staff morale

How will the benefits accrue?
% When - over what timescale?
% Where in the organization?

Costs
% Development costs (OTO)
% Examples:
  - Cost of development team
  - Consultant fees
  - Software used (buy or build?)
  - Hardware (what to buy, buy/lease?)
  - Facilities (site, communications, power, ...)
% Installation and conversion costs:
  - Installing the system
  - Training personnel
  - File conversion, ...
%
% Operational costs (on-going)
% Examples:
  - System maintenance
    - Hardware (repairs, lease, supplies, ...)
    - Software (license and contracts)
    - Facilities
  - Personnel
    - Operations (data entry, backups, ...)
    - Support (user support, hardware and software maintenance, supplies, ...)
    - On-going training costs

Today’s Menu

Last Seminar:
Measurement
(Ken led)

This Seminar:
Reuse Economics
(Chris is leading)

Next Seminar:
Reengineering for Reuse
(Tan leads)

Four Types of Feasibility

Technical feasibility
% Is the project possible with current technology?
  % How much technical risk is there?
  % Does the technology exist at all?
  % Is it available locally?
  % Can it be obtained?
  % Will it be compatible with other systems?
% Schedule feasibility
% Is it possible to build a solution in time to be useful?
  % Any constraints on the schedule?
  % Can these constraints be met?
% Operational feasibility
% Urgency of the problem and the acceptability of any solution?
  % If the system is developed, will it be used?
% Economic feasibility
% Is the project possible, given resource constraints?
% What benefits will result from the system?
  % Both tangible and intangible benefits
% What are the development and operational costs?
% Are the benefits worth the costs?

Benefits
% Cost/Flows
% ROI = \( \frac{\text{net benefits}}{\text{costs}} = \frac{\text{benefits - costs}}{\text{costs}} \)

Costs
% Costs/Flows
% 4

Last Seminar:
Measurement
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This Seminar:
Reuse Economics
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Next Seminar:
Reengineering for Reuse
(Tan leads)
Example: costs for small Client-Server project

<table>
<thead>
<tr>
<th>Personnel</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Systems Analysts (400 hours @ $15.00/hr)</td>
<td>$20,250</td>
</tr>
<tr>
<td>1 Systems Analyst (250 hours @ $20.00/hr)</td>
<td>$5,000</td>
</tr>
<tr>
<td>2 Development Analysts (400 hours @ $15.00/hr)</td>
<td>$13,500</td>
</tr>
<tr>
<td>2 Database Specialists (600 hours each @ $60.00/hr)</td>
<td>$7,200</td>
</tr>
<tr>
<td>1 Project Manager (200 hours @ $40.00/hr)</td>
<td>$8,000</td>
</tr>
<tr>
<td>1 Systems Analyst (500 hours @ $15.00/hr)</td>
<td>$7,500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expenses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Maintenance Agreement for Server DBMS software</td>
<td>$525</td>
</tr>
<tr>
<td>1 Preprinted forms (15,000/year @ .22/form)</td>
<td>$3,300</td>
</tr>
</tbody>
</table>

Total Projected Annual Costs: $11,270

Calculating Present Value

→ A dollar today is worth more than a dollar tomorrow...

→ Your analysis should be normalized to “current year” dollar values.

→ The discount rate

→ measures opportunity cost:
  - Money invested in this project means money not available for other things
  - Benefits expected in future years are more prone to risk
 → “what is the average annual return for investments in this industry?”

→ Present Value:

→ The “current year” dollar value for costs/benefits n years into the future

→ for a given discount rate i:

$$\text{Present Value}(n) = \frac{1}{(1 + i)^n}$$

→ E.g. if the discount rate is 12%, then

- $$\text{Present Value}(1) = \frac{1}{(1 + 0.12)^1} = 0.893$$
- $$\text{Present Value}(2) = \frac{1}{(1 + 0.12)^2} = 0.797$$

Analyzing Costs vs. Benefits

→ Identify costs and benefits

→ Tangible and intangible, one-time and recurring
→ Assign values to costs and benefits

→ Determine Cash Flow

→ Project the costs and benefits over time, e.g. 3-5 years
→ Calculate Net Present Value for all future costs/benefits

→ determines future costs/benefits of the project in terms of today’s dollar values
→ A dollar earned today is worth more than a potential dollar earned next year

→ Do cost/benefit analysis

→ Calculate Return on Investment:

→ Allows comparison of lifetime profitability of alternative solutions
→ ROI = Total Profit / Total Cost

→ Calculate Break-Even point:

→ how long will it take (in years) to pay back the accrued costs:

$$T = \frac{\text{Accrued Benefit}}{\text{Accrued Cost}}$$

Net Present Value

→ Measures the total value of the investment

→ with all figures adjusted to present dollar values

$$\text{NPV} = \text{Cumulative PV of all benefits} - \text{Cumulative PV of all costs}$$

<table>
<thead>
<tr>
<th>Cash Flow</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. Costs</td>
<td>$100,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Limits</td>
<td>$120,000</td>
<td>$150,000</td>
<td>$180,000</td>
<td>$210,000</td>
<td>$240,000</td>
</tr>
<tr>
<td>Present Value</td>
<td>$1</td>
<td>$0.893</td>
<td>$0.797</td>
<td>$0.712</td>
<td>$0.636</td>
</tr>
<tr>
<td>Time-adj Costs</td>
<td>($100,000,000)</td>
<td>($3,572)</td>
<td>($3,387)</td>
<td>($3,260)</td>
<td>($3,118)</td>
</tr>
<tr>
<td>Cumulative Costs</td>
<td>($100,000)</td>
<td>($103,572)</td>
<td>($107,159)</td>
<td>($110,719)</td>
<td>($114,137)</td>
</tr>
<tr>
<td>Benefits</td>
<td>0</td>
<td>$25,000</td>
<td>$35,000</td>
<td>$50,000</td>
<td></td>
</tr>
<tr>
<td>1st-year Benefits</td>
<td>0</td>
<td>$22,325</td>
<td>$35,000</td>
<td>$49,925</td>
<td>$50,000</td>
</tr>
<tr>
<td>Cumulative Benefits</td>
<td>$22,325</td>
<td>$47,325</td>
<td>$85,925</td>
<td>$135,850</td>
<td>$155,850</td>
</tr>
<tr>
<td>Net Costs-Benefits</td>
<td>($100,000)</td>
<td>($81,243)</td>
<td>($66,924)</td>
<td>($39,884)</td>
<td>($11,850)</td>
</tr>
</tbody>
</table>

→ Assuming subsequent years are like year 4.

→ the net present value of this investment in the project will be:

→ after 5 years, $13,652
→ after 6 years, $36,168
Computing the payback period

→ Can compute the break-even point:
  % when does lifetime benefits overtake lifetime costs?
  % Determine the fraction of a year when payback actually occurs:

\[
\begin{align*}
\text{payback period} & = \text{beginningYear amount} \times \frac{\text{beginningYear amount}}{\text{endYear amount} + \text{beginningYear amount}} \\
\end{align*}
\]

\% For our last example, 51,611 / (70,501 + 51,611) = 0.42
\% Therefore, the payback period is approx 3.4 years

Return on Investment (ROI) analysis

→ For comparing overall profitability
  % Which alternative is the best investment?
  % ROI measures the ratio of the value of an investment to its cost.

→ ROI is calculated as follows:

\[
\text{ROI} = \frac{\text{Estimated lifetime benefits} - \text{Estimated lifetime costs}}{\text{Estimated lifetime costs}}
\]

or:

\[
\text{ROI} = \frac{\text{Net Present value}}{\text{Estimated lifetime costs}}
\]

% For our example
  % \( \text{ROI} = (795,440 - 488,692) / 488,692 = 63\% \)
  % or \( \text{ROI} = 306,748 / 488,692 = 63\% \)

→ Solution with the highest ROI is the best alternative
  % But need to know payback period too to get the full picture
  % E.g. A lower ROI with earlier payback may be preferable in some circumstances

An Not-So-Gentle Reminder

→ Think about your Term Paper today
  % Why?
  % → The topic is due by next Wed (Mar 10)
  % → Your interests
  % → Your expertise
  % → Come up with some keywords first, then scope & read some literature, refine iteratively
  % → I’m here to help

“today”
I do really mean today!
Before you go to bed tonight.
Tomorrow is too late!