System Analysis and Design

FEASIBILITY ANALYSIS

Feasibility analysis guides the organization in determining whether to proceed with the project.

Feasibility analysis also identifies the important risks associated with the project that must be managed if the project is approved.

Each organization has its own process and format for the feasibility analysis, but most include techniques to assess three areas: **Technical Feasibility, Economic Feasibility, and Organizational Feasibility.**

Most project teams revise the feasibility study throughout the SDLC and revisit its contents at various checkpoints during the project. If at any point the project's risks and limitations outweigh its benefits, the project team may decide to **cancel the project** or **make substantial revisions**.

Technical Feasibility: Can We Build It?

- Familiarity with application: Less familiarity generates more risk.
- Familiarity with technology: Less familiarity generates more risk.
- Project size: Large projects have more risk.
- Compatibility: The harder it is to integrate the system with the company's existing technology, the higher the risk will be.

Economic Feasibility: Should We Build It?

- Development costs
- Annual operating costs
- Annual benefits (cost savings and/or increased revenues)
- Intangible benefits and costs

Organizational Feasibility: If We Build It, Will They Come?

- Is the project strategically aligned with the business?
- Project champion(s)
- Senior management
- Users
- Other stakeholders

Technical Feasibility

The extent to which the system can be successfully **designed, developed, and installed by the IT group**. Technical feasibility analysis is, in essence, a **technical risk analysis that strives to answer the question: "Can we build it?"**

1. Users' and Analysts' familiarity with the application:

When analysts are unfamiliar with the business application area, they have a greater chance of misunderstanding the users or missing opportunities for improvement. The risks increase dramatically when the users themselves have limited knowledge of the application. If the project involves a new business innovation, neither the users nor the analysts may have any direct knowledge or experience of the proposed new application. **In general, the development of new systems is riskier than extensions to an existing system, because existing systems tend to be better understood.**

2. Familiarity with the technology

Is another important source of technical risk. **When a system uses technology that has not been used before within the organization**, there is a greater chance that problems and delays will occur because of the need to learn how to use the technology. **Risk increases dramatically when the technology itself is new (e.g., a Big Data project using Hadoop)**. When the technology is not new, but the organization lacks experience with it, technical risk is reduced somewhat, since outside expertise should be available from vendors and consultants.

3. Project size

Is an important consideration, whether measured as **the number of people on the development team, the length of time it will take to complete the project, or the number of distinct features in the system**. Larger projects present more risk, because they are more complicated to manage and because there is a greater chance that some important system requirements will be misunderstood.

4. Compatibility

Project teams need to consider the compatibility of the new system with the technology that already exists in the organization. Systems are rarely built in a vacuum—they are built in organizations that have numerous systems already in place. New technology and applications need to be able to integrate with the existing environment for many reasons. They may rely on data from existing systems, they

may produce data that feed other applications, and they may have to use the company's existing communications infrastructure.

Economic Feasibility "Cost–Benefit analysis"

This attempts to answer the question "Should we build the system?"

Is determined by identifying costs and benefits associated with the system, assigning values to them, calculating future cash flows, and measuring the financial worthiness of the project. As a result of this analysis, the financial opportunities and risks of the project can be understood

1. Cash Flow Analysis and Measures

Return on Investment

The return on investment (ROI) is a calculation that measures the average rate of return earned on the money invested in the project. ROI is a simple calculation that divides the project's net benefits (total benefits – total costs) by the total costs. The ROI formula is

$$\text{ROI} = \frac{\text{Total Benefits} - \text{Total Costs}}{\text{Total Costs}}$$

$$\text{ROI} = \frac{152{,}000 - 138{,}000}{138{,}000} = \frac{14{,}000}{138{,}000} = 10.14\%$$

A high ROI suggests that the project's benefits far outweigh the project's cost,

Break-Even Point

Another common approach to measuring a project's worth is the break-even point. The break-even point (also called the payback method) is **defined as the number of years it takes a firm to recover its original investment in the project from net cash flows**. As shown in row 4 of Figure 1-8, the project's cumulative cash flow figure becomes positive during Year 3, so the initial investment is "paid back" over two years plus some fraction of the third year.

$$\text{BEP} = \begin{array}{c}\text{Number of years}\\ \text{of negative cash}\\ \text{flow}\end{array} + \frac{\text{That year's Net Cash Flow} - \text{That year's Cumulative Cash Flow}}{\text{That year's Net Cash Flow}}$$

		Year 0	Year 1	Year 2	Year 3	Total
	Total Benefits		45,000	50,000	57,000	152,000
	Total Costs	100,000	10,000	12,000	16,000	138,000
③	Net Benefits (Total Benefits – Total Costs)	(100,000)	35,000	38,000	41,000	14,000
④	Cumulative Net Cash Flow	(100,000)	(65,000)	(27,000)	14,000	

Using the values in Figure 1-8, the BEP calculation is:

$$\text{BEP} = 2 + \frac{41{,}000 - 14{,}000}{41{,}000} = 2 + \frac{28{,}000}{41{,}000} = 2.68 \text{ years}$$

Discounted Cash Flow Technique

Discounted cash flows are used to **compare the present value of all cash inflows and outflows for the project in today's dollar terms**. The key to understand **present values** is to **recognize that if you had a dollar today, you could invest it and receive some rate of return on your investment**. Therefore, a dollar received in the future is worth less than a dollar received today, since you forgot that potential return. If you have a friend who owes you $100 today, but instead gives you that $100 in 3 years—you've been had! Assuming you could have invested those dollars at a 10% rate of return, you will be receiving the equivalent of $75 in today's terms. The basic formula to convert a future cash flow to its present value is

$$\text{PV} = \frac{\text{Cash flow amount}}{(1 + \text{Rate of return})^n}, \text{ where } n \text{ is the year in which the cash flow occurs.}$$

The rate of return used **in the present value calculation is sometimes called the required rate of return, or the cost of obtaining the capital needed to fund the project**., $100 received in 3 years with a required rate of return of 10% has a PV of $75.13

$$PV = \frac{100}{(1 + 0.1)^3} = \frac{100}{1.331} = 75.13$$

In Figure 1-9, the present value of the projected benefits and costs shown in Figure 1-8 have been calculated using a 10% required rate of return.

	Year 0	Year 1	Year 2	Year 3	Total
Total Benefits		45,000	50,000	57,000	
PV of Total Benefits		40,909	41,322	42,825	125,056
Total Costs	100,000	10,000	12,000	16,000	
PV of Total Costs	100,000	9,091	9,917	12,021	131,029

Net Present Value (NPV)

The NPV is simply the difference between **the total present value of the benefits and the total present value of the costs.**

$$\begin{aligned} NPV &= \Sigma \text{ PV of Total Benefits} - \Sigma \text{ PV of Total Costs} \\ &= \$125{,}056 - \$131{,}029 = (\$5{,}973) \end{aligned}$$

If the NPV is greater than zero, the project is considered economically acceptable. Unfortunately for this project, the NPV is less than zero, indicating that for a required rate of return of 10%, this project should not be accepted. The required rate of return would have to be something less than 6.65% before this project returns a positive NPV. This example illustrates the fact that sometimes the "naïve" techniques of ROI and BEP find that the project appears acceptable, but the more rigorous and financially correct NPV technique finds the project is unacceptable.

Identify Costs and Benefits

The systems analyst's first task when developing an **economic feasibility analysis** is to identify the kinds of costs and benefits the system will have and list them along the left-hand column of a spreadsheet.

1. Identify Costs and Benefits	List the tangible costs and benefits for the project. Include both one-time and recurring costs.
2. Assign Values to Costs and Benefits	Work with business users and IT professionals to create numbers for each of the costs and benefits. Even intangibles should be valued if at all possible.
3. Determine Cash Flow	Forecast what the costs and benefits will be over a certain period, usually, 3–5 years. Apply a growth rate to the values, if necessary.
4. Assess Project's Economic Value	Evaluate the project's expected returns in comparison to its costs. Use one or more of the following evaluation techniques:
• **Return on Investment (ROI)**	Calculate the rate of return earned on the money invested in the project, using the ROI formula.
• **Break-Even Point (BEP)**	Find the year in which the cumulative project benefits exceed cumulative project costs. Apply the breakeven formula, using figures for that year. This calculation measures how long it will take for the system to produce benefits that cover its costs.
• **Net Present Value (NPV)**	Restate all costs and benefits in today's dollar terms (present value), using an appropriate discount rate. Determine whether the total present value of benefits is greater than or less than the total present value of costs.

Development Costs	Operational Costs
Development team salaries	Software upgrades
Consultant fees	Software licensing fees
Development training	Hardware repair and upgrades
Hardware and software	Cloud storage fees
Vendor installation	Operational team salaries
Office space and equipment	Communications charges
Data conversion costs	User training
Tangible Benefits	**Intangible Benefits**
Increased sales	Increased market share
Reductions in staff	Increased brand recognition
Reductions in inventory	Higher-quality products
Reductions in IT costs	Improved customer service
Better supplier prices	Better supplier relations

FIGURE 1-11
Example of Costs and Benefits for Economic Feasibility

Figure 1-11 lists examples of costs and benefits that may be included. The costs and benefits can be broken down into four categories: (1) development costs, (2) operational costs, (3) tangible benefits, and (4) intangibles benefits.

	2012	2013	2014	2015	2016	Total
Benefits						
Increased sales		500,000	530,000	561,800	595,508	2,187,308
Reduction in customer complaint calls[a]		70,000	70,000	70,000	70,000	280,000
Reduced inventory costs		68,000	68,000	68,000	68,000	272,000
Total Benefits[b]		**638,000**	**668,000**	**699,800**	**733,508**	**2,739,308**
Development Costs						
2 servers @ $125,000	250,000	0	0	0	0	250,000
Printer	100,000	0	0	0	0	100,000
Software licenses	34,825	0	0	0	0	34,825
Server software	10,945	0	0	0	0	10,945
Development labor	1,236,525	0	0	0	0	1,236,525
Total Development Costs	**1,632,295**	**0**	**0**	**0**	**0**	**1,632,295**
Operational Costs						
Hardware		50,000	50,000	50,000	50,000	200,000
Software		20,000	20,000	20,000	20,000	80,000
Operational labor		115,000	119,600	124,384	129,359	488,343
Total Operational Costs		**185,000**	**189,600**	**194,384**	**199,359**	**768,343**
Total Costs	**1,632,295**	**185,000**	**189,600**	**194,384**	**199,359**	**2,400,638**
Total Benefits – Total Costs	**(1,632,295)**	**453,000**	**478,400**	**505,416**	**534,149**	**338,670**
Cumulative Net Cash Flow	**(1,632,295)**	**(1,179,295)**	**(700,895)**	**(195,479)**	**338,670**	
Return on Investment (ROI)	**14.1%**	**(338,670/2,400,638)**				
Break-even Point	**3.37 years**	**(3 years of negative cumulative cash flow + [534,149 – 338,670]/534,149 = .37)**				

[a] Customer service values are based on reduced costs of handling customer complaint phone calls.

[b] An important yet intangible benefit will be the ability to offer services that our competitors currently offer.

	2012	2013	2014	2015	2016	Total
Benefits						
Increased sales		500,000	530,000	561,800	595,508	
Reduction in customer complaint calls[a]		70,000	70,000	70,000	70,000	
Reduced inventory costs		68,000	68,000	68,000	68,000	
Total Benefits[b]		**638,000**	**668,000**	**699,800**	**733,508**	
Present Value Total Benefits		**601,887**	**594,518**	**587,566**	**581,007**	**2,364,978**
Development Costs						
2 Servers @ $125,000	250,000	0	0	0	0	
Printer	100,000	0	0	0	0	
Software licenses	34,825	0	0	0	0	
Server software	10,945	0	0	0	0	
Development labor	1,236,525	0	0	0	0	
Total Development Costs	**1,632,295**	**0**	**0**	**0**	**0**	
Operational Costs						
Hardware		50,000	50,000	50,000	50,000	
Software		20,000	20,000	20,000	20,000	
Operational labor		115,000	119,600	124,384	129,359	
Total Operational Costs		**185,000**	**189,600**	**194,384**	**199,359**	
Total Costs	**1,632,295**	**185,000**	**189,600**	**194,384**	**199,359**	
Present Value Total Costs	**1,632,295**	**174,528**	**168,743**	**163,209**	**157,911**	**2,296,686**
NPV (PV Total Benefits – PV Total Costs)						**68,292**

[a] Customer service values are based on reduced costs of handling customer complaint phone calls.

[b] An important yet intangible benefit will be the ability to offer services that our competitors currently offer.

Assignments

Create the Feasibility study of your course project.

You must include Technical, and Economic feasibility.

Calculate the ROI, NPV, and BEP