Lecture 7: The Feasibility Study

- What is a feasibility study?
  - What to study and conclude?
- Types of feasibility
  - Technical
  - Economic
  - Schedule
  - Operational
- Quantifying benefits and costs
  - Payback analysis
  - Net Present Value Analysis
  - Return on Investment Analysis
- Comparing alternatives

Content of a feasibility study

- Things to be studied in the feasibility study:
  - The present organizational system
    - Stakeholders, users, policies, functions, objectives, ...
  - Problems with the present system
    - inconsistencies, inadequacies in functionality, performance, ...
  - Goals and other requirements for the new system
    - Which problem(s) need to be solved?
    - What would the stakeholders like to achieve?
  - Constraints
    - including nonfunctional requirements on the system (preliminary pass)
  - Possible alternatives
    - "Sticking with the current system" is always an alternative
    - Different business processes for solving the problems
    - Different levels/types of computerization for the solutions
    - Advantages and disadvantages of the alternatives
- Things to conclude:
  - Feasibility of the project
  - The preferred alternative.

Why a feasibility study?

- Objectives of a feasibility study:
  - To find out if a system development project can be done:
    - ...is it possible?
    - ...is it justified?
  - To suggest possible alternative solutions.
  - To provide management with enough information to know:
    - Whether the project can be done
    - Whether the final product will benefit its intended users
    - What the alternatives are (so that a selection can be made in subsequent phases)
    - Whether there is a preferred alternative
- A feasibility study is a management-oriented activity
  - After a feasibility study, management makes a "go/no-go" decision.
  - Need to examine the problem in the context of broader business strategy

Exploring Feasibility

- The "PIECES" framework
  - Useful for identifying operational problems to be solved, and their urgency
    - Performance
      - Is current throughput and response time adequate?
    - Information
      - Do end users and managers get timely, pertinent, accurate and useful formatted information?
    - Economy
      - Are services provided by the current system cost-effective?
    - Control
      - Are there effective controls to protect against fraud and to guarantee information accuracy and security?
    - Efficiency
      - Does current system make good use of resources: people, time, flow of forms, ...
    - Services
      - Are current services reliable? Are they flexible and expandable?
  - See the course website for a more specific list of PIECES questions
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?

- **Economic feasibility**
  - Is the proposed technology or solution practical?
  - What benefits will result from the system?
    - Both tangible and intangible benefits
    - Quantity there?
  - What are the development and operational costs?
  - Are the benefits worth the costs?

- **Operational feasibility**
  - Is it possible to build a solution in time to be useful?
    - Any constraints on the schedule?
    - Can these constraints be met?

- **Schedule feasibility**
  - Is the project possible with current available 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?

- **Cost-benefit analysis**
  - Purpose - answer questions such as:
    - Is the project justified (i.e. will benefits outweigh costs)?
    - Can the project be done, given current cost constraints?
    - What is the minimal cost to attain a certain system?
    - Which alternative offers the best return on investment?
  - Examples of things to consider:
    - Hardware/software selection
    - How to convince management to develop the new system
  - Selection among alternative financing arrangements (rent/lease/purchase)
  - Difficulties
    - Benefits and costs can both be intangible, hidden and/or hard to estimate
    - Ranking multi-criteria alternatives

Economic feasibility

- Can the bottom line be quantified yet?
  - Very early in the project:
    - A judgement of whether solving the problem is worthwhile.
  - Once specific requirements and solutions have been identified:
    - ...the costs and benefits of each alternative can be calculated

Benefits and Costs

- **Tangible 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
  - But very important!
    - Business analysts help estimate $ values
    - Examples:
      - Increased flexibility of operation
      - Better customer relations
      - Improved staff morale

- **Development costs (OTO)**
  - Development and purchasing costs:
    - Cost of development team
    - Consultant fees
    - Software (buy or build?)
  - Facility costs (office, communications, power, ...)

- **Operational costs (on-going)**
  - System maintenance:
    - Hardware (repairs, lease, supplies, ...)
    - Software (licences and contracts),
    - Facilities
  - Personnel:
    - For operating (data entry, backups, ...)
    - For support (user support, hardware and software maintenance, supplies, ...)
    - On-going training costs
Example: costs for small Client-Server project

Personnel:
1. 2 System Analysts (400 hours/ea $35.00/hr) $28,000
2. 4 Programmer/Analysts (250 hours/ea $25.00/hr) $25,000
3. 1 GUI Designer (200 hours/ea $35.00/hr) $7,000
4. 1 Telecommunications Specialist (50 hours/ea $45.00/hr) $2,250
5. 1 System Architect (100 hours/ea $45.00/hr) $4,500
6. 1 Database Specialist (15 hours/ea $40.00/hr) $600
7. 1 System Librarian (250 hours/ea $10.00/hr) $2,500

Expenses:
1. 4 Smalltalk training registration ($3500.00/student) $14,000

New Hardware & Software:
1. 1 Development Server (Pentium Pro class) $18,700
2. 1 Server Software (operating system, misc.) $1,500
3. 1 DBMS server software $7,500
4. 7 DBMS Client software ($950.00 per client) $6,650

Total Development Costs: $118,200

PROJECTED ANNUAL OPERATING COSTS

Personnel:
1. 1 Programmer/Analysts (125 hours/ea $25.00/hr) $3,125
2. 1 System Librarian (20 hours/ea $10.00/hr) $200

Expenses:
1. 1 Maintenance Agreement for Pentium Pro Server $995
2. 1 Maintenance Agreement for Server DBMS software $525
3. Preprinted forms (15,000/year @ .22/form) $3,300

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
    - "This number is company- and industry-specific."
    - "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
      - \[ \text{Present Value}(1) = \frac{1}{(1 + 0.12)^1} = 0.893 \]
      - \[ \text{Present Value}(2) = \frac{1}{(1 + 0.12)^2} = 0.797 \]

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>Year</th>
<th>Cash Flow</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$(100,000)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>$(4,000)</td>
<td>$(9,590)</td>
</tr>
<tr>
<td>2</td>
<td>$2,050</td>
<td>$(7,597)</td>
</tr>
<tr>
<td>3</td>
<td>$2,050</td>
<td>$(5,191)</td>
</tr>
<tr>
<td>4</td>
<td>$5,000</td>
<td>$(2,191)</td>
</tr>
</tbody>
</table>

Net Costs+Benefits

- Accrued Cost (initial + incremental) \times Accrued Benefit

Net Costs+Benefits

- $100,000
- $(81,243)
- $(67,195)
- $(33,564)
- $(11,580)
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:
    - \( \text{endYear amount} / \text{beginningYear amount} \)

For our last example, \( 51,611 / (70,501 + 51,611) = 0.42 \)
Therefore, the payback period is 3.42 years

Payback Analysis for Client-Server System Alternative

- Cashflow description: Year 1, Year 2, Year 3, Year 4, Year 5, Year 6
- Operating costs: \(-12,000\), \(-11,000\), \(-10,000\), \(-9,000\), \(-8,000\), \(-7,000\)
- Revenue forecast from the software: \(7,000\), \(8,000\), \(9,000\), \(10,000\), \(11,000\), \(12,000\)
- Time adjusted costs (discounted to present): \(12,054\), \(13,146\), \(14,327\), \(15,692\), \(17,235\), \(19,000\)
- Cumulative lifetime net adjusted costs: \(4,063,000\), \(4,154,000\), \(4,246,000\), \(4,340,000\), \(4,435,000\), \(4,532,000\)
- Payback Analysis:
  - Payback point is at year 3.42

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:

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

- For our example:
  - ROI = \((795,440 - 488,692) / 488,692 = 62.76\%\)
  - or \(\text{ROI} = 306,748 / 488,692 = 62.76\%\)

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

Schedule Feasibility

- How long will it take to get the technical expertise?
  - We may have the technology, but that doesn’t mean we have the skills required to properly apply that technology.
    - May need to hire new people
    - Or re-train existing systems staff
    - Whether hiring or training, it will impact the schedule.

Assess the schedule risk:
- Given our technical expertise, are the project deadlines reasonable?
  - If there are specific deadlines, are they mandatory or desirable?
    - If the deadlines are not mandatory, the analyst can propose several alternative schedules.

What are the real constraints on project deadlines?
- If the project overruns, what are the consequences?
  - Deliver a properly functioning information system two months late...
  - or deliver an error-prone, useless information system on time?
  - Missed schedules are bad, but inadequate systems are worse!
Operational Feasibility

How do end-users and managers feel about...
- the problem you identified?
- the alternative solutions you are exploring?

You must evaluate:
- Not just whether a system can work,
- but also whether a system will work.

Any solution might meet with resistance:
- Does management support the project?
- How do the end users feel about their role in the new system?
- Which users or managers may resist (or not use) the system?
  - People tend to resist change.
  - Can this problem be overcome? If so, how?
- How will the working environment of the end users change?
- Can or will end users and management adapt to the change?

Comparing Alternatives

How do we compare alternatives?
- When there are multiple selection criteria?
- When none of the alternatives is superior across the board?

Use a Feasibility Analysis Matrix
- The columns correspond to the candidate solutions;
- The rows correspond to the feasibility criteria;
- The cells contain the feasibility assessment notes for each candidate;
  e.g., for operational feasibility, candidates can be ranked 1, 2, 3, etc.
- A final ranking or score is recorded in the last row.

Other evaluation criteria to include in the matrix
- quality of output
- ease of use
- vendor support
- cost of maintenance
- load on system

Feasibility Study Contents

1. Purpose & scope of the study
   - Objectives (of the study)
   - who commissioned it & who did it,
   - process used for the study,
   - how long did it take, ...
2. Description of present situation
   - organizational setting, current system(s),
   - Related factors and constraints.
3. Problems and requirements
   - What’s wrong with the present situation?
   - What changes are needed?
4. Objectives of the new system
   - Goals and relationships between them
5. Possible alternatives
   - including ‘do nothing’.
6. Criteria for comparison
   - definition of the criteria
7. Analysis of alternatives
   - description of each alternative
   - evaluation with respect to criteria
   - cost/benefit analysis and special implications.
8. Recommendations
   - what is recommended and implications
   - what to do next;
   - e.g., may recommend an interim solution and a permanent solution
9. Appendices
   - to include any supporting material.

Example matrix

<table>
<thead>
<tr>
<th>Candidate 1 Name</th>
<th>Candidate 2 Name</th>
<th>Candidate 3 Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Operational Feasibility</td>
<td>Technical Feasibility</td>
</tr>
<tr>
<td>Schedule Feasibility</td>
<td>Economic Feasibility</td>
<td>Ranking</td>
</tr>
</tbody>
</table>
## Feasibility Criteria

<table>
<thead>
<tr>
<th>Operational Feasibility</th>
<th>Technical Feasibility</th>
<th>Economic Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operational Feasibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Technical Feasibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cost to develop:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximately $350,000.</td>
<td>Approximately $400,000.</td>
<td>Approximately $420,000.</td>
</tr>
<tr>
<td>Payback period (discounted):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximately 4.5 years.</td>
<td>Approximately 3.5 years.</td>
<td>Approximately 3.3 years.</td>
</tr>
<tr>
<td>Net present value:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximately $216,000.</td>
<td>Approximately $306,748.</td>
<td>Approximately $325,500.</td>
</tr>
<tr>
<td>Detailed calculations:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>See Attachment A.</td>
<td>See Attachment A.</td>
<td>See Attachment A.</td>
</tr>
<tr>
<td>Schedule Feasibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>An assessment of how long the solution will take to design and implement:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 3 months.</td>
<td>9-12 months</td>
<td>9 months</td>
</tr>
<tr>
<td><strong>Ranking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100%</td>
<td>65.5</td>
<td>92</td>
</tr>
</tbody>
</table>