COE691: Software Requirements and Specifications

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Everyone Makes a Mark

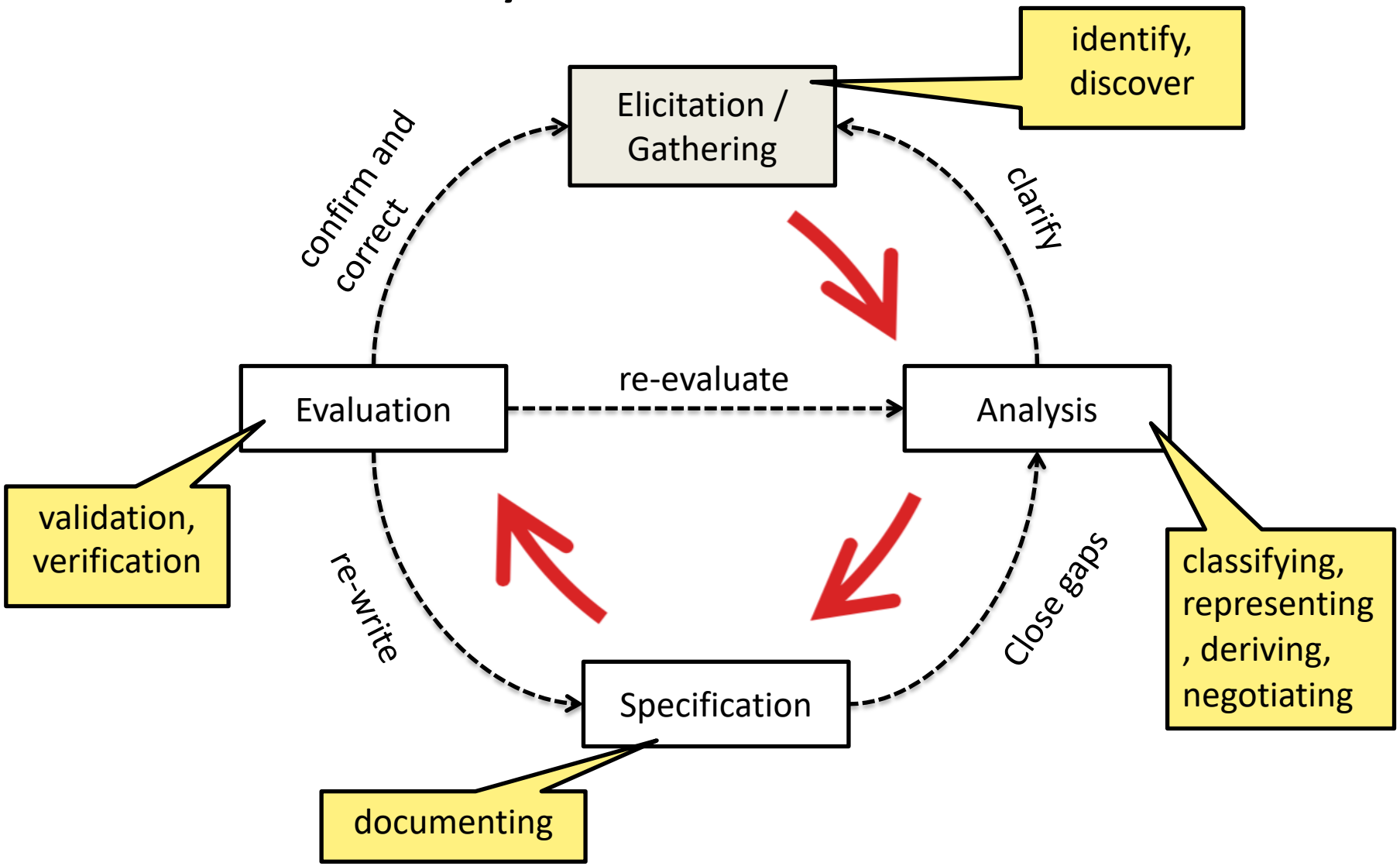
Last Week

- Requirements
- Requirement Engineering Process
- Types of Requirements
- Quality of Requirements

Week 3: Agenda

- Requirements Inception
  - Primary investigation procedure
- Requirements Elicitations
  - Requirement Resources
  - Stakeholder Analysis
  - Elicitation Techniques

Recall: RE Lifecycle



Requirements Inception

- Inception is the initial short step to establish a common vision about the product (product vision) and basic scope for the project (project scope)
- It includes:
  - Analysis of perhaps 10% of the use cases
  - Analysis of the critical non-functional requirement,
  - Creation of a business case,
  - Preparation of the development environment so that programming can start in the following elaboration phase

Requirements Inception

- Most projects require a short initial step in which the following kinds of questions are explored –
  - What is the vision and business case for this project
  - Feasible?
  - Buy and/or build this system?
  - Rough unreliable range of cost ? Is it $10K, $100K, millions?
  - Should we proceed or stop?
  - Do the stakeholders have basic agreement on the vision of the project, and is it worth investing in serious investigation?

Requirements Inception

- Defining the vision and obtaining an order-of-magnitude (unreliable) estimate requires doing some requirements exploration. However, the purpose of the inception phase is not to define all the requirements or generate a believable estimate or project plan .
- The inception phase should be relatively short for most projects, such as one or a few weeks long.
  - It is to decide if the project is worth a serious investigation (during elaboration), not to do that investigation

Activities and Artifacts in the Inception Phase

- A short requirements workshop
- Most actors, goals, and use case named
- Most use cases written in brief format
- 10~20% of the use cases are written in fully dressed detail to improve understanding of the scope and complexity
- Most influential and risk quality requirements identified
- Initial Vision and Supplementary Specification document
- Risk list
- Technical proof-of-concept prototypes and other investigations to explore the technical feasibility of special requirements

Activities and Artifacts in the Inception Phase

- User interface-oriented prototype to clarify the vision of functional requirements
- Recommendations on what components to buy/build/reuse, to be refined in the elaboration and elicitation phases.
- High-level candidate architecture and components proposed
- Plan for the first iteration
- Candidate tools list

How Long is Inception?

- Inception phase should be relatively short for most projects
- One or a few weeks long.
- On many projects, if it is more than a week long, then the point of inception has been missed: It is to decide if the project is worth a serious investigation
- May include the first requirements workshop, planning for the first iteration, and then quickly moving forward to elaboration

Sample Inception Artifacts

Artifact	Comment
Vision and Business Case	Describes the high-level goals and constraints, the business case, and provides an executive summary.
Use-Case Model	Describes the functional requirements. During inception, the names of most use cases will be identified, and perhaps 10% of the use cases will be analyzed in detail.
Supplementary Specification	Describes other requirements, mostly non-functional. During inception, it is useful to have some idea of the key non-functional requirements that have will have a major impact on the architecture.
Glossary	Key domain terminology, and data dictionary.
Risk List & Risk Management Plan	Describes the risks (business, technical, resource, schedule) and ideas for their mitigation or response.
Prototypes and proof-of-concepts	To clarify the vision, and validate technical ideas.
Iteration Plan	Describes what to do in the first elaboration iteration.
Phase Plan & Software Development Plan	Low-precision guess for elaboration phase duration and effort. Tools, people, education, and other resources.
Development Case	A description of the customized UP steps and artifacts for this project. In the UP, one always customizes it for the project.

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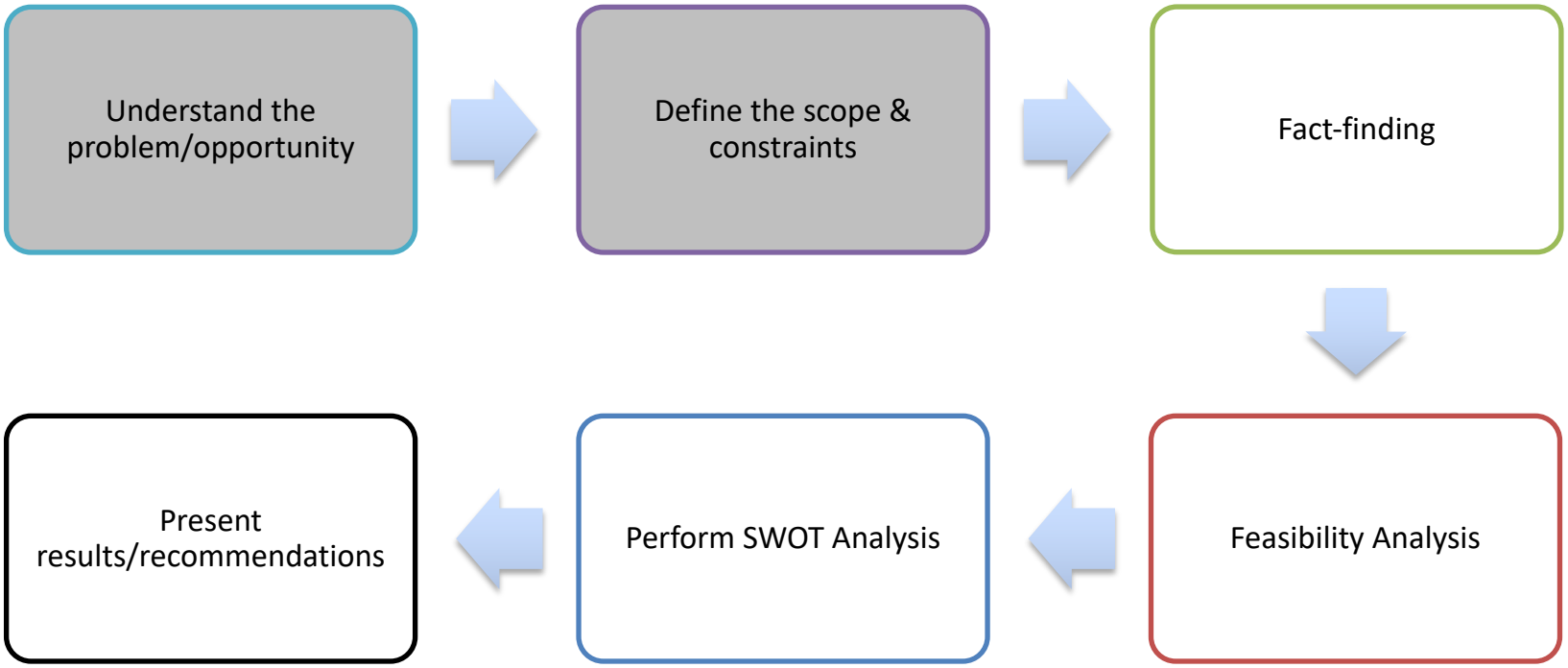
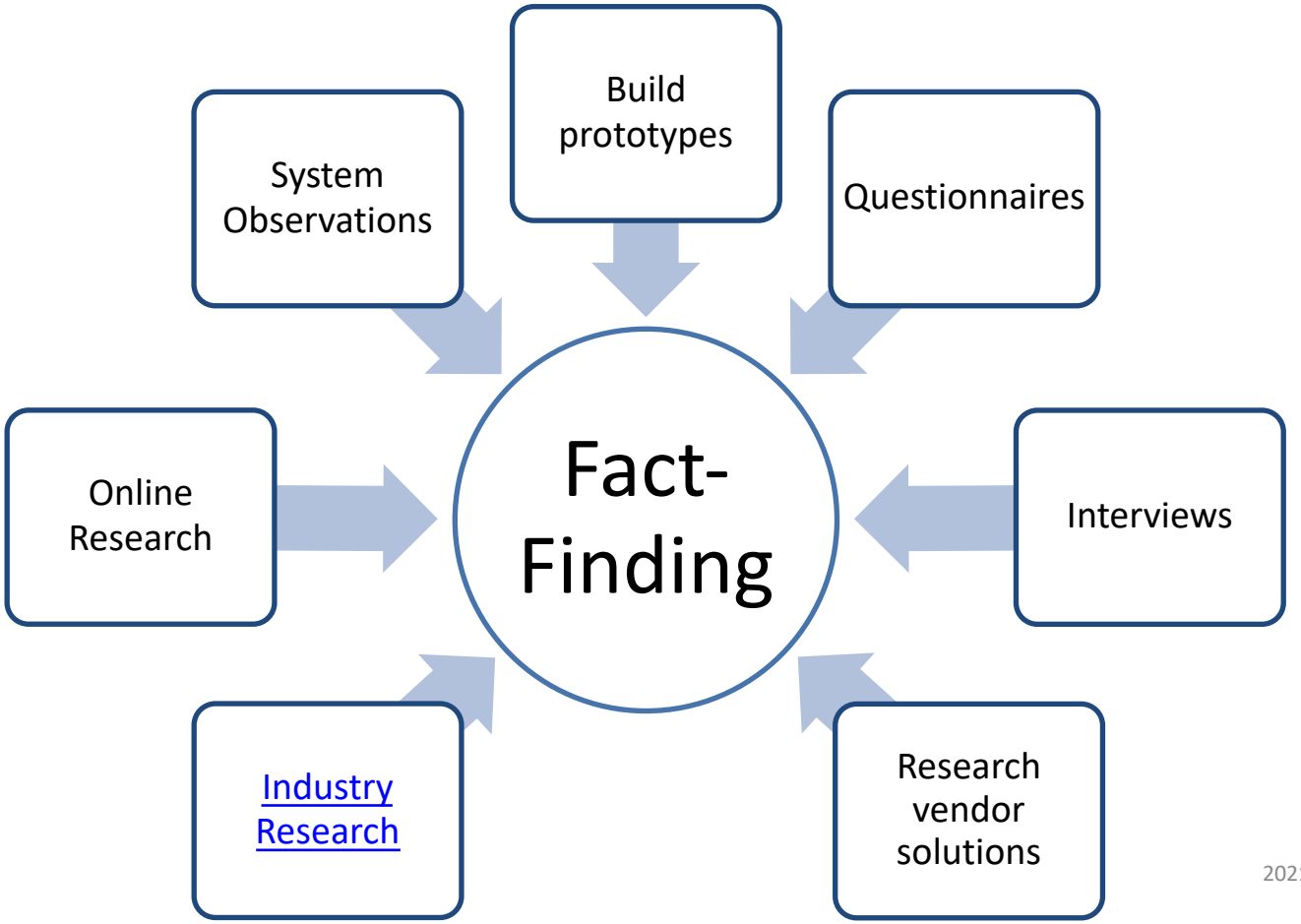
These artifacts are only partially completed in this phase. They will be iteratively refined in subsequent iterations

Preliminary Investigation

- A **preliminary investigation** begins to evaluate the business opportunity or problem.



Fact Finding Techniques



1. Questionnaire

- **Pre-prepared form** used to ask same questions
- Used when there are **too many interviewees** / **in distance**
- Used **with** or **without** interview
- **Multiple** designs for different audiences
- Wording is important – no chance for clarification
- **Buzzwords** mean different things to different people
- *Buzzword* is a vogue term in a particular profession, field of study, popular culture, etc. (4G)

1. Questionnaire

- Advantage:
  - **Cover** large population **economically** and respondents don't have to write long essays as answers
  - **Preliminary insight** into business
  - **Closed-ended** questions direct person answering question
  - **Open-ended** questions encourage discussion and elaboration
- Disadvantage:
  - Some questions may not apply to everyone
  - No contact
  - Not well suited for gathering detailed information

Types of Questions

Closed-ended questions - Require short answer (Y, N, #)	e.g. How long have you been working for this department?
Open-ended questions - Require long answer	e.g. what kind of problem do you have with the current system?
Compound questions - 2 or more questions in one	e.g. How often do you get Error Report **and** what do you do with them?
Leading questions - Influence interviewee's answer	e.g. Do you agree with many of your colleagues that the current system must be replaced?
Probing questions - Don't cross examine, but ask for examples	e.g. what constitutes an "error in output"? Please give an example.

Example

RMO: Ridgeline Mountain Outfitters

RMO Questionnaire

This questionnaire is being sent to all telephone-order sales personnel. As you know, RMO is developing a new customer support system for order taking and customer service.

The purpose of this questionnaire is to obtain preliminary information to assist in defining the requirements for the new system. Follow-up discussions will be held to permit everybody to elaborate on the system requirements.

Part I. Answer these questions based on a typical four-hour shift.

1. How many phone calls do you receive?_____
2. How many phone calls are necessary to place an order for a product?_____
3. How many phone calls are for information about RMO products, that is, questions only?_____
4. Estimate how many times during a shift customers request items that are out of stock._____
5. Of those out-of-stock requests, what percentage of the time does the customer desire to put the item on back order?_____%
6. How many times does a customer try to order from an expired catalog?_____
7. How many times does a customer cancel an order in the middle of the conversation?_____
8. How many times does an order get denied due to bad credit?_____

Part II. Circle the appropriate number on the scale from 1 to 7 based on how strongly you agree or disagree with the statement.

Question	Strongly Agree						Strongly Disagree
It would help me do my job better to have longer descriptions of products available while talking to a customer.	1	2	3	4	5	6	7
It would help me do my job better if I had the past purchase history of the customer available.	1	2	3	4	5	6	7
I could provide better service to the customer if I had information about accessories that were appropriate for the items ordered.	1	2	3	4	5	6	7
The computer response time is slow and causes difficulties in responding to customer requests.	1	2	3	4	5	6	7

Part III. Please enter your opinions and comments.

Please briefly identify the problems with the current system that you would like to see resolved in a new system.

_____
_____
_____

2. Interviews

- An interview is a conversation between two or more people where questions are asked by the interviewer to elicit facts or statements from the interviewee.
- Appropriate for Open-ended questions
- One-2-one or one-2-many

Advantage

- Direct (Face to face) contact
- Avoid distraction & sidetracks

Disadvantage

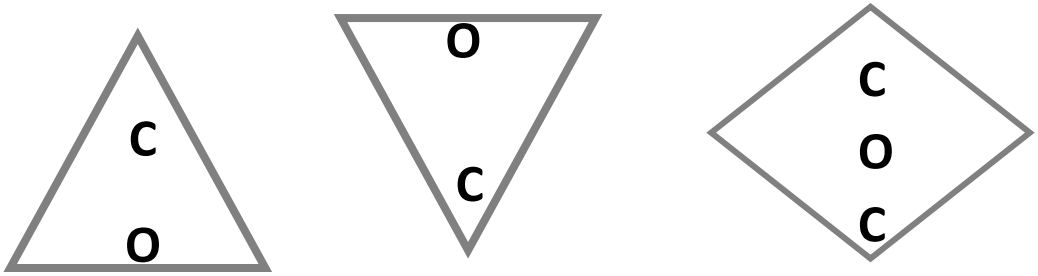
- Time consuming
- Costly if interviewees are too many/ located at different locations

2. Types of Interviews

Structured interviews	With structured interviews, each participant is asked the exact same question in the same order. While this can be effective, many would argue that the same thing can be achieved through administering a survey.
Unstructured interviews	Unstructured interviews are more like conversations; there are no prearranged questions which allows questions to be generated by what the interviewee says.
Semi-structured interviews	Semi-structured interviews provide the best of both worlds. Under this format, the researcher prepares an interview guide, but also allows the conversation to flow naturally, meaning that questions do not necessarily have to be asked in order, go "off-script".

Interview Guide

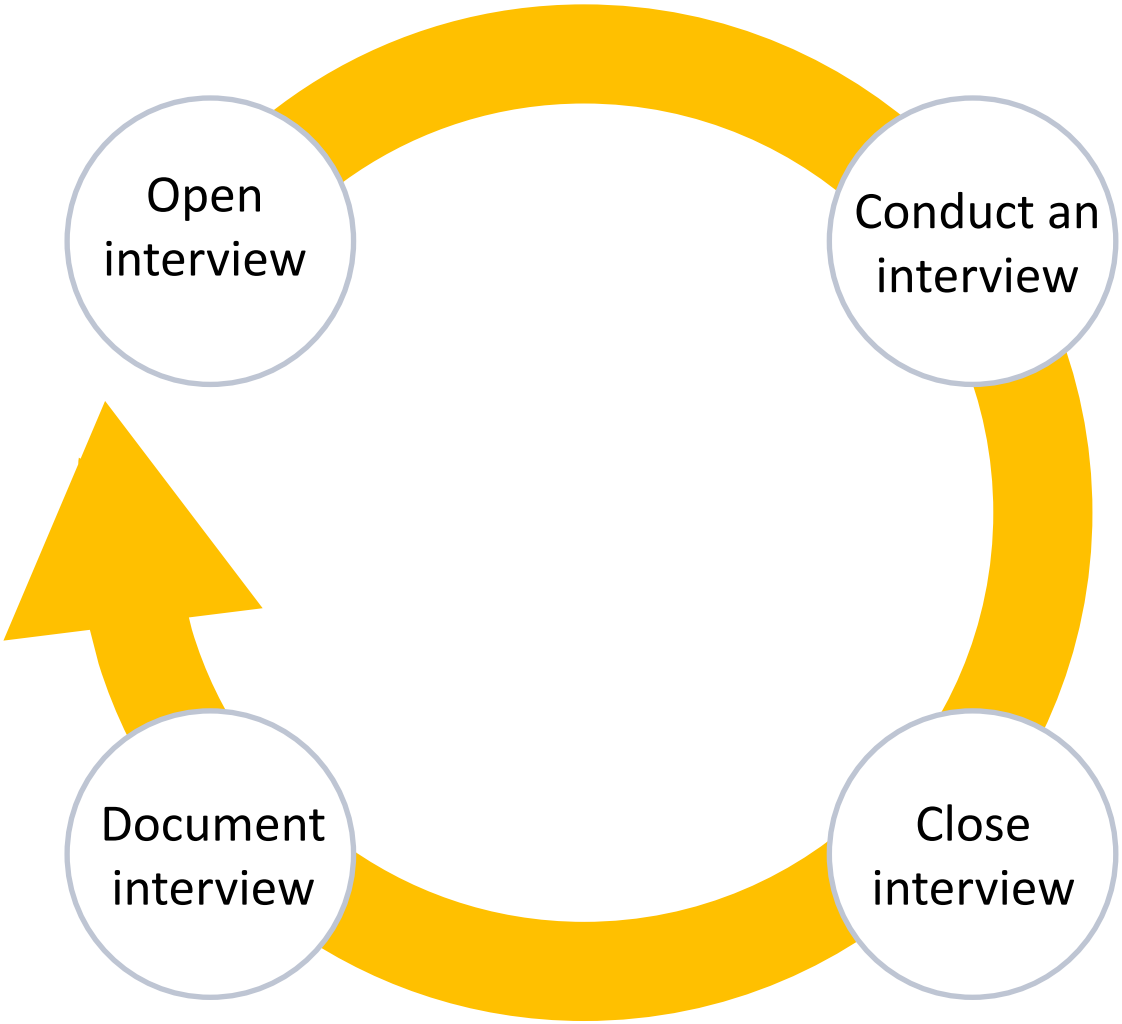
- The interview guide is a (orderly) list of questions you will ask your participants during the interview.
- Interview Guide structures
  - Pyramid: First close-ended then open-ended questions
    - Easy questions first to break the ice
  - Funnel: First open-ended then close-ended questions
    - Long answer questions first when the interviewee is not too tired to answer
  - Diamond: Close-ended, open-ended, close-ended questions



Prepare for Interview

- When preparing for an interview you need:
  - Read background
  - Schedule and inform interviewees
  - Decide who to interview and what to ask
  - Is interviewee's view different from yours?
  - Biased? Interviewee's feeling about IS can affect their answer
  - Keep interview short
  - Ask about routine operations + exceptions (incorrect balance?, supplier fails to deliver?)

Interview Procedure



Preliminary Investigation

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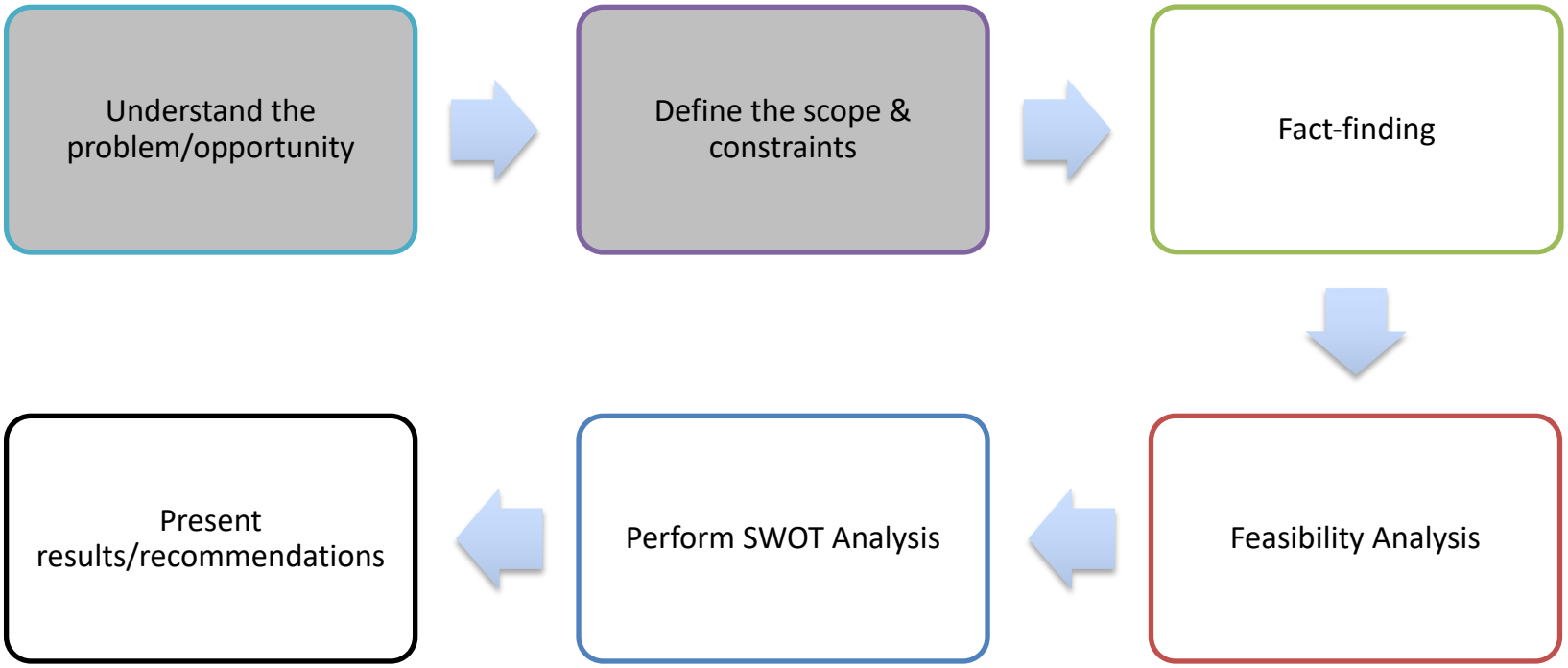
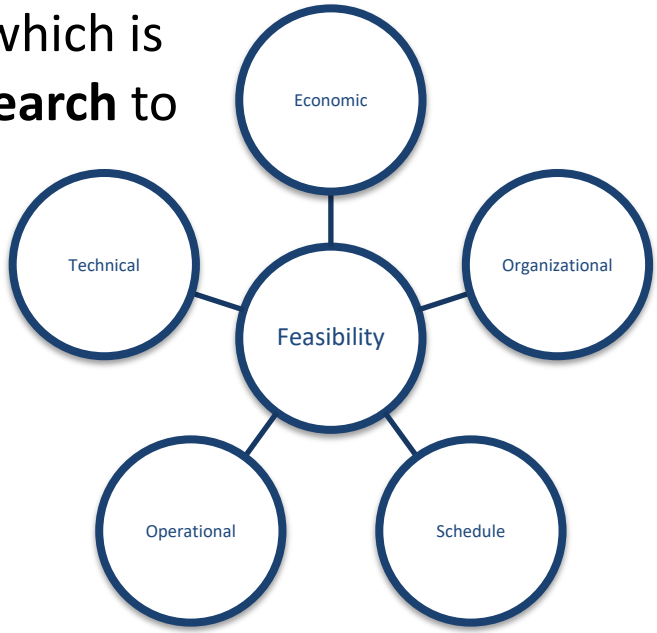


EVALUATE THE FEASIBILITY

Feasibility

- Once problem is defined, analyst must decide to proceed or not?
- A **project feasibility** is an evaluation and analysis of the **potential** of the proposed project which is based on **extensive investigation** and **research** to support the process of decision making.

- Each organization has its **own** process and format for the feasibility study, but most include techniques to assess following areas:



Operational Feasibility

- **Operational feasibility** assessment focuses on the degree to which the proposed development project fits in the existing business environment.
- Operational feasibility:
  - Is there a workable solution to the problem?
  - Is this system useful?
  - Will the system be used effectively after it is developed?
  - Will the new system place more demands on users?

Technical Feasibility

- The technical feasibility assessment is focused on **gaining** an understanding of the *present technical resources* of the organization and their **applicability** to the **expected needs** of the proposed system.
- It is an **evaluation** of the hardware and software and how it **meets** the need of the proposed system.
- It tries to answer the question: "**Can we build it**?"

Economic Feasibility

- The purpose of the economic feasibility assessment is to determine the **positive economic benefits** to the organization that the proposed system will provide.
- Economic feasibility analysis is also called a *cost-benefit analysis*, that identifies the **costs** and **benefits** associated with the system.
- This attempts to answer the question: "**Should we build the system**?"

Benefit-Cost Analysis

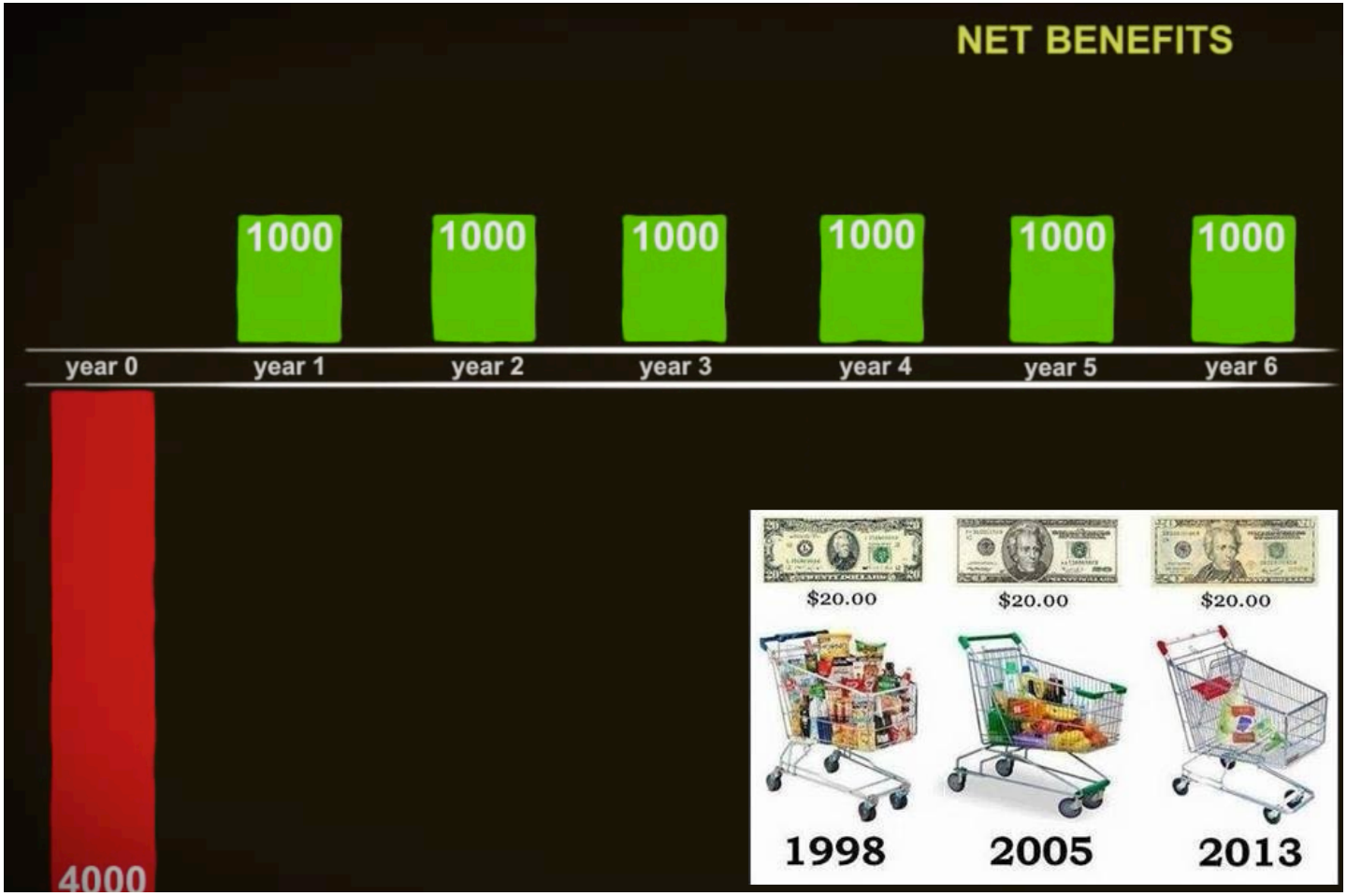
- Decide which solution makes the most sense from a financial point of view.
- Example:

  Benefit cost rate (BCR) = Discounted value of incremental benefits ÷ Discounted value of Incremental costs

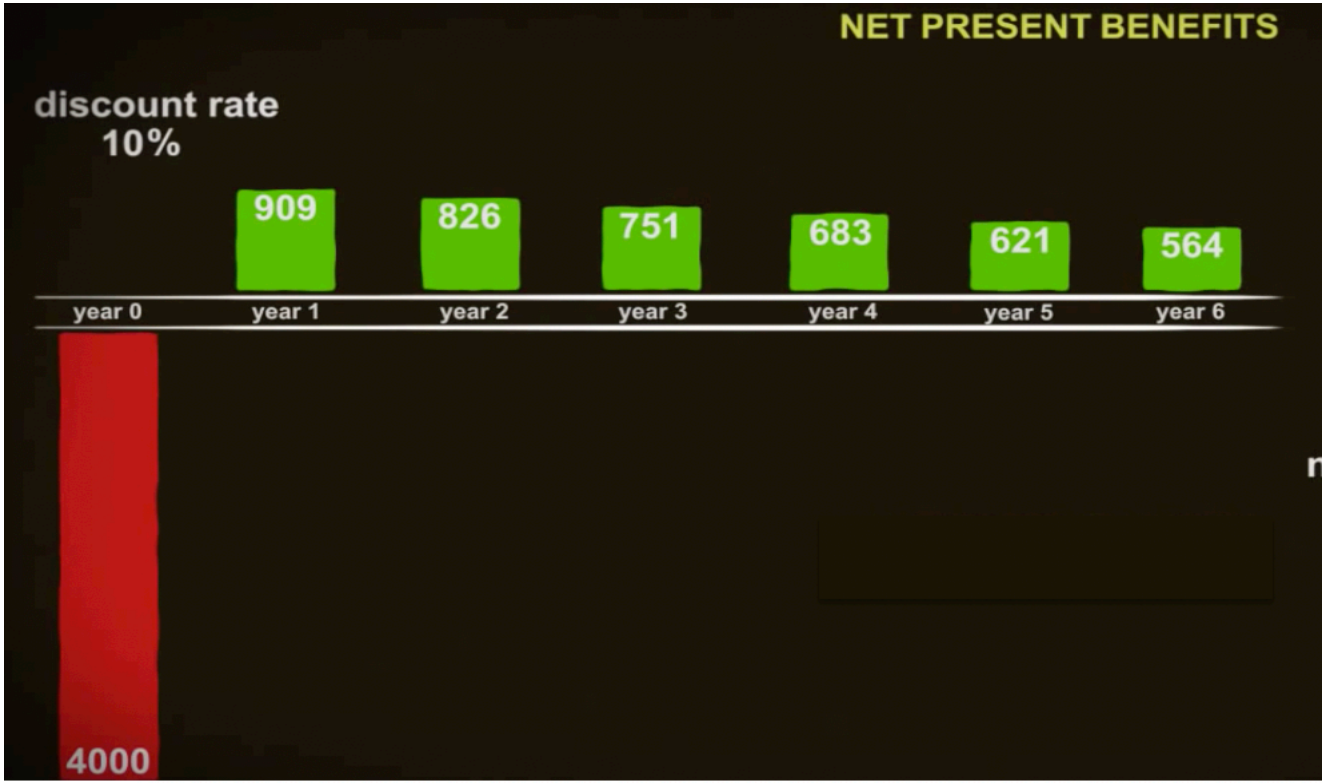
Costs	Benefits
Actual price of software	More efficient business processes
Cost of installation	More efficient staff
User training	Better customer information
Annual maintenance	Better data management

	Solution A	Solution B	Solution C
Costs	$10000	$15000	$20000
Benefits	$12000	$19000	$23000
BCR	1.2	1.27	1.15

Example : No inflation



Example with inflation



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

Present Value (PV)

- The basic formula to convert a future cash flow to its present value is:

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

	Year 0	Year 1	Year 2	Year 3	Total
Total Benefits		45,000	50,000	55,000	
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

Source: Analysis and Design of Information Systems, 3rd ed. by Arthur M. Langer, Springer-Verlag, 2008.

Discounted value of incremental benefits

Discounted value of incremental costs

Net Present Value (NPV)

The Formula for NPV

$$NPV = \frac{\text{Cash flow}}{(1+i)^t} - \text{initial investment}$$

where:

$i = \text{Required return or discount rate}$

$t = \text{Number of time periods}$

If analyzing a longer-term project with multiple cash flows, the formula for the net present value of a project is:

$$NPV = \sum_{t=0}^{n} \frac{R_t}{(1+i)^t}$$

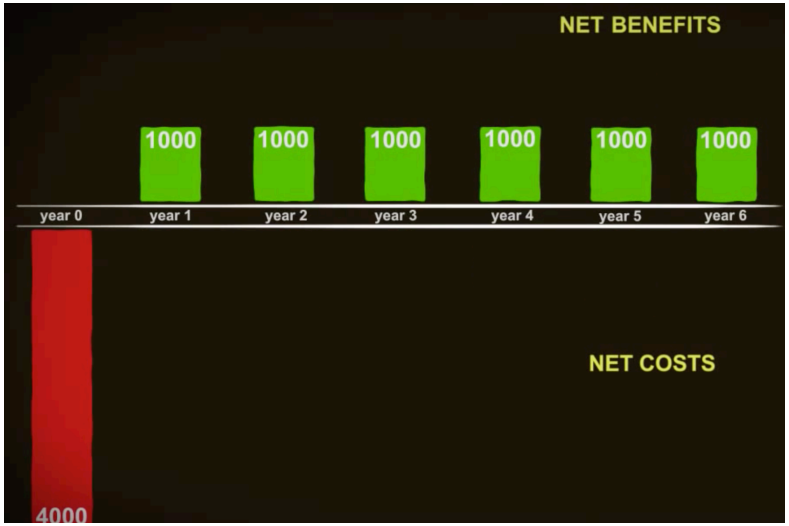
where: *Rt*=net cash inflow-outflows during a single period
i=discount rate or return that could be earned in alternative investments
t=number of time periods

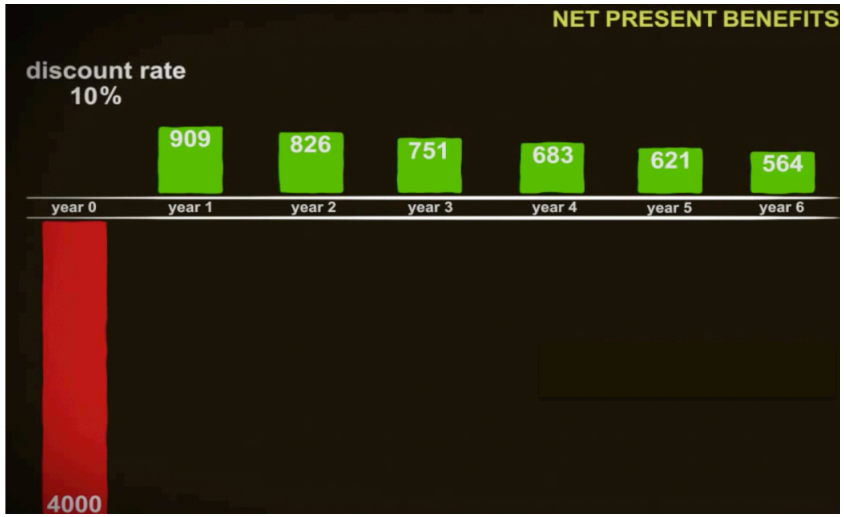
NPV : Example 1

- Imagine a project that costs $1,000 and will provide three cash flows of $500, $300, and $800 over the next three years. Assume there is no salvage value at the end of the project and the required rate of return is 8%. The NPV of the project is calculated as follows:

$$
\begin{aligned}
NPV &= \frac{\$500}{(1+0.08)^1} + \frac{\$300}{(1+0.08)^2} + \frac{\$800}{(1+0.08)^3} - \$1000 \\
&= \$355.23
\end{aligned}
$$

NPV : Example 2





Return on Investment (ROI)

- The return on investment (ROI) is a calculation that measures the **average rate of return** earned on the money invested in the project.

	Year 0	Year 1	Year 2	Year 3	Total
Total Benefits		45,000	50,000	55,000	
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

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

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

Organizational Feasibility

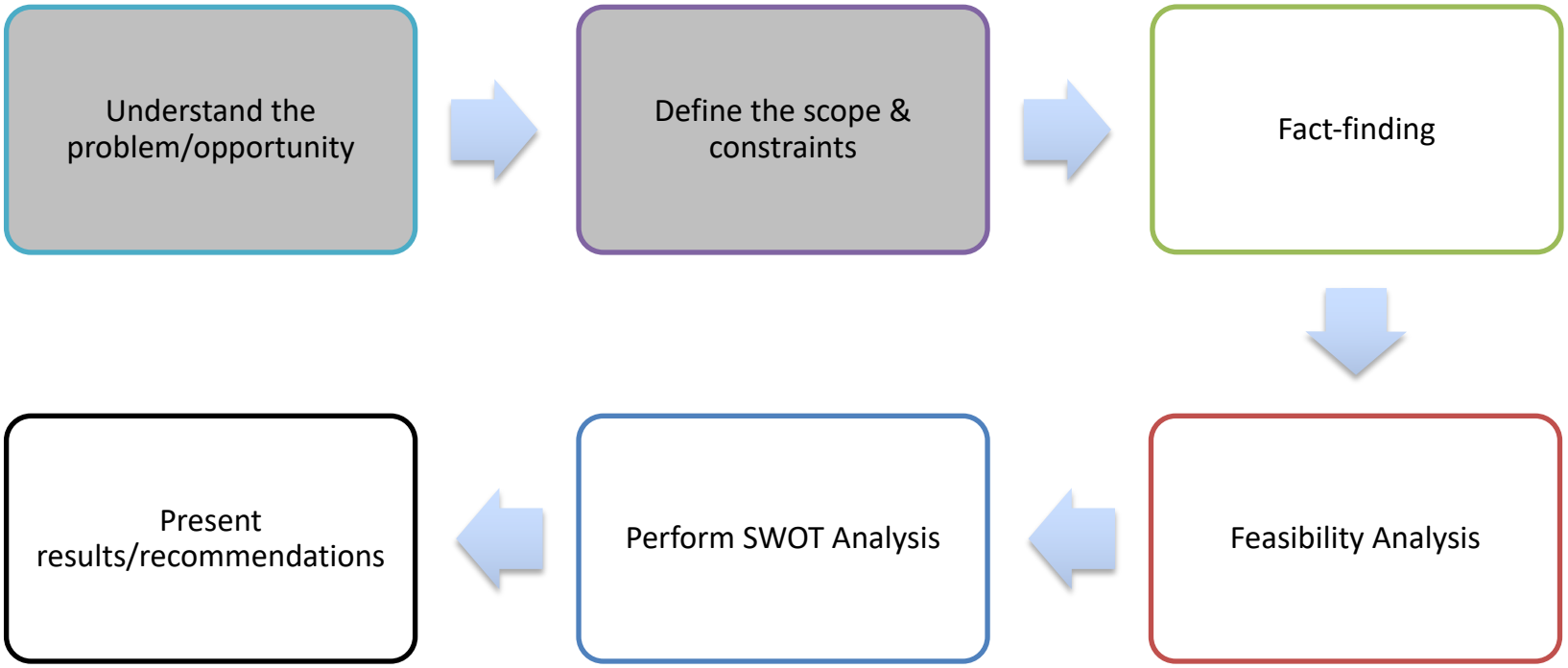
- Organizational feasibility assessment is how well the system ultimately will be accepted by its users and incorporated into the ongoing operations of the organization.
- In essence, an organizational feasibility analysis is to answer the question “If we build it, will they come?”

Schedule Feasibility

- Schedule feasibility assessment is a measure of how reasonable the project timetable is. Usually, projects are initiated with specific deadlines.
- A project will fail if it takes too long to be completed before it is useful.
- Who determines deadlines?
  - Client (user) – Registration period on Quest, Olympic games
  - Developer – estimated deadlines, how accurate?

Preliminary Investigation

- A **preliminary investigation** begins to evaluate the business opportunity or problem.



SWOT Analysis

- SWOT = (Strengths, Weaknesses, Opportunities, and Threats)
- SWOT analysis is a framework for identifying and analyzing the internal and external factors that can have an impact on the viability of a project
  - Strengths - **internal** attributes and resources that support a successful outcome.
  - Weaknesses - **internal** attributes resources that work against a successful outcome.
  - Opportunities - **external** factors the project can capitalize on or use to its advantage.
  - Threats - **external** factors that could jeopardize the project.
- Examples: http://www.marketingteacher.com/lesson-store/#swot-analysis-examples

SWOT Analysis Example

Strengths

Customer-centric design & messaging
Effective calls to action
Useful and relevant content
Intuitive navigation and search
Quick and easy checkout process
Responsive design with full mobile support

Weaknesses

Outdated or ineffective design
Ineffective or concealed calls to action
Content that is not customer-centric
Confusing structure and navigation
Cumbersome and lengthy checkout process
Lack of mobile support

Opportunities

New technologies to improve user experience
Emerging new and untapped markets
New niches and market segments
New design trends to better convey messages
More effective marketing tactics

Threats

Competitors copying features or ideas
Emergence of new competitors
Changing customer needs
New laws or regulations
SPAM & unsolicited advertising
Upgraded browser software
Fraudulent activity

SWOT Analysis: Facebook

Strengths

With the growing use of mobile phones and introduction of Facebook app, a precedent increase is seen in the overall usage has occurred. According to FY2015, Facebook had about 169 million daily account users which is a big number as compared to the previous years. It also captured major markets in US, Brazil and India.

Weaknesses

Facebook generates its revenues only through advertisement and thereby it is one of its weak points. These advertisers allocate a small budget for Facebook advertising and their commitments are also short live

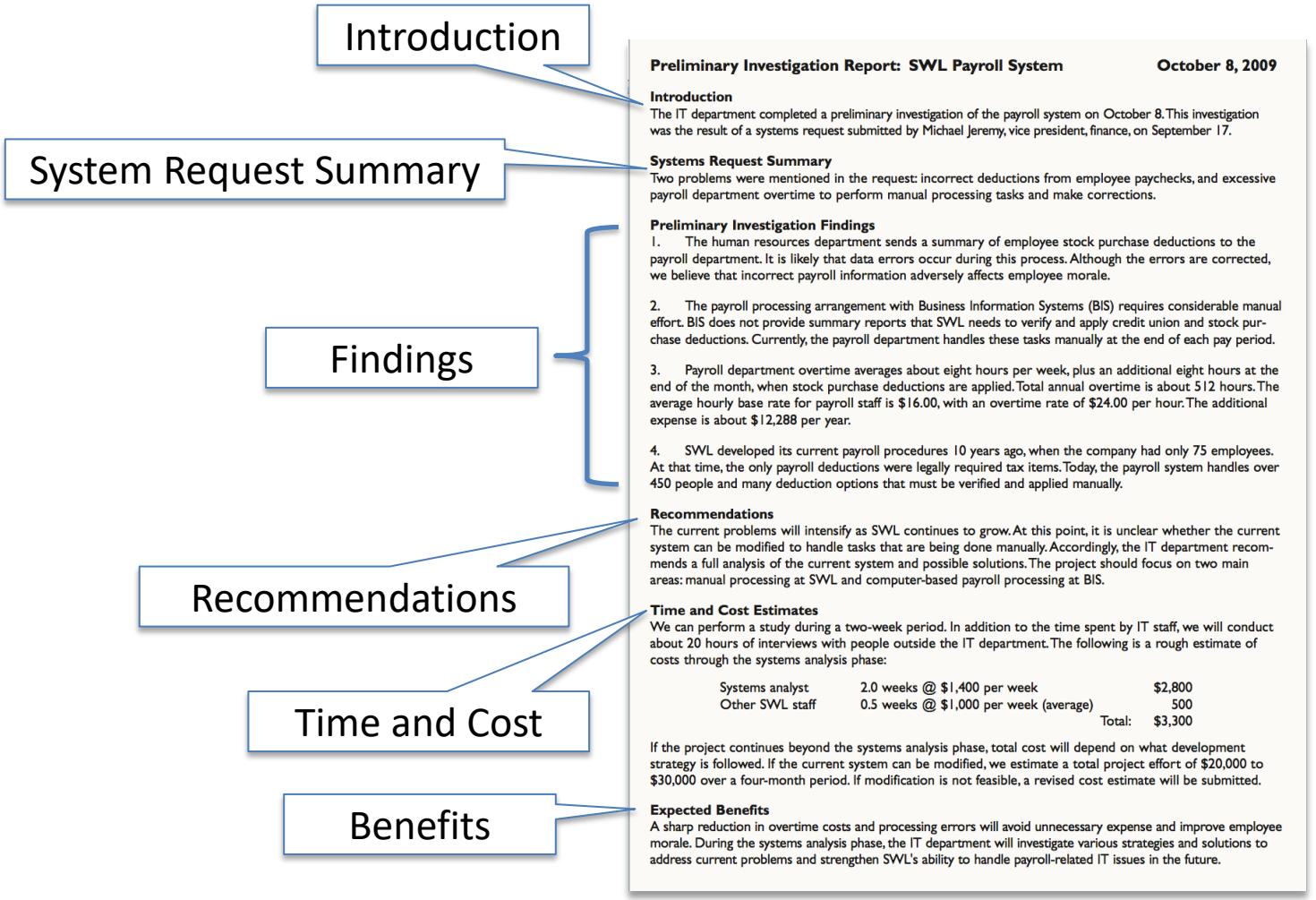
Opportunities

Digital marketing is here to stay in business for a while and Facebook is well positioned to gain maximum profits out of it. It is believed by the industry that about shares of U.S digital display ad market will see an increase of 26.9 % by 2017 and Facebook is expected to gain revenues from it.

Threats

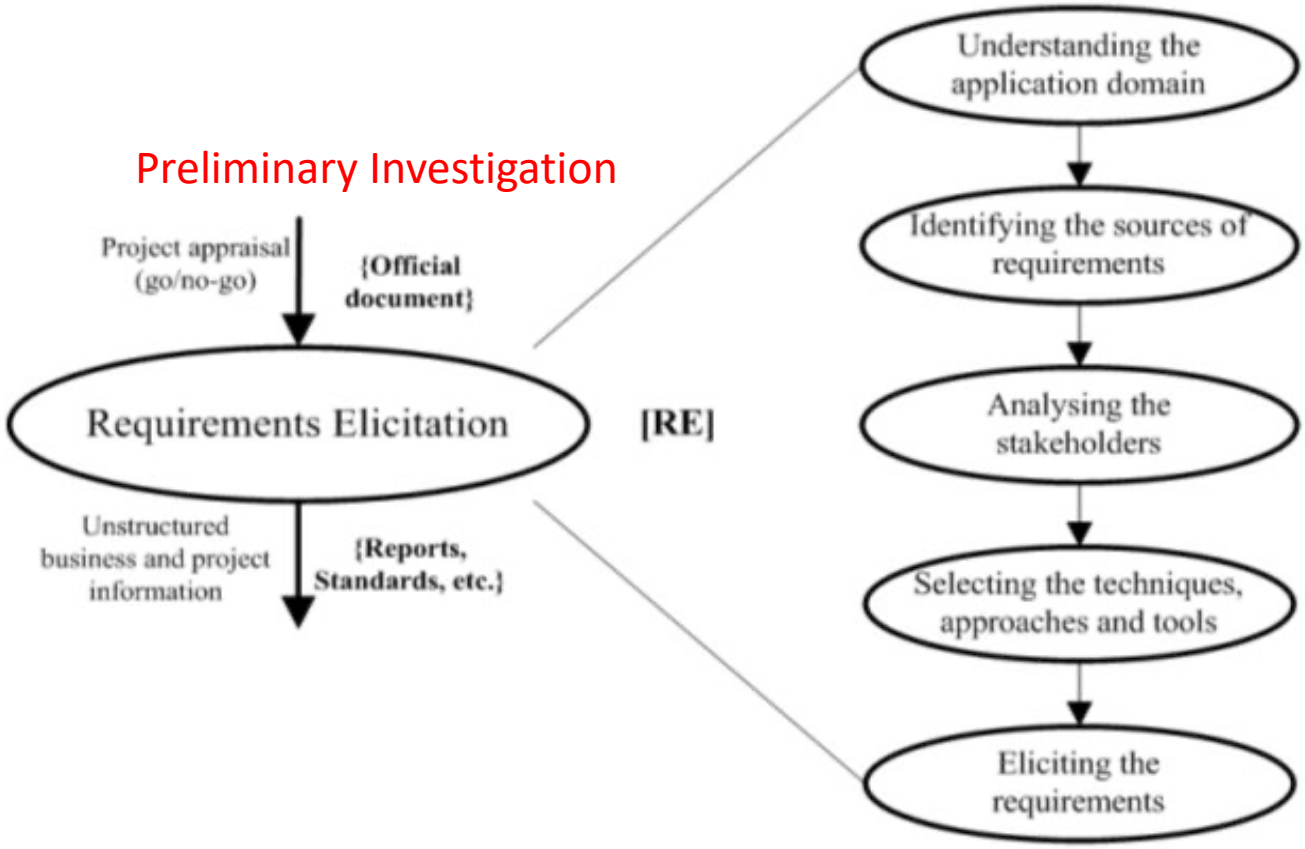
Large number of social sites have developed strong competition with Facebook. These social sites are developing tools to engage the consumers and are successful. Also, there are mobile businesses which can provide audience information like Facebook does and are attracting advertisers too. These apps or mobile businesses are a huge threat for Facebook. Another threats from law making agencies for developing products that do not protect user's privacy.

Preliminary Investigation Report



Requirements Elicitation

Requirements Elicitation



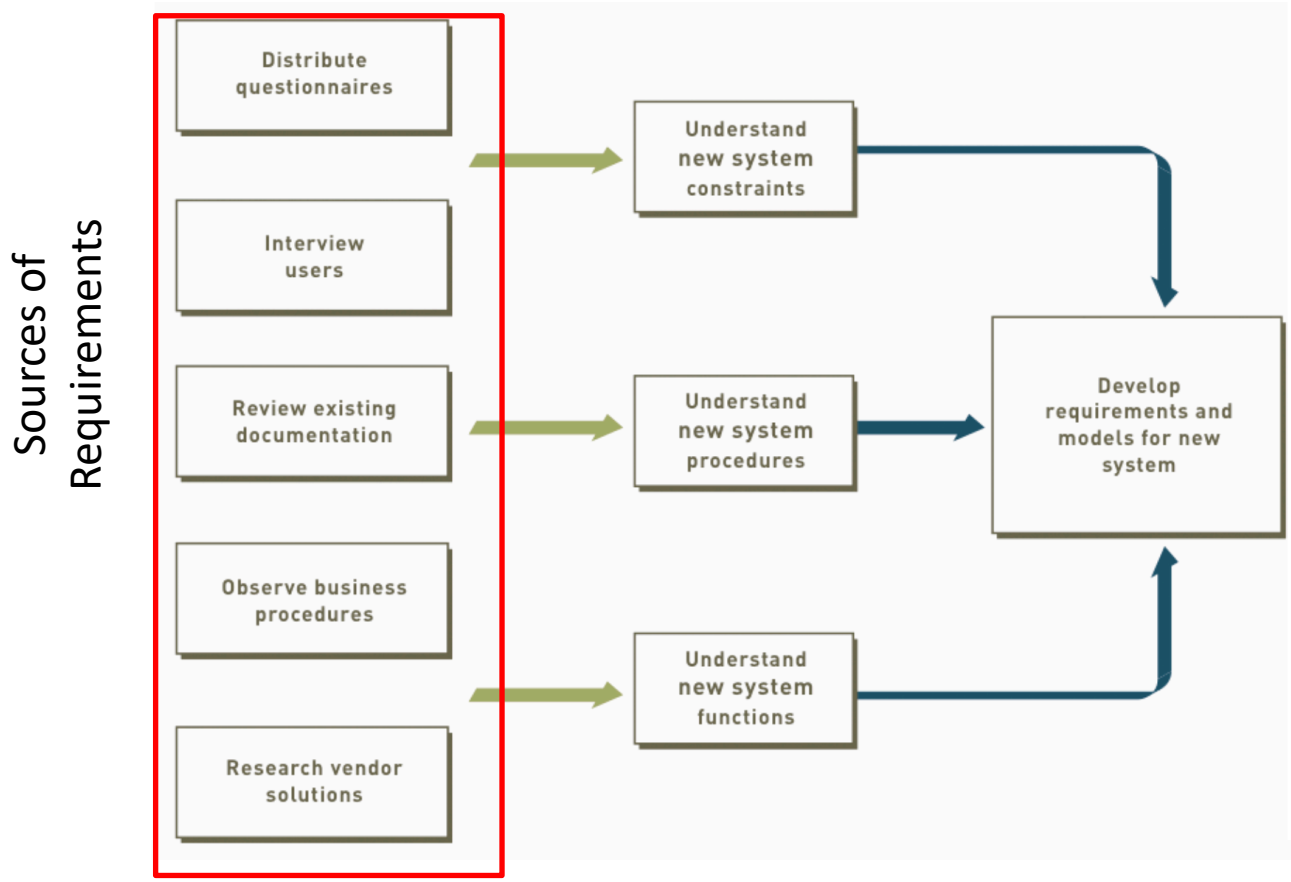
Requirements Elicitation - Objectives

- Understand the *processes, people, and resources* involved
- Determine the *coverage* and *boundary* of the future system (scope)
  - VERY important decision, huge consequences if wrong
- Separate requirements according to *level of priority*

1. Requirement's elicitation: Dimensions

- Requirement's elicitation is not at all straightforward. It is not just a matter of “collecting” requirements—that is, simply writing down the requirements as they are gathered from stakeholders. There are therefore seven dimensions to requirements elicitation
  1. *Understanding the business*
  2. *Understanding the application domain*
  3. *Understanding the specific problem.*
  4. *Understanding the needs and constraints of system stakeholders.*
  5. *Understanding acquisition and project management.*
  6. *Understanding requirements engineering and systems engineering*
  7. *Understanding the technologies and engineering involved.*

2. Sources of Requirements



- Source: Systems Analysis and Design in a Changing World, 6th Edition

2. Source of requirements

- **Discussions with all classes of stakeholders** in order to elicit their requirements based on their individual perspectives of the process.
- **Competitive analysis** of any competing systems already in the marketplace.
- **Policy and Procedure Manuals** for the business and process at hand so that all system interactions, regulatory constraints and so on can be identified.
- **The marketing and customer care departments** should not be overlooked. It is likely that they have data that can be extracted from **customer surveys** and **questionnaires**.
- For **legacy systems**, the following should also be considered: System Manuals, Specifications, Issue Logs, and Enhancement Requests.

3. Rationale for Stakeholder Analysis

Identify who **needs to participate (primary & secondary)**

Assess how stakeholders **be affected or might affect** (+ve/-ve)

Identify **the multiple interests** and **objectives** of stakeholders in relation to the particular project management

Understand the actual **resources, influence, authority or power** that stakeholders can have on particular project initiatives

Assess the most **appropriate means** for them to **participate**

Assess the **capacity** of stakeholders to **participate** in the planning process

Begin to understand potential **conflicts** that could arise in the project

Steps in Stakeholder Analysis

Steps in Stakeholder Analysis	Possible Questions & Tools
1. Identify stakeholders	-Who are primary, secondary, and has interest in the issue? -*Tool*: *Stakeholder rings*
2.Investigate characteristics of stakeholder	-What are the interest, 4 RS (Rights, Responsibilities, Returns, and Relationship) -*Tools*: *Stakeholder power and interests grid, and 4R matrix, Venn-Diagram , and Matrix of conflict & trade-off*
3. Identify power and influence of stakeholders	-What are the power and influence of each stakeholder - *Tools: Graph of stakeholders importance and influence*

1.Identifying Stakeholders

- People with interest in successful system implementation
- Three primary groups of stakeholders
  - Users (use system)
  - Clients (pay for and own system
  - Technical staff (ensure system operation)
- Every type of stakeholder is identified by systems analyst

Stakeholders Ring

- Stakeholders that hold a direct interest in a business or organization and its dealings are known as primary stakeholders. These stakeholders usually invest their financial capital directly into the business.
- Examples: Employees, customers, suppliers, vendors and business partners.

- Stakeholders that do not hold direct interests in a business but can have a reasonable influence over a business's dealings are known as secondary stakeholders. An organization does not directly depend upon these stakeholders for survival of its immediate interests.
- Examples: Business competitors, trade unions, media groups, pressure groups and state or local government organizations are some examples of secondary stakeholders

Identifying Stakeholders

- The table below identifies some of the people who might be stakeholders in your job or in your projects:

Your boss	Shareholders	Government
Senior executives	Alliance partners	Trades associations
Your co-workers	Suppliers	The press
Your team	Lenders	Interest groups
Customers	Analysts	The public
Prospective customers	Future recruits	The community
Your family	Key contributors	Key advisors

Stakeholder Register

- A stakeholder register is a **document** which contains the information about the project's stakeholders.
- It identifies the **people**, **groups** and **organizations** that have any kind of interest in your project.
- A stakeholder register includes basic information on stakeholders:
  - Identification information: The stakeholders' names, positions, locations, roles in the project, and contact information
  - Assessment information: The stakeholders' major requirements and expectations, potential influences, and phases of the project in which stakeholders have the most interest.

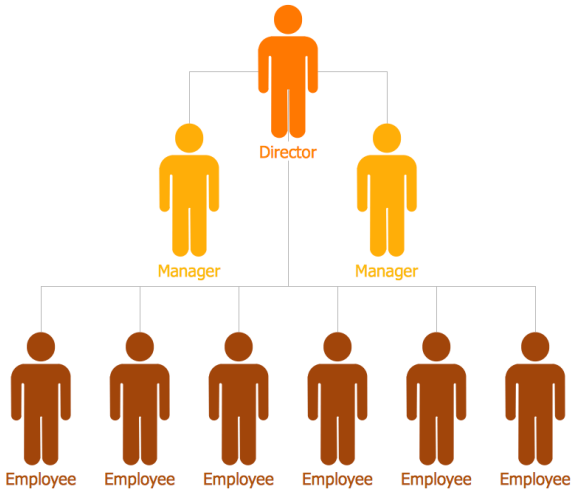
Sample Stakeholder Register

Name	Position	Internal/ External	Project Role	Contact Information
Stephen	VP of Operations	Internal	Project sponsor	stephen@globaloil.com
Betsy	CFO	Internal	Senior manager, approves funds	betsy@globaloil.com
Chien	CIO	Internal	Senior manager, PM's boss	chien@globaloil.com
Ryan	IT analyst	Internal	Team member	ryan@globaloil.com
Lori	Director, Accounting	Internal	Senior manager	lori@globaloil.com
Sanjay	Director, Refineries	Internal	Senior manager of largest refinery	sanjay@globaloil.com
Debra	Consultant	External	Project manager	debra@gmail.com
Suppliers	Suppliers	External	Supply software	suppliers@gmail.com

Stakeholders Classification

Stakeholder classification: Is the stakeholder internal or external to the organization? Is the stakeholder a supporter of the project or resistant to it?

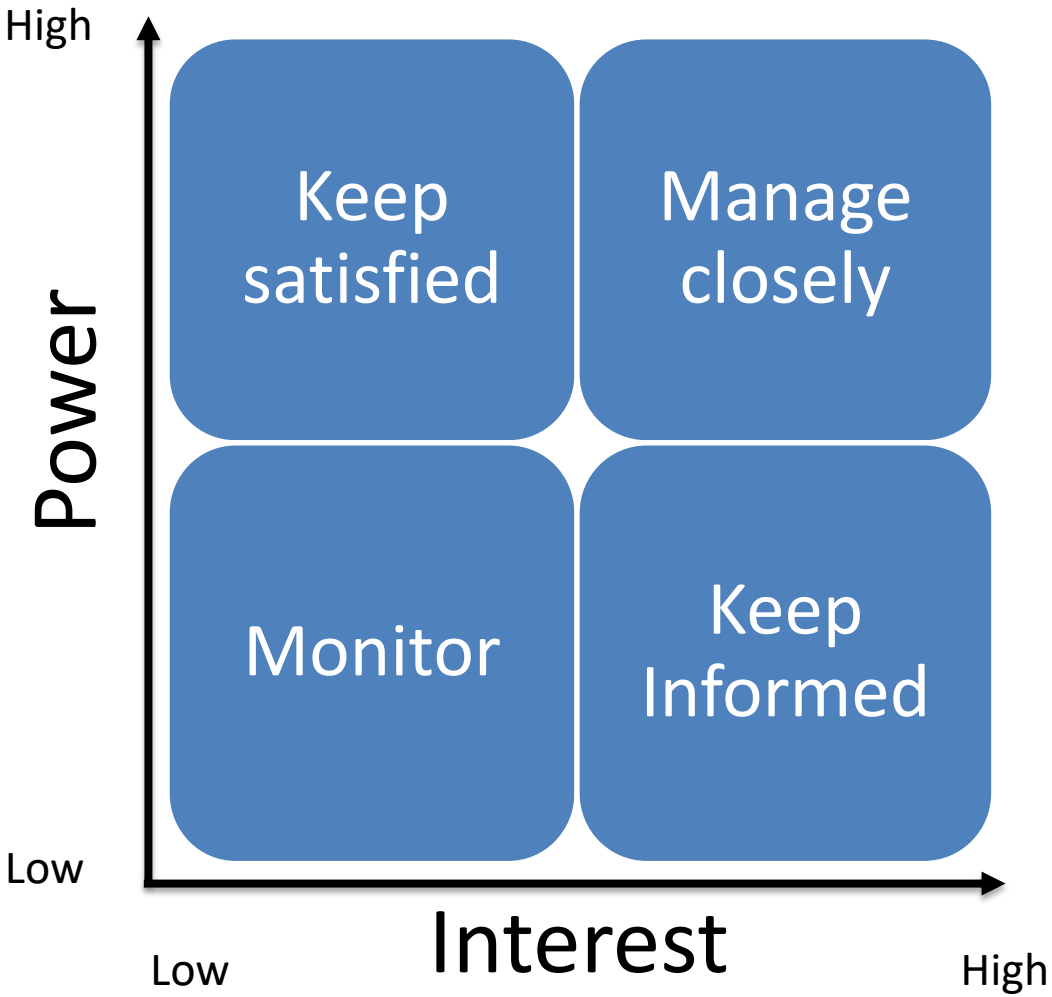
	Role
Champion	A champion: • Initiates the project • Promotes the project • Allocates his or her time to the project • Provides resources
Organizational Management	Organizational managers: • Know about the project • Budget enough money for the project • Encourage users to accept and use the system
System Users	Users: • Make decisions that influence the project • Perform hands-on activities for the project • Ultimately determine whether the project is successful by using or not using the system

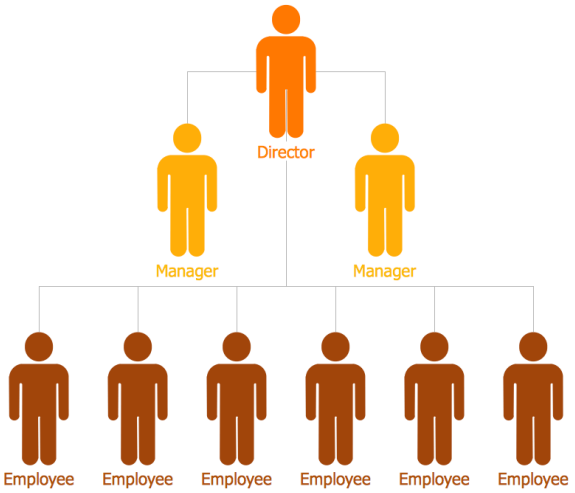


2. Prioritize Your Stakeholders

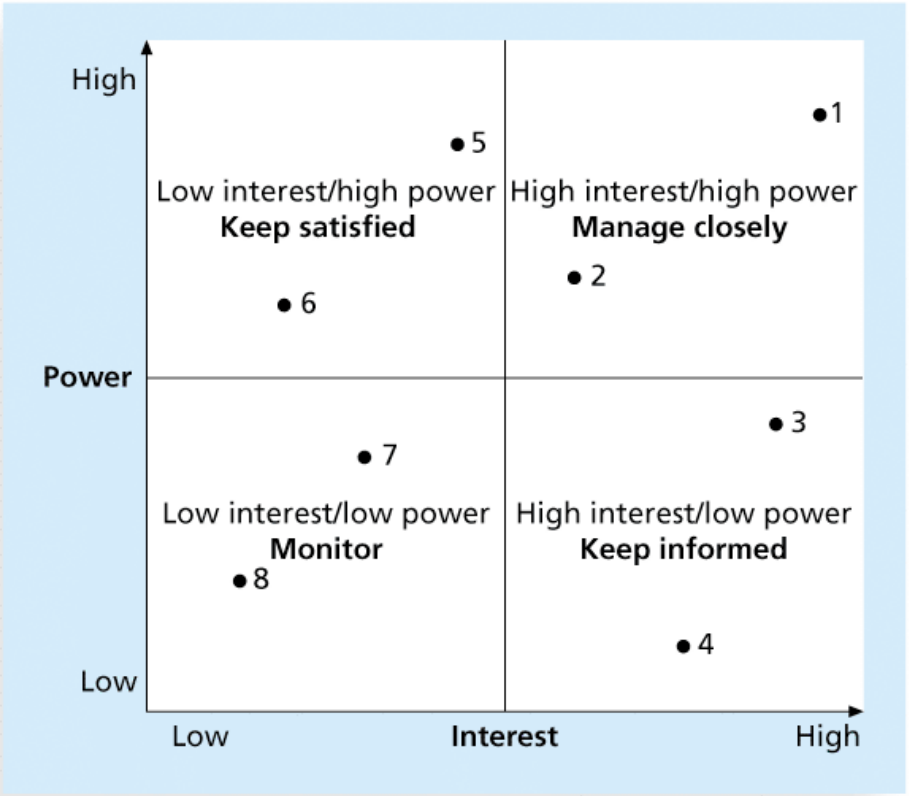
- After identifying key project stakeholders, you can use different classification models to determine an approach for managing stakeholder relationships
- A **power/interest grid** can be used to group stakeholders based on their level of authority (power) and their level of concern (interest) for project outcomes

2. Power/Interest Grid





Power/Interest Grid



Power/Interest Grid to prioritize stakeholders

Figure 2: Example Power/Interest Grid With Stakeholders Marked

Adapted from Mendelow, A.L. (1981). '**Environmental Scanning - The Impact of the Stakeholder Concept**,' ICIS 1981 Proceedings, 20.

Stakeholder Engagement Levels

- **Unaware:** Unaware of the project and its potential impacts on them
- **Resistant:** Aware of the project yet resistant to change
- **Neutral:** Aware of the project yet neither supportive nor resistant
- **Supportive:** Aware of the project and supportive of change
- **Leading:** Aware of the project

Name	Power/ Interest	Current Engagement	Potential Management Strategies
Stephen	High/high	Leading	Stephen can seem intimidating due to his physical stature and deep voice, but he has a great personality and sense of humor. He previously led a similar refinery upgrade program at another company and knows what he wants. Manage closely and ask for his advice as needed. He likes short, frequent updates in person.
Chien	High/ medium	Resistant	Chien is a very organized yet hardheaded man. He has been pushing corporate IT standards, and the system the PM and sponsor (Debra and Stephen) like best goes against those standards, even though it's the best solution for this project and the company as a whole. Need to convince him that this is okay and that people still respect his work and position.
Ryan	Medium/ high	Supportive	Ryan has been with the company for several years and is well respected, but he feels threatened by Debra. He also resents her getting paid more than he does. He wants to please his boss, Chien, first and foremost. Need to convince him that the suggested solution is in everyone's best interest.
Betsy	High/low	Neutral	Very professional, logical person. Gets along well with Chien. She has supported Debra in approving past projects with strong business cases. Provide detailed financial justification for the suggested solution to keep her satisfied. Also ask her to talk to Chien on Debra's behalf.

Planning Stakeholder Management

- After identifying and analyzing stakeholders, project teams should develop a plan for management them
- The stakeholder management plan can include:
  - Current and desired engagement levels
  - Interrelationships between stakeholders
  - Communication requirements
  - Potential management strategies for each stakeholder
  - Methods for updating the stakeholder management plan

Techniques for Requirement Elicitation

- ***Observation***
  - Observe users at work
  - Obtain subtle information not told by customer
  - Job Protocol Analysis
  - Social analysis
- ***Interviewing***
  - Requires skill, preparation, listening
  - Ask specific details: boundaries, exceptions, anticipated changes
  - Ask vision of future
  - Ask alternatives
  - Ask minimally acceptable solution
  - Ask other sources of information
- ***Brainstorming*** : Moderated meeting with trigger questions
- ***Prototyping*** : To stimulate reaction by user.
- **Questionaries:** Conduct Full list of questions
- **Scenarios:** collect and document all Scenarios
- **Use-cases:** Also required for requirements analysis

Elicitations Problems

- Inadequate time allotted
- Inadequate preparation
- Inadequate user representation
- Different Vocabularies
  - Developers and users speak different languages
- Political Factor
- Ambiguity of natural language
- Requirement changes during the process
- Inability of stakeholders to articulate requirements
- Lack of Cooperation
  - Lack of stakeholder's commitment or buy-in
- Conflicting stakeholders' requirements
- Unrealistic requirements

NEXT WEEK

- Techniques for Requirement Elicitation