VII. The Feasibility Study

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Feasibility Study Contents

The Feasibility Study

- The objective of a feasibility study is to find out if an information system project can be done, and if so, how.
- A feasibility study should tell management:
  - ✓Whether the project can be done;
  - ✓What are alternative solutions?
  - ✓What are the criteria for choosing among them?
  - ✓Is there a preferred alternative?
- After a feasibility study, management makes a go/no-go decision.

• ***A feasibility study is a***
• ***management-oriented activity***

Dimensions of Feasibility

- Operational -- how will the solution work?
- Technical -- is the technology needed available?
- Economic -- return on investment
- Schedule -- can the system be delivered on time?

Constraints may be hard or soft

Economic Feasibility

- The bottom line for many projects!
- Economic feasibility amounts to judging whether possible benefits of the project are worthwhile.
- As soon as a specific solution has been identified, the analyst can weigh the costs and benefits of each alternative.
- This is called *cost-benefit analysis*.

Cost/Benefit Analysis

- The purpose of a cost/benefit analysis is to answer questions such as:
  - ✓Is the project justified (benefits outweigh costs)?
  - ✓Can the project be done, within cost constraints?
  - ✓What is the minimal cost to attain a certain system?
- 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

- 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) or by department (production, purchasing, sales,...)

Types of Costs

- Project-related costs
  - ✓Development and purchasing costs;
  - ✓Installation, training and conversion costs.
- Operational costs (on-going)
  - ✓Maintenance: hardware, software, facilities
  - ✓Personnel: operation, maintenance.
- For a small business that wants to introduce a PC-based information system, these cost categories amount to:
  - ✓Project costs: purchase hardware, software, furniture; customize software, train, install, 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,...

Personnel:

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

Expenses:

4	Smalltalk training registration ($3500.00/student)	$14,000

New Hardware & Software:

1	Development Server (Pentium Pro class)	$18,700
1	Server Software (operating system, misc.)	$1,500
1	DBMS server software	$7,500
7	DBMS Client software ($950.00 per client)	$6,650
	Total Development Costs:	**$118,200**

PROJECTED ANNUAL OPERATING COSTS

Personnel:

2	Programmer/Analysts (125 hours/ea $25.00/hr)	$6,250
1	System Librarian (20 hours/ea $10.00/hr)	$200

Expenses:

1	Maintenance Agreement for Pentium Pro Server	$995
1	Maintenance Agreement for Server DBMS software	$525
	Preprinted forms (15,000/year @ .22/form)	$3,300
	Total Projected Annual Costs:	**$11,270**

Sample Costs for a Client-Server Devel/nt Project

Accounting Methods

- ***Payback Analysis:*** how long will it take (usually, in years) to pay back the project, and accrued costs:
  Total costs (initial + incremental) - Yearly return (or savings)
- ***Return on Investment Analysis***: compares the lifetime profitability of alternative solutions.

$$\frac{\text{Lifetime benefits - Lifetime costs}}{\text{Lifetime costs}}$$

- ***Net Present Value Analysis:*** determines the profitability of the new project in terms of today's dollar values. Will tell you that if you invest in the proposed project, after n years you will have $XXX profit/loss on your investment

Discount Rate

- 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. The number is company/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

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

- For example, if the discount rate is 12%, then
  Present Value (1) = $1/(1 + 0.12)^1 = 0.893$
  Present Value (2) = $1/(1 + 0.12)^2 = 0.797$
  …

Payback Analysis

Basically, we need to compute
Total costs (initial + incr.) - Yearly return (or savings)
but it must be done with present dollar values.

Cash Flow	Year 0	Year 1	Year 2	Year 3	Year 4
Dev. Costs	($100,000)				
Oper.Costs		($4,000)	($4,500)	($5,000)	($5,500)
Present Value	1	0.893	0.797	0.712	0.636
Time-adj. Costs	($100,000)	($3,572)	($3,587)	($3,560)	($3,816)
Cumulative Costs	($100,000)	($103,572)	($107,159)	($110,719)	($114,135)
Benefits	0	$25,000	$30,000	$35,000	$50,000
T-adj Benefits	0	$22,325	$23,910	$24,920	$31,800
Cumulative Benefits	0	$22,325	$46,235	$71,155	$102,955
Net Costs+Benefits	($100,000)	($81,243)	($60,924)	($39,564)	($11,580)

The ***net present value*** of the investment in the project after 5 years is $13,652, and after 6 years is $36,168, assuming the same figures as for year 4.

Payback Analysis for Client-Server System Alternative

(Numbers rounded to nearest $1)

Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Development cost:	($410,040)						
Operation & maintenance cost:		($15,045)	($16,000)	($17,000)	($18,000)	($19,000)	($20,000)
Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567	0.507
Time-adjusted costs (adjusted to present	($410,040)	($13,435)	($12,752)	($12,104)	($11,448)	($10,773)	($10,140)
Cumulative time-adjusted costs over	($410,040)	($431,475)	($444,227)	($456,331)	($467,779)	($478,552)	($488,692)
Benefits derived from operation of new	$0	$150,000	$170,000	$190,000	$210,000	$230,000	$250,000
Discount factors for 12%:	1.000	$0.89	$0.80	$0.71	$0.64	$0.57	$0.51
Time-adjusted benefits (current of present	$0	$133,950	$135,490	$135,280	$133,560	$130,410	$126,750
Cumulative time-adjusted benefits over	$0	$133,950	$269,440	$404,720	$538,280	$668,690	$795,440
	0	1	2	3	4	5	6
Cumulative lifetime time-adjusted costs +	($410,040)	($297,525)	($174,787)	($51,611)	$70,501	$190,138	$306,748

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:

$$\frac{|\text{beginningYear amount}|}{(\text{endYear amount} + |\text{beginningYear amount}|)}$$

- 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 it is 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.

	A	B	C	D	E	F	G	H	I	J
1	Net Present Value Analysis for Client-Server System Alternative									
2	(Numbers rounded to nearest $1)									
3										
4	Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total	
5	Development cost:	($418,040)								
6	Operation & maintenance cost:		($15,045)	($16,000)	($17,000)	($18,000)	($19,000)	($20,000)		
7	Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567	0.507		
8	Present value of annual costs:	($418,040)	($13,435)	($12,752)	($12,104)	($11,448)	($10,773)	($10,140)		
9	Total present value of lifetime costs:								($488,692)	
10										
11	Benefits derived from operation of new	$0	$150,000	$170,000	$190,000	$210,000	$230,000	$250,000		
12	Discount factors for 12%:	1.000	$0.89	$0.80	$0.71	$0.64	$0.57	$0.51		
13	Present value of annual benefits:	$0	$133,950	$135,490	$135,280	$133,560	$130,410	$126,750		
14	Total present value of lifetime benefits:								$795,440	
15										
16	NET PRESENT VALUE OF THIS ALTERNATIVE:								$306,748	
17										

Return on Investment (ROI)

- ROI analysis compares the lifetime profitability of alternative solutions or projects.
- ROI for a solution measures the amount the business gets back from an investment vs the amount invested.
- ROI is calculated as follows:

$$\text{ROI} = \frac{(\text{Est. lifetime benefits} - \text{Est. lifetime costs})}{\text{Estimated lifetime costs}}$$

Or, ROI = Net Present value / Estimated lifetime costs

- For our example, ROI = (795,440-488,692)/ 488,692= 306,748 / 488,692 = 62.76%
- The solution offering the highest ROI is the best alternative.

Risk Analysis

- One of the criteria for comparing alternatives often has to do with an evaluation of the risks for each alternative.
- For example, one alternative may have a higher risk of rejection by users of the system.
- Or, an alternative may have better backing from top management, which means that it has lower risk of failure because top management changed its mind.

Risk Factors: A Sample

- System requirements:
  - ✓Poorly understood requirements at scheduling time;
  - ✓Customer changes requirements;
  - ✓IS staff insist on unnecessary features;
- Tools and technology:
  - ✓Unsuitable target deployment environment;
  - ✓Unsuitable development tools;
  - ✓New tools;
  - ✓No technology standards

More Risk Factors

- People:
  - ✓Inadequate participation by users in development process;
  - ✓Poor project management;
  - ✓Poorly trained developers;
- Environment:
  - ✓Weak upper management commitment;
  - ✓Changing environment;
  - ✓Changing technological environment;
  - ✓Government action.

Feasibility Analysis Matrix

	Candidate 1 Name	Candidate 2 Name	Candidate 3 Name
Description			
Operational Feasibility			
Technical Feasibility			
Schedule Feasibility			
Economic Feasibility			
Ranking			

Feasibility Criteria	Wt.	Candidate 1	Candidate 2	Candidate 3	Candidate ..
Operational Feasibility **Functionality**. Describes to what degree the alternative would benefit the organization and how well the system would work. **Political**. A description of how well received this solution would be from both user management, user, and organization perspective.	30%	Only supports Member Services requirements and current business processes would have to be modified to take advantage of software functionality **Score: 60**	Fully supports user required functionality. **Score: 100**	Same as candidate 2. **Score: 100**	
Technical Feasibility **Technology**. An assessment of the maturity, availability (or ability to acquire), and desirability of the computer technology needed to support this candidate. **Expertise**. An assessment to the technical expertise needed to develop, operate, and maintain the candidate system.	30%	Current production release of Platinum Plus package is version 1.0 and has only been on the market for 6 weeks. Maturity of product is a risk and company charges an additional monthly fee for technical support. Required to hire or train C++ expertise to perform modifications for integration requirements. **Score: 50**	Although current technical staff has only Powerbuilder experience, the senior analysts who saw the MS Visual Basic demonstration and presentation, has agreed the transition will be simple and finding experienced VB programmers will be easier than finding Powerbuilder programmers and at a much cheaper cost. MS Visual Basic 5.0 is a mature technology based on version number. **Score: 95**	Although current technical staff is comfortable with Powerbuilder, management is concerned with recent acquisition of Powerbuilder by Sybase Inc. MS SQL Server is a current company standard and competes with SYBASE in the Client/Server DBMS market. Because of this we have no guarantee future versions of Powerbuilder will "play well" with our current version SQL Server. **Score: 60**	

Feasibility Criteria	Wt.	Candidate 1	Candidate 2	Candidate 3	Candidate ..
Operational Feasibility	30%	**Score: 60**	**Score: 100**	**Score: 100**	
Technical Feasibility	30%	**Score: 50**	**Score: 95**	**Score: 100**	
Economic Feasibility **Cost to develop:** **Payback period (discounted):** **Net present value:** **Detailed calculations:**	30%	 Approximately $350,000. Approximately 4.5 years. Approximately $210,000. See Attachment A. **Score: 60**	 Approximately $418,040. Approximately 3.5 years. Approximately $306,748. See Attachment A. **Score: 85**	 Approximately $400,000. Approximately 3.3 years. Approximately $325,500. See Attachment A. **Score: 90**	
Schedule Feasibility An assessment of how long the solution will take to design and implement.	10%	Less than 3 months. **Score: 95**	9-12 months **Score: 80**	9 months **Score: 85**	
Ranking	100%	60.5	92	83.5	

Another Example

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

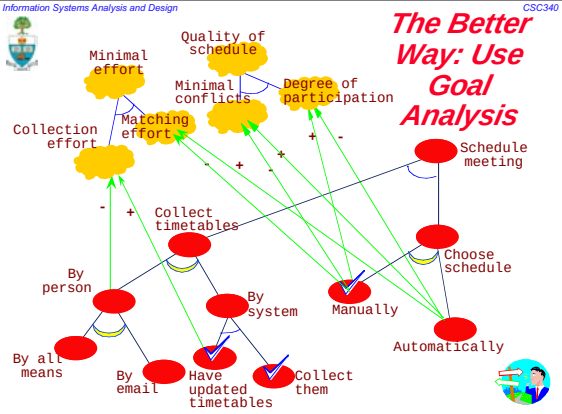
Criteria	Alternatives		
	Strobe	KEE	Loops
Zeus reqs (H+)	H	H+	H
Min costs (H)	H	L	Unresolved**
Customizability	H-*	M	H

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

Comparing Alternatives with Multiple Criteria

- Assign a weight to each criterion.
- Use dominating criteria.
- Eliminate unsatisfactory alternatives by setting "acceptability" threshold levels.

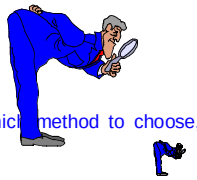
The Better Way: Use Goal Analysis



	MinEffort	SchedQuality
By all means/Manually	-1-1	-1+1
By email/Manually	-1-1	-1+1
By system/Manually	+1	-1+1
By all means/Automat	-1-1	+1-1
By email/Automat	-1-1	+1-1
By system/Automat	+1	+1-1

Information Acquisition

- There are many techniques for acquiring the information used in a feasibility study.
  - ✓Study available documents and data;
  - ✓Sampling;
  - ✓Interviews;
  - ✓Questionnaires;
  - ✓Observation.
- You need to know which method to choose, and how to actually use it.



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 current situation -- organizational setting, current system(s).
- Related factors and constraints.
- Problems and requirements.
- Objectives of the new system.
- 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 that include supporting material.

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, and 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 her 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 (***scoping***)
- 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***)

An 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***,...
- Confirm your understanding with the 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.