Feasibility Study

tvhoang@cit.ctu.edu.vn

Department of Software Engineering, CIT

Contents

- **What is a feasibility study?**
  - What to study and conclude?
- **Types of feasibility**
  - Technical
  - Economic
  - Schedule
  - Operational
- **Quantifying benefits and costs**
- **Comparing alternatives**

Why a feasibility study?

- **Objectives:**
  1. **To answer that it is possible to develop the proposed system or not**
  2. **To suggest possible alternative solutions**
  3. **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

Why a feasibility study? (cont.)

- **A management-oriented activity:**
  - After achieving a feasibility study, the management makes a decision: "go/no-go"
  - 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 current organizational system**
    - Stakeholders, users, policies, functions, objectives,...
  - **Problems with the current 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

Content of a feasibility study (cont.)

- **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**

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, accurate and usefully formatted information?
- **Economy**
  - Are services provided by the current system cost-effective?
  - Could there be a reduction in costs and/or an increase in benefits?

Exploring Feasibility (cont.)

- **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?

Four Types of feasibility

1. Technical feasibility
2. Economic feasibility
3. Schedule feasibility
4. Operational feasibility

Four Types of feasibility – 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 for this team?
  - Is relevant technology mature enough to be easily applied to our problem?

Four Types of feasibility – Technical feasibility

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

Four Types of feasibility – Economic feasibility

- **Can the final result be quantified yet?**
  - Very early in the project…
  - A judgment 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

Four Types of feasibility – Economic feasibility

- **Cost-benefit analysis**
  - **Purpose is to answer questions such as:**
    - Is the project justified (i.e. will benefits outweigh costs)?
    - What is the minimal cost to obtain a certain system?
    - How soon will the benefits accrue?
    - Which alternative offers the best return on investment?
  - **Examples of things to consider:**
    - Hardware/software selection
    - Selection of 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

Four Types of feasibility – Economic feasibility

- **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
      - Dollar earned today is worth more than a (potential) dollar earned next year

Four Types of feasibility – Economic feasibility

- **Analyzing Costs vs. Benefits**
  - **Do cost/benefit analysis**
    - Calculate Return on Investment (ROI):
      - Allows comparison of lifetime profitability of alternative solutions

$$ROI = \frac{\text{Total Profit}}{\text{Total Cost}} = \frac{\text{Lifetime benefits - Lifetime costs}}{\text{Lifetime costs}}$$

    - Calculate Break-Even point:
      - how long will it take (in years) to pay back the accrued costs:

@T (Accrued Benefit > Accrued Cost)

Four Types of feasibility - Economic feasibility

- **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?"

Four Types of feasibility – Economic feasibility

- **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**
  - Present_Value(1) = $1/(1 + 0.12)^1 = 0.893$
  - Present_Value(2) = $1/(1 + 0.12)^2 = 0.797$

Four Types of feasibility – Economic feasibility

- **Net Present Value**
  - **Measures the total value of the investment**
    - …with all figures adjusted to present dollar values
      - NPV = Cumulative PV of all benefits - Cumulative PV of all costs

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)

Four Types of feasibility – Economic feasibility

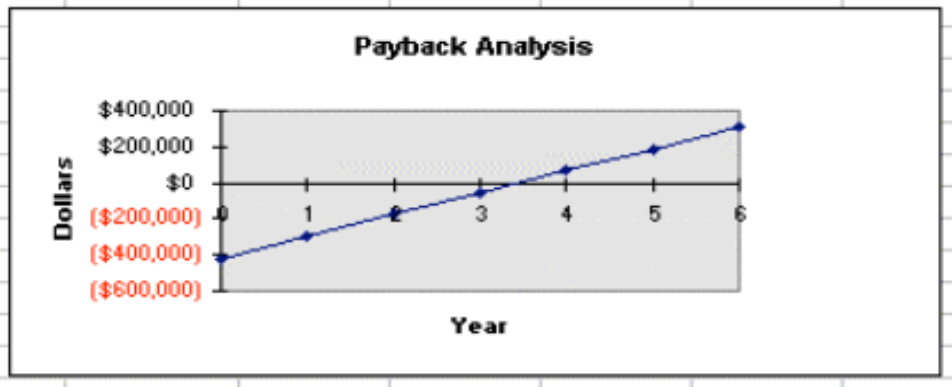
- **Assuming subsequent years are like year 4…**
  - the net present value of this investment in the project will be:
  - after 5 years: **$13,652**
  - after 6 years: **$36,168**

Four Types of feasibility – Economic feasibility

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:	($418,040)						
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	($418,040)	($13,435)	($12,752)	($12,104)	($11,448)	($10,773)	($10,140)
Cumulative time-adjusted costs over	($418,040)	($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 +	($418,040)	($297,525)	($174,787)	($51,611)	$70,501	$190,138	$306,748



Four Types of feasibility – Economic feasibility

- **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:

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

    - For our last example: **51,611 / (70,501 + 51,611) = 0.42**
    - Therefore, the payback period is about **3.4 years**

Four Types of feasibility – Economic feasibility

- **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:

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

or

$$\text{ROI} = \text{Net Present value / Estimated lifetime costs}$$

  - For our example
    - ROI = (795,440 - 488,692) / 488,692 ≈ 63%,
    - or ROI = 306,748 / 488,692 ≈ 63%

Four Types of feasibility – Economic feasibility

- **Solution with the highest ROI is the best alternative**
  - But need to know payback period too to get the full picture
    - Sometimes, a **lower ROI** with **earlier payback** may be preferable in some circumstances

Four Types of feasibility – 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

Four Types of feasibility – Schedule feasibility

- **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!**

Four Types of feasibility – 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

Four Types of feasibility – Operational feasibility

- **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?

Feasibility Study Contents

- **Purpose & scope of the study**
  - Objectives (of the study)
  - 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.

Feasibility Study Contents

- **Problems and requirements**
  - What's wrong with the present situation?
  - What changes are needed?
- **Objectives of the new system**
  - Goals and relationships between them
- **Possible alternatives**
  - …including 'do nothing'
- **Criteria for comparison**
  - definition of the criteria

Feasibility Study Contents

- **Analysis of alternatives**
  - Description of each alternative
  - Evaluation with respect to criteria
  - Cost/benefit analysis and special implications.
- **Recommendations**
  - What is recommended and implications
  - What to do next
- **Appendices**
  - To include any supporting material

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
  - 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.
  - A final ranking or score is recorded in the last row.

Example matrix

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

Example matrix

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**	

Example matrix

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**	

Main references

- **Prof Steve Easterbrook, lecture notes, University of Toronto, Canada.**

Q&A