VI. The Feasibility Study

What is a feasibility study? What to study and conclude?

Benefits and costs

Cost/Benefit analysis

Accounting methods

Comparing alternatives

The PIECES Framework

Operational Feasibility:
The PIECES Framework

More on Operational Feasibility:
Acceptability of Potential Solutions

The feasibility study is a management-oriented activity

Constraints may be hard or soft

Types of Feasibility

Operational

Technical

Economic (Cost/Benefits Analysis)

Schedule

Acceptability of Potential Solutions

How do end users and managers feel about the problem (solution)?

It's not only important to evaluate whether a system can work but also evaluate whether a system will work.

A workable solution might fail because of end-user or management resistance.

Does management support the project?

How will the working environment of the end-users change?

Can or will end-users and management adapt to the change?

What to Study? ...What to Conclude?

Things to be studied during the feasibility study phase:

- The present organizational system, including users, policies, functions, objectives,
- Problems with the present system (inconsistencies, inadequacies in functionality, performance,...)
- Objectives and other requirements for the new system (what needs to change?)
- Constraints, including nonfunctional requirements on the system (preliminary pass)
- Possible alternatives (the current system is always one of those)
- Advantages and disadvantages of the alternatives

Things to conclude: Feasibility of the project and the preferred alternative.

Do it!

The Feasibility Study Phase

- The objectives of a feasibility study are to find out if an information system project can be done (is it possible?...is it justified?) and to suggest possible alternative solutions.
- A feasibility study should provide management with enough information to decide:
  - whether the project can be done
  - whether the final product will benefit its intended users
  - what are the alternatives among which a solution will be chosen (during subsequent phases)
  - is there a preferred alternative
- After a feasibility study, management makes a go/no go decision

The feasibility study is a management-oriented activity

Constraints may be hard or soft

Types of Feasibility

Operational -- Define the urgency of the problem and the acceptability of any solution; If the system is developed, will it be used? Includes people-oriented and social issues; internal issues, such as manpower problems, labour objections, manager resistance, organizational conflicts and politics; also external issues, including social acceptability, legal aspects and government regulations.

Technical -- Is the project feasibility within the limits of current technology? Does the technology exist at all? Is it available within given resource constraints (i.e., budget, schedule,...)?

Economic (Cost/Benefits Analysis) -- Is the project possible, given resource constraints? Are the benefits that will accrue from the new system worth the costs? What are the savings that will result from the system, including tangible and intangible ones? What are the development and operational costs?

Schedule -- Constraints on the project schedule and whether they could be reasonably met

Acceptability of Potential Solutions

How do end users and managers feel about the problem (solution)?

It’s not only important to evaluate whether a system can work but also evaluate whether a system will work.

A workable solution might fail because of end-user or management resistance.

- Does management support the project?
- How do the end-users feel about their role in the new system?
- What end-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?
**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?
- The technology for any defined solution is usually available; however, the question is whether that technology is mature enough to be easily applied to our problem.
- Some firms like to use state-of-the-art technology, but most firms prefer to use mature and proven technology.
- A mature technology has a larger customer base for obtaining advice concerning problems and improvements.
- Assuming that required technology is practical, is it available in the information systems shop? If the technology is available, does it have the capacity to handle the solution?
- If the technology is not available, can it be acquired?

**Schedule Feasibility**

- We may have the technology, but that doesn’t mean we have the skills required to properly apply that technology. True, all information systems professionals can learn new technologies; however, that learning curve will impact the technical feasibility of the project; specifically, it will impact the schedule.
- Given our technical expertise, are the project deadlines reasonable? Some projects are initiated with specific deadlines; You need to determine whether the deadlines are mandatory or desirable. If the deadlines are desirable rather than mandatory, the analyst can propose alternative schedules.
- It is preferable (unless the deadline is absolutely mandatory) to deliver a properly functioning information system two months late than to deliver an erronious, useless information system on time! Missed schedules are bad, but inadequate systems are worse!

**Economic Feasibility**

- The bottom line in many projects is economic feasibility.
- During the early phases of the project, economic feasibility analysis amounts to little more than judging whether the possible benefits of solving the problem are worthwhile.
- As soon as specific requirements and solutions have been identified, the analyst can weigh the costs and benefits of each alternative.
- This is called a cost-benefit analysis.

**Cost/Benefit Analysis**

- The purpose of a cost/benefit analysis is to answer questions such as:
  - Is the project justified (because benefits outweigh costs)?
  - Can the project be done, within given cost constraints?
  - What is the minimal cost to attain a certain system?
  - What is the preferred alternative, among candidate solutions?
- 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 — discovering and assessing benefits and costs: they can both be intangible, hidden and/or hard to estimate, it’s also hard to rank multi-criteria alternatives

**Types of Benefits**

- Examples of particular benefits: cost reductions, error reductions, increased throughput, 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:
  - Monitory -- 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) or 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 (ongoing)
  - Maintenance: hardware (maintenance, lease, materials,...), software (maintenance fees and contracts), facilities
  - Personnel: operation, maintenance
- For a small business that wants to introduce a PC-based information system, these cost categories translate to the following:
  - Project costs: purchasing (hardware, software, office furniture), customizing software, training, system installation and file conversion
  - On-going costs: operating the system (data entry, backups, helping users, vendors etc.), maintenance (software) and user support, hardware and software maintenance, supplies
**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, in years from now, we use the formula:
  \[ \text{Present Value} = \frac{1}{(1 + i)^n} \]
- For example, if the discount rate is 12%, then:
  - Present Value (1) = \(\frac{1}{(1 + 0.12)^1} = 0.893\)
  - Present Value (2) = \(\frac{1}{(1 + 0.12)^2} = 0.797\)

**Accounting Methods**

**Sample Costs for a Client-Server Devel Project**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBMS Client software (950.00 per client)</td>
<td>$6,650</td>
</tr>
<tr>
<td>DBMS server software</td>
<td>$7,500</td>
</tr>
<tr>
<td>Server Software (operating system, misc.)</td>
<td>$1,500</td>
</tr>
<tr>
<td>Development Server (Pentium Pro class)</td>
<td>$18,700</td>
</tr>
<tr>
<td>New Hardware &amp; Software</td>
<td></td>
</tr>
<tr>
<td>Smalltalk training registration (3500.00/student)</td>
<td>$14,000</td>
</tr>
</tbody>
</table>

**Expenses:**

- System Librarian (20 hours/ea, $10.00/hr) $200
- Programmer/Analysts (125 hours/ea, $25.00/hr) $6,250
- System Librarian (250 hours/ea, $10.00/hr) $2,500
- Database Specialist (15 hours/ea, $40.00/hr) $600
- System Architect (100 hours/ea, $45.00/hr) $4,500
- Telecommunications Specialist (50 hours/ea, $45.00/hr) $2,250
- GUI Designer (200 hours/ea, $35.00/hr) $7,000
- Programmer/Analysts (250 hours/ea, $25.00/hr) $6,250
- System Analysts (400 hours/ea, $35.00/hr) $14,000

**Personnel:**

**Total Projected Annual Costs:**

- Preprinted forms (15,000/year, @ $0.22/form) $3,300
- Total Development Costs: $100,000

**Cash Flow Year 0 Year 1 Year 2 Year 3 Year 4**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>$25,000</th>
<th>$30,000</th>
<th>$35,000</th>
<th>$50,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative Benefits</td>
<td>$22,325</td>
<td>$23,910</td>
<td>$24,920</td>
<td>$31,800</td>
</tr>
<tr>
<td>Net Costs + Benefits</td>
<td>($100,000)</td>
<td>($81,243)</td>
<td>($60,924)</td>
<td>($39,564)</td>
</tr>
<tr>
<td>Net Costs (Initial + Incremental) - Yearly return (or savings)</td>
<td>$13,652</td>
<td>$13,652</td>
<td>$13,652</td>
<td>$13,652</td>
</tr>
<tr>
<td>Present Value</td>
<td>0.893</td>
<td>0.797</td>
<td>0.712</td>
<td>0.636</td>
</tr>
<tr>
<td>Discounted Benefits</td>
<td>$22,325</td>
<td>$23,910</td>
<td>$24,920</td>
<td>$31,800</td>
</tr>
<tr>
<td>Present Value (1)</td>
<td>0.893</td>
<td>0.797</td>
<td>0.712</td>
<td>0.636</td>
</tr>
<tr>
<td>Present Value (2)</td>
<td>0.797</td>
<td>0.712</td>
<td>0.636</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.
- Determining the fraction of a year when a payback actually occurs:
  \[ \text{fraction} = \frac{\text{beginningYear amount}}{(\text{endYear amount} - \text{beginningYear amount})} \]
- For our last example, \(51,611 / (70,501 + 51,611) = 0.42\)
- Therefore, the payback period is 3.42 years.
### Net Present Value

- After discounting all costs and benefits, subtract the sum of the discounted costs from the sum of the discounted benefits to determine the net present value.
- If positive, the investment is good.
- If negative, the investment is bad.
- When comparing multiple solutions or projects, the one with the highest positive net present value is the best investment.

### Return on Investment (ROI) Analysis

- The ROI analysis technique compares the lifetime profitability of alternative solutions or projects.
- The ROI for a solution or project is a percentage rate that measures the relationship between the amount the business gets back from an investment and the amount invested.
- The ROI for a potential solution or project 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, \( \text{ROI} = \frac{(795,440 - 488,692)}{488,692} = 62.76\% \).
- The solution offering the highest ROI is the best alternative.

### Comparing Alternatives with the Feasibility Analysis Matrix

- How do we compare alternatives when there are multiple selection criteria and none of the alternatives is superior across the board?
- Use a Feasibility Analysis Matrix!
- In a feasibility analysis matrix,
  - The columns correspond to the candidate solutions
  - Some rows correspond to the feasibility criteria
  - The 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.
- Examples of other evaluation criteria: quality of output, ease of use, vendor support, cost of maintenance, load on system

### Feasibility Analysis Matrix

<table>
<thead>
<tr>
<th>Description</th>
<th>Candidate 1 Name</th>
<th>Candidate 2 Name</th>
<th>Candidate 3 Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational Feasibility</td>
<td>Required functionality.</td>
<td>Required functionality.</td>
<td>Required functionality.</td>
</tr>
<tr>
<td>Technical Feasibility</td>
<td>Powerbuilder is a mature product.</td>
<td>Powerbuilder is a mature product.</td>
<td>MS Visual Basic is a mature product.</td>
</tr>
<tr>
<td>Schedule Feasibility</td>
<td>15 months.</td>
<td>18 months.</td>
<td>12 months.</td>
</tr>
<tr>
<td>Economic Feasibility</td>
<td>Current production processes would have to be modified to take advantage of software.</td>
<td>Current production processes would have to be modified to take advantage of software.</td>
<td>Current production processes would have to be modified to take advantage of software.</td>
</tr>
<tr>
<td>Ranking</td>
<td>Score: 100</td>
<td>Score: 95</td>
<td>Score: 85</td>
</tr>
</tbody>
</table>
Comparing Alternatives with Multiple Criteria

Methods
- Assign a weight to each criterion; evaluate each criterion for each alternative in absolute or relative terms.
- Use dominating criteria: compare on the most important criterion and eliminate all inferior alternatives; compare on next important criterion etc.
- Eliminate unsatisfactory alternatives by setting "acceptability" threshold levels, only consider alternatives that exceed these thresholds.

Feasibility Study Contents
- Purpose and scope of the study -- objectives, who commissioned it, who did it, sources of information, process used for the study, how long did it take...
- Description of present situation -- organizational setting, current system(s). Related factors and constraints.
- Objectives of the new system.
- Problems and requirements.
- Possible alternatives -- including, possibly, the present situation.
- Criteria for comparison -- definition of the criteria
- Analysis of alternatives -- includes description of each alternative, evaluation with respect to criteria, including cost/benefit analysis and special implications.
- Recommendations -- what is recommended, implications, what to do next; sometimes it makes sense to recommend an interim solution and a permanent solution.
- Appendices which include supporting material.

Another Example
Consider a scenario: You want to adopt a programming environment for your Zeus project; there are three alternatives: Strobe, KEE and Loops

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Alternatives</th>
<th>Strobe</th>
<th>KEE</th>
<th>Loops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zeus reqs (H+)</td>
<td>H</td>
<td>H+</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>Min costs (H)</td>
<td>H</td>
<td>L</td>
<td>Unresolved**</td>
<td></td>
</tr>
<tr>
<td>Customizability</td>
<td>H-</td>
<td>M</td>
<td>H</td>
<td></td>
</tr>
</tbody>
</table>

**: H-, provided source code is available.
**: the following questions need to be answered: (i) hardware platform for the project? (ii) do we get a free copy?

An Example
Your friendly campus bookstore wants to improve handling of textbook orders. Right now, the orders come in on a paper form from instructors, the information is copied on cards for a card file, purchase orders are generated for publishers. A clerk keeps track of incoming shipments. All information is thrown away at the end of the year, so instructors can’t say “same as last year”.

- Can you (as systems analyst) help?

Here are the steps you may want to follow:
- Talk to the manager, convince him that a feasibility study is a good idea, generate a proposal, sign a contract and get started.
- Find out how other kinds of information are handled (payroll, scheduling of employees,...); it turns out that they are not problems, so the new system need not deal with such information (accepting). Talk to the people who handle orders; what do they do? Where is the problem, if any? What would they like to see? (information acquisition)

Another Example (cont’d)
As you begin to understand the setup, you begin to form an idea of how different processes are done: HandleOrder, AnswerQuery, PurchaseBooks, GetUsedBooks...
- You confirm your understanding with the manager and assistant manager.
- Next you consider alternatives: (a) improve the manual system with redesigned cards, new card-filing system; (b) install a personal computer with a database where you keep all book orders; (c) install a network of PCs to handle orders, purchase orders, inventory.
- You confirm with the manager that his criteria for evaluating alternative solutions are: (1) cost – no more than $30K; (2) improved service; (3) ease of use.
- Next, you evaluate each alternative with respect to each criterion. To do this, you talk to your technical people who help you with advice on the size of programming tasks etc. Once you are done, you show the results to the manager. You don’t show him any conclusions yet.
- Finally, you prepare your report and you hand it in.