Chapter 2: Feasibility Study

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Chapter Overview

- 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
The feasibility study phase

Objectives of a feasibility study:
- To find out if an 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
  - 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

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,…
- Possible solution 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
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 project possible, given resource constraints?
  - What benefits will result from the system?
    - Both tangible and intangible benefits
    - Quantify them!
  - What are the development and operational costs?
  - Are the benefits worth the costs?

Four types of feasibility (2)

- **Schedule feasibility**
  - Is it possible to build a solution in time to be useful

- **Operational feasibility**
  - Urgency of the problem and the acceptability of any solution:
    - If the system is developed, will it be used?
  - Human and social issues…
    - Manager resistance?
    - Organizational conflicts and policies?
    - Social acceptability?
    - Legal aspects and government regulations?
Technical feasibility

- Is the proposed technology or solution practical?
  - Do we currently possess the necessary technology?
  - Do we possess the necessary technical expertise, and is the schedule reasonable?
  - Is relevant technology mature enough to be easily applied to our problem?

- What kinds of technology will we need?
  - Some organizations like to use state-of-the-art technology
  - ...but most prefer to use mature and proven technology
  - A mature technology has a larger customer base for obtaining advice concerning problems and improvements

- Is the required technology available “in house”?
  - If the technology is available …does it have the capacity to handle the solution?
  - If the technology is not available …can it be acquired?

Economic feasibility

- Cost-benefit analysis
  - Purpose - answer questions such as:
    - Is the project justified (i.e. will benefits outweigh costs)?
    - Can the project be done, within given cost constraints?
    - What is the minimal cost to attain a certain system?
    - Which alternative offers the best return on investment?
  - 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
Types of benefits

Examples of particular benefits: cost reductions, error reductions, increased flexibility of operation, improved operation, better (e.g., more accurate) and more timely information

Benefits may be classified into one of the following categories:
- **Monetary**: when $-values can be calculated
- **Tangible (Quantified)**: when benefits can be quantified, but $-values can't be calculated
- **Intangible**: when neither of the above applies

How to identify benefits?
- By organizational level (operational, lower/middle/higher management)
- By department (production, purchasing, sales, ...)

Types of costs

**Project-related costs:**
- **Development and purchasing costs**: who builds the system (internally or contracted out)? software used (buy or build)? hardware (what to buy, buy/lease)? facilities (site, communications, power, ...)
- **Installation and conversion costs**: installing the system, training of personnel, file conversion, ....

**Operational costs (on-going):**
- **Maintenance**: hardware (maintenance, lease, materials, ...), software (maintenance fees and contracts), facilities
- **Personnel**: operation, maintenance
Sample costs for a client/server development project

<table>
<thead>
<tr>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyst, Analyst (400 hours x $75/hr)</td>
</tr>
<tr>
<td>Parameter Analyst (200 hours x $75/hr)</td>
</tr>
<tr>
<td>GI/Document (250 hours x $50/hr)</td>
</tr>
<tr>
<td>Telecommunications Engineer (50 hours x $150/hr)</td>
</tr>
<tr>
<td>Analyst, Analyst (400 hours x $75/hr)</td>
</tr>
<tr>
<td>Database Specialist (50 hours x $150/hr)</td>
</tr>
<tr>
<td>System Architect (60 hours x $100/hr)</td>
</tr>
</tbody>
</table>

Expenses

1. Software license maintenance ($9,500 (5 years)) $47,500

Net Hardware & Software:

1. Hardware: Server (Windows Pro license) $18,500
2. Server Software: Licensing (vendor included) $5,000
3. DBMS: license software $7,000
4. DBMS: license (5-year license $500 per year) $5,000

Total Development Costs: $102,000

Projected Annual Operating Costs

<table>
<thead>
<tr>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyst, Analyst (200 hours x $75/hr)</td>
</tr>
<tr>
<td>System Architect (200 hours x $100/hr)</td>
</tr>
</tbody>
</table>

Expenses:

1. Maintenance Agreement for Windows Pro Server: $1,050
2. Maintenance Agreement for Server DBMS software: $900
3. Projected taxes (15.5% year x $20,000) $3,100

Total Projected Annual Costs: $20,250

Accounting methods

- Assuming that both benefits and costs can be identified and evaluated, how do we compare them to determine project feasibility?

  - **Payback Analysis:** how long will it take (usually, in years) to pay back the project, and accrued costs:
    
    \[
    \text{Total costs(initial + incremental) - Yearly return(or savings)}
    \]

  - **Return on Investment Analysis:** compares the lifetime profitability of alternative solutions
    
    \[
    \text{Lifetime benefits} - \text{Lifetime costs}
    \]

  - **Net Present Value Analysis:** determines the profitability of the new project in terms of today's dollar values
Discount rates

- A dollar today is worth more than a dollar tomorrow…
- The dollar values used in this type of analysis should be normalized to refer to current year dollar values.
- For this, we need a number, the discount rate, which measures the opportunity cost of investing money in other projects, rather than the information system development one. This number is company- and industry-specific.
- To calculate the present value, i.e., the real dollar value given the discount rate i, n years from now, we use the formula:

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

- For example, if the discount rate is 12%, then
  - Present Value (1) = \( \frac{1}{(1 + 0.12)^1} = 0.893 \)
  - Present Value (2) = \( \frac{1}{(1 + 0.12)^2} = 0.797 \)

Payback analysis

- Basically, we need to compute:

\[
\text{Total costs}(\text{initial + incremental}) - \text{Yearly return(or savings)}
\]

but it must be done with present dollar values.

<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>Dev. Costs</td>
<td>$100,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opar Costs</td>
<td>$54,000</td>
<td>$54,000</td>
<td>$65,000</td>
<td>$65,000</td>
<td></td>
</tr>
<tr>
<td>Present Value</td>
<td>1.000</td>
<td>0.893</td>
<td>0.797</td>
<td>0.712</td>
<td>0.636</td>
</tr>
<tr>
<td>Time-adjust Costs</td>
<td>$100,000</td>
<td>$12,243</td>
<td>$13,527</td>
<td>$14,900</td>
<td>$16,374</td>
</tr>
<tr>
<td>Cumulative Costs</td>
<td>$100,000</td>
<td>$103,243</td>
<td>$116,770</td>
<td>$131,670</td>
<td>$147,044</td>
</tr>
<tr>
<td>Benefits</td>
<td>0</td>
<td>$25,000</td>
<td>$30,000</td>
<td>$35,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>Cumulative Benefits</td>
<td>0</td>
<td>$25,000</td>
<td>$55,000</td>
<td>$90,000</td>
<td>$140,000</td>
</tr>
<tr>
<td>Net Costs-Benefits</td>
<td>$100,000</td>
<td>$81,243</td>
<td>$$60,254</td>
<td>$35,054</td>
<td>$11,000</td>
</tr>
</tbody>
</table>
### Payback Analysis for Client-Server System Alternative

<table>
<thead>
<tr>
<th>Year</th>
<th>Development cost</th>
<th>Operation &amp; maintenance costs</th>
<th>Total costs</th>
<th>Payback period</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8,000,000</td>
<td>1,000,000</td>
<td>9,000,000</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8,000,000</td>
<td>1,000,000</td>
<td>9,000,000</td>
<td>3.42 years</td>
</tr>
<tr>
<td>2</td>
<td>8,000,000</td>
<td>1,000,000</td>
<td>9,000,000</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>8,000,000</td>
<td>1,000,000</td>
<td>9,000,000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>8,000,000</td>
<td>1,000,000</td>
<td>9,000,000</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>8,000,000</td>
<td>1,000,000</td>
<td>9,000,000</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>8,000,000</td>
<td>1,000,000</td>
<td>9,000,000</td>
<td></td>
</tr>
</tbody>
</table>

**How to compute exactly the payback period**

- Need to determine the time period when lifetime benefits will overtake the lifetime costs. This is the **break-even point**.

\[
\text{payback period} = \frac{\text{beginningYear amount}}{(\text{endYear amount} + \text{beginningYear amount})}
\]

- Determining the fraction of a year when a payback actually occurs:

\[
\frac{\text{beginningYear amount}}{(\text{endYear amount} + \text{beginningYear amount})}
\]

- For our last example, \(\frac{51,611}{(70,501 + 51,611)} = 0.42\)
- Therefore, the payback period is 3.42 years
Net present value analysis for client-server system alternative

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Net Present Value Analysis for Client-Server System Alternative</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td>(Numbers rounded to nearest $)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Development cost:</td>
<td>$941,600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Operations &amp; maintenance cost:</td>
<td>($95,045)</td>
<td>($96,000)</td>
<td>($17,000)</td>
<td>($18,000)</td>
<td>($19,000)</td>
<td>($20,000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Discount factors for 15%</td>
<td>1.000</td>
<td>0.869</td>
<td>0.759</td>
<td>0.665</td>
<td>0.589</td>
<td>0.527</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Total present value of lifetime benefits:</td>
<td>$941,600</td>
<td>($93,435)</td>
<td>($17,750)</td>
<td>($17,060)</td>
<td>($16,440)</td>
<td>($15,775)</td>
<td>($14,140)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Benefits description:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Operating cost</td>
<td>$0</td>
<td>$190,000</td>
<td>$170,000</td>
<td>$110,000</td>
<td>$20,000</td>
<td>$20,000</td>
<td>$25,000</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Discount factors for 15%</td>
<td>1.000</td>
<td>0.869</td>
<td>0.759</td>
<td>0.665</td>
<td>0.589</td>
<td>0.527</td>
<td>0.477</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Total present value of lifetime benefits:</td>
<td>$0</td>
<td>($133,600)</td>
<td>($135,490)</td>
<td>($136,260)</td>
<td>($136,800)</td>
<td>($136,140)</td>
<td>($135,250)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Net present value of lifetime benefits:</td>
<td>$795,440</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>ROI: (Estimated lifetime benefits - Estimated lifetime costs) / Estimated lifetime costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>or,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>ROI: Net Present value / Estimated lifetime costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>For our example</td>
<td>ROI = (795,440-488,692)/ 488,692 = 62.76%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>The solution offering the highest ROI is the best alternative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 with the feasibility analysis matrix

- In a feasibility analysis matrix, the columns correspond to the candidate solutions; Rows correspond to the feasibility criteria; Cells contain the feasibility assessment notes for each candidate.

- Each row can be assigned a rank or score for each criterion (e.g., for operational feasibility, candidates can be ranked 1, 2, 3, etc.).

- After ranking or scoring all candidates on each criterion, a final ranking or score is recorded in the last row.

Feasibility study matrix: example (1)
### Feasibility Study Matrix: Example (2)

<table>
<thead>
<tr>
<th>Feasibility Criteria</th>
<th>Candidate 1</th>
<th>Candidate 2</th>
<th>Candidate 3</th>
<th>Candidate 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operational Feasibility</strong></td>
<td>30%</td>
<td>Score: 40</td>
<td>Score: 100</td>
<td>Score: 100</td>
</tr>
<tr>
<td><strong>Technical Feasibility</strong></td>
<td>30%</td>
<td>Score: 50</td>
<td>Score: 90</td>
<td>Score: 100</td>
</tr>
<tr>
<td><strong>Economic Feasibility</strong></td>
<td>30%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cost to develop:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payback period (discounted):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net present value:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detailed calculations:</td>
<td>See Attachment A</td>
<td>See Attachment A</td>
<td>See Attachment A</td>
<td></td>
</tr>
<tr>
<td><strong>Schedule Feasibility</strong></td>
<td>10%</td>
<td>Score: 85</td>
<td>Score: 90</td>
<td>Score: 90</td>
</tr>
<tr>
<td>An assessment of how long the solution will take to design and implement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Ranking**: 100%

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### Additional Readings
