- SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

UNIT III - Software Project Management

Project Management Principles, Process and Project Metrics, Function Point analysis, LOC, Make/Buy Decision, COCOMO II -Project Planning, SWOT analysis, Functions of manager, Team building & development, Risk Management.

MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

Project Management

Software Project Management

- Concerned with activities involved in ensuring that software is delivered
  - on time
  - within the budget
  - in accordance with the requirements
- Project management is needed because software development is always subject to budget, requirement and schedule constraints that are set by the development organisation or the customer

MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

Project Management

- Organising, planning and scheduling software projects
- Objectives
  - To introduce software project management and to describe its distinctive characteristics
  - To discuss project planning and the planning process
  - To show how graphical schedule representations are used by project management
  - To discuss the notion of risks and the risk management process

Management Activities

- Proposal writing
- Project planning and scheduling
- Project costing
- Project monitoring and reviews
- Personnel selection and evaluation
- Report writing and presentations

Failed Projects : **Airbus A380**

- Building the Airbus A380—the world's largest commercial aircraft at the time—required production facilities from across the globe to build individual parts of the aeroplane.
- All teams used different computer-aided design (CAD) programs.
- During installation, they discovered the parts designed by different teams didn't fit together.
- This cost the company $6 billion to put right and set the project back two years.

Failed Projects : **Ford Edsel**

- Ford did extensive market research before it released the Edsel.
- They spent 10 years and $250 million on research and planning—but by the time all this was completed, and the car was unveiled in 1957, Ford had missed its chance.
- The market had already moved on to buying compact cars, which didn't include the Edsel.

Failed Project: Ariane 5 Disaster

- On June 4th, 1996, the very first Ariane 5 rocket ignited its engines and began speeding away from the coast of French Guiana.
- 37 seconds later, the rocket flipped 90 degrees in the wrong direction, and less than two seconds later, aerodynamic forces ripped the boosters apart from the main stage at a height of 4km.
- This caused the self-destruct mechanism to trigger, and the spacecraft was consumed in a gigantic fireball of liquid hydrogen.

Failed Project: Ariane 5 Disaster

- The fault was a software bug in the rocket's Inertial Reference System. This system is used to determine whether it was pointing up or down, which is formally known as the horizontal bias.
- This value was represented by a 64-bit floating variable, which was perfectly adequate.
- However, when the software attempted to stuff this 64-bit variable, which can represent billions of potential values, into a 16-bit integer, which can only represent 65,535 potential values.
- For the first few seconds of flight, the rocket's acceleration was low, so the conversion between these two values was successful.
- However, as the rocket's velocity increased, the 64-bit variable exceeded 65k, and became too large to fit in a 16-bit variable.

A German pro basketball team was Failed Project : Relegated to a lower division due to a Windows update

In 2015, the Paderborn Baskets, a second division German basketball team, was relegated to a lower division for starting a game late, due to a necessary 17-minute Windows update to the scoreboard's laptop.

The game between the Chemnitz Niners and the Paderborn Baskets was set to begin as normal, when Paderborn connected its laptop to the scoreboard. According to Paderborn Baskets general manager Patrick Seidel, as reported in the Die Zeit journal, the laptop was connected by 6:00 p.m. (meaning 1 hour and 30 minutes before the game), and was set "as usual." However, according to Seidel, "As both teams warmed up, the computer crashed. When we booted it again by 7:20 p.m., it started downloading updates automatically." When the computer finished downloading and installing all the updates, the game finally began at 7:55 p.m.

Paderborn won the game 69 to 62.

As a result, Paderborn lost a point as a penalty and found itself relegated from the ProA to the ProB division

A $2 billion air traffic control System Failed due to insufficient computer memory

On April 30, 2014, hundreds of LAX flights were delayed or canceled because all computers in the airport crashed due to a bug in the En Route Automation Modernization (ERAM) system.

The system failure was sparked due to a U-2 spy plane that was flying through the region.

The $2.4 billion system, made by Lockheed Martin Corp, cycled off and on trying to fix the error, which was due to a lack of altitude information in the airplane's flight plan.

After an air traffic controller entered an estimated altitude of the plane, the system calculated all possible flight paths to ensure that it was not on a crash course with other planes.

However, that process caused the system to fall short in memory and shut down every other flight processing function. Fortunately, no injuries or accidents were reported.

The ERAM system failed because it limits how much data each plane can send. Most planes have simple flight plans, so they do not exceed that limit. However, the U-2 operating that day had a complex flight plan that brought it close to the system's limit.

MIT-WPU

।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

Project Management Principles

5 Project Management Principles

1. Address important questions at the beginning of the project
2. Sketch out a scope and goals for your project
3. Communicate roles, expectations, and objectives to the team
4. Monitor progress and identify roadblocks
5. Make sure all deliverables have been met and finalize the project

Project Management Principles

Address important questions at the beginning of the project	• Should this project happen and how will it help the company? • Can the company benefit from this project at this time? • What problem is this project solving?
Sketch out a scope and goals for your project	• What is this project's main goal and deliverables needed to reach that goal? • What risks exist for this project, and how can you avoid them? • What is the scope of this project and how will you manage expanding priorities and changing workloads if they happen mid-project
Communicate roles, expectations, and objectives to the team	• The progress you've made along the project timeline • The goals and advantages of the project • The project's roadblocks and successes
Monitor progress and identify roadblocks	• Do all team members understand the expectations and is the project on time? • What roadblocks exist? How can you remove them for your team? • Are you communicating and staying organized? • Does the project need to be redirected from its original scope?
Make sure all deliverables have been met and finalize the project	• Have all deliverables been met? • Were all deliverables carried out to a standard of quality the team is proud of? • What did your team do well? • How could a project like this function better next time?

People in the Project

- Projects don’t get done by themselves. We need people to carry them out.
- This is where project managers and project management team come into the picture. When we look at the project management life-cycle, there are many people and groups involved.
- A project manager is a person who is responsible for leading the project. In other words, project managers are the spearheads of a project.
- A project team is a group of individuals teamed together. Their purpose is to achieve a specific business task or goal.

MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

Software Process & Project Metrics

Software process and **project metrics** are quantitative measures that enable **software** engineers to gain insight into the efficiency of the **software process** and the **projects** conducted using the **process** framework. In **software project** management, we are primarily concerned with productivity and quality **metrics**.

Software Measures: Lines of Code , Function Point

Software Metrics

Metrics is a quantitative measure of the degree to which a system, component or a process possesses a given attribute.

Software Metrics refers to a broad range of measurements for computer software.

Project Metrics :relate to **Project** Quality. They are used to quantify defects, cost, schedule, productivity and estimation of various **project** resources and deliverables.

Process and Project Metrics [1]

a) Process Metrics

These are metrics that pertain to Process Quality. They are used to measure the efficiency and effectiveness of various processes.

b) Project Metrics

These are metrics that pertain to Project Quality. They are used to quantify defects, cost, schedule, productivity and estimation of various project resources and deliverables.

Software Measurement

Measurement can be applied to the software process with the intent of improving it on a continuous basis.

Measurement can be used throughout a software project to assist in estimation, quality control, productivity assessment and project control.

Software Measurement

a) Direct Measures- cost and efforts applied i.e.
    i. Line of Code -LOC ,
    ii. Function Point -FP,
    iii. execution speed,
    iv. memory size,
    v. defect reported.

b) Indirect Measures- quality, complexity, efficiency, reliability, maintainability.

Direct Measurement : Function Point (FP)

- A function point calculates software size with the help of logical design and performance of functions as per user requirements.
- It also helps in determining the business functionality of a software application.
- It is derived from a software's requirements and can be estimated in the early phases of software development, before the actual lines of code can be determined.
- The number of function points in a code depends on function complexity.
- Measure software development and maintenance independently of technology used for implementation

Direct Measurement : Function Point (FP)

- Since Function Points measures systems from a functional perspective they are independent of technology.
- Regardless of language, development method, or hardware platform used, the number of function points for a system will remain constant.
- The only variable is the amount of effort needed to deliver a given set of function points.

Five Components of Function Point

A. Data Function
- Internal logic files
- External Interface files

B. Transactional Functions
- External Inputs
- External Output
- External Inquires


New Customer
Customer
Contact
Alt. Contact
Bill to
Phone
Fax
Alt. Phone
Ship to
Type
OK
Cancel
Next

Components of Function Point – Data Points

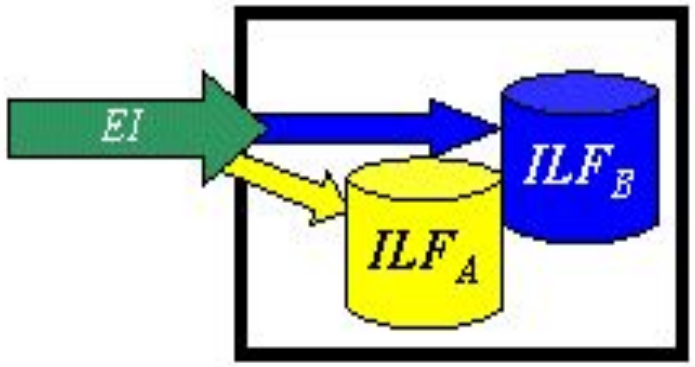
ILF

Internal Logical Files (ILF's) - a user identifiable group of logically related data that resides entirely within the applications boundary and is maintained through external inputs.

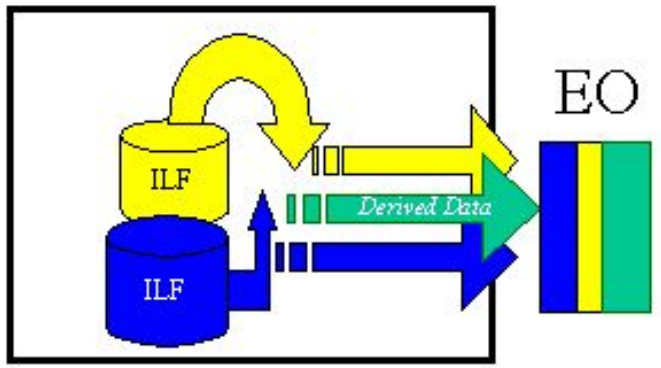
EIF

External Interface Files (EIF's) - a user identifiable group of logically related data that is used for reference purposes only. The data resides entirely outside the application and is maintained by another application. The external interface file is an internal logical file for another application.

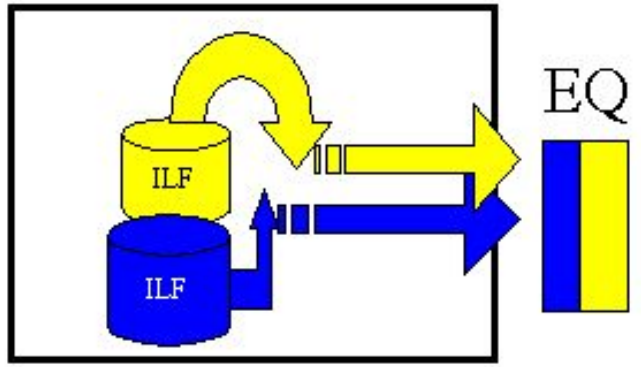
Components of Function Point - Transactions



External Inputs



External Output



External Inquires

After the components have been classified as one of the five major components (EI's, EO's, EQ's, ILF's or EIF's), a ranking of low, average or high is assigned depending on the complexity.

Function Point (FP) Benefits

-Benefits :

- ✔ Function Point Analysis can be used to determine whether a tool, an environment, a language is more productive compared with others
- ✔ increase in productivity and
- ✔ reduction in the risk of inflation of created code.

Direct Measurement: Lines of Code (LOC)

Lines of code/statements (LOC)

- It is a software metric used to measure the size of a computer program by counting the number of **lines** in the text of the program's source **code**
- Studies show correlation between LOC and the overall cost and length of development, and between LOC and number of defects.
- The lower your LOC measurement is, the better it is.

Direct Measurement: Lines of Code (LOC)

Examples of use include:

- productivity KLOC/person-month
- quality faults/KLOC
- cost $$/KLOC
- documentation doc_pages/KLOC

LOC- Example

```
for (i = 0; i < 100; i += 1)
{
printf("hello");
} /* Now how many lines of code is this? */
```

In this example we have:

- 4 Physical Lines of Code (LOC)
- 2 Logical Line of Code (LLOC)
- 1 comment line

LOC- Example

C	COBOL

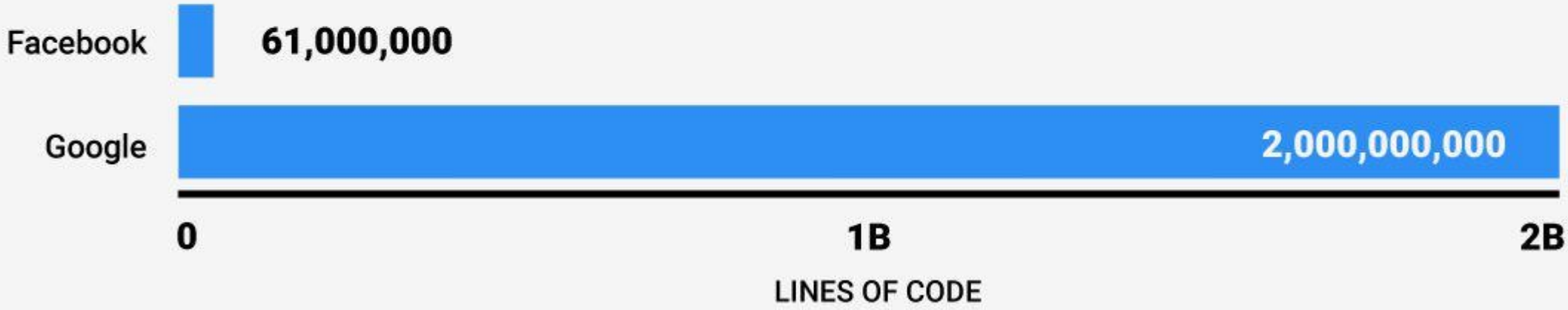
`# include <stdio.h>`
 	
`int main() {`
`  printf("\nHello world\n");`
`}`
	`identification division.`
	`program-id. hello .`
	`procedure division.`
	`display "hello world"`
	`goback .`
	`end program hello .`

Lines of code: 4 (excluding whitespace)	Lines of code: 6 (excluding whitespace)

The range is extraordinary: the average iPhone app has less than 50,000 lines of code, while Google's entire code base is two billion lines for all services.

MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

HOW FACEBOOK'S CODE COMPARES TO ALL OF GOOGLE'S INTERNET SERVICES



Estimation Model

Estimation is the process of finding an estimate, or approximation.
Determines how much money, effort, resources, and time it will take to build a system.

Estimation is based on −

- Past Data/Past Experience
- Available Documents/Knowledge
- Assumptions
- Identified Risks

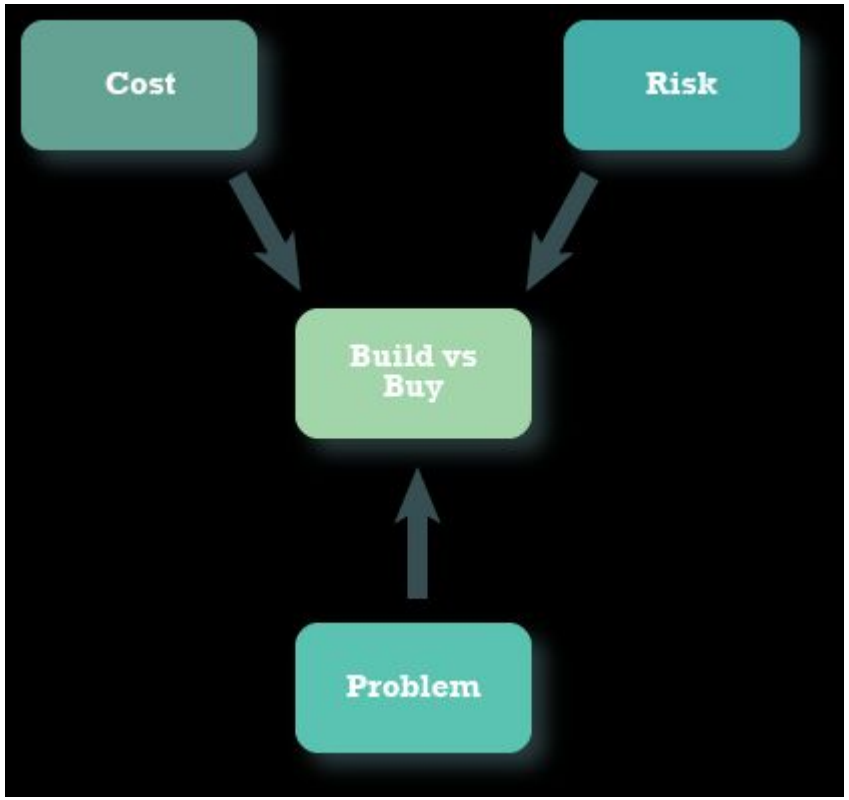
The four basic steps in Software Project Estimation are −

1. Estimate the size of the development product.
2. Estimate the effort in person-months or person-hours.
3. Estimate the schedule in calendar months.
4. Estimate the project cost in agreed currency.

- **Make/Buy Decision**
- **COCOMO II**

Make-or-Buy Decision

A make-or-buy decision is the act of choosing between manufacturing a product in-house or purchasing it from an external supplier.



Build to Compete. Buy to Standardize.

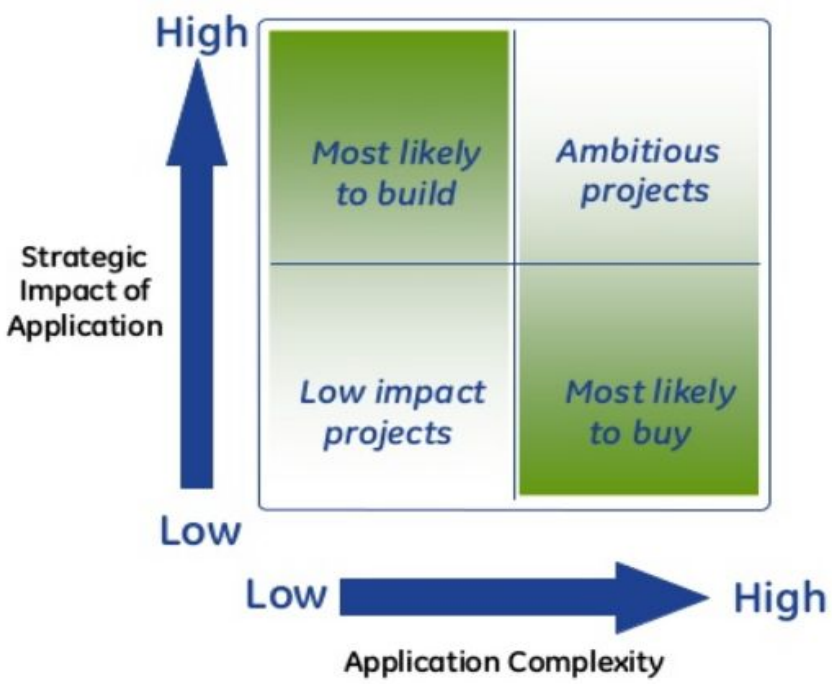
Make-or-Buy Decision

Options:

1. software may be purchased (or licensed) off-the shelf
2. “fully-experience” or “partially experience” software components may be acquired and then modified and integrated to meet specific needs.
3. software may be custom built by an outside contractor to meet the purchaser’s specification.

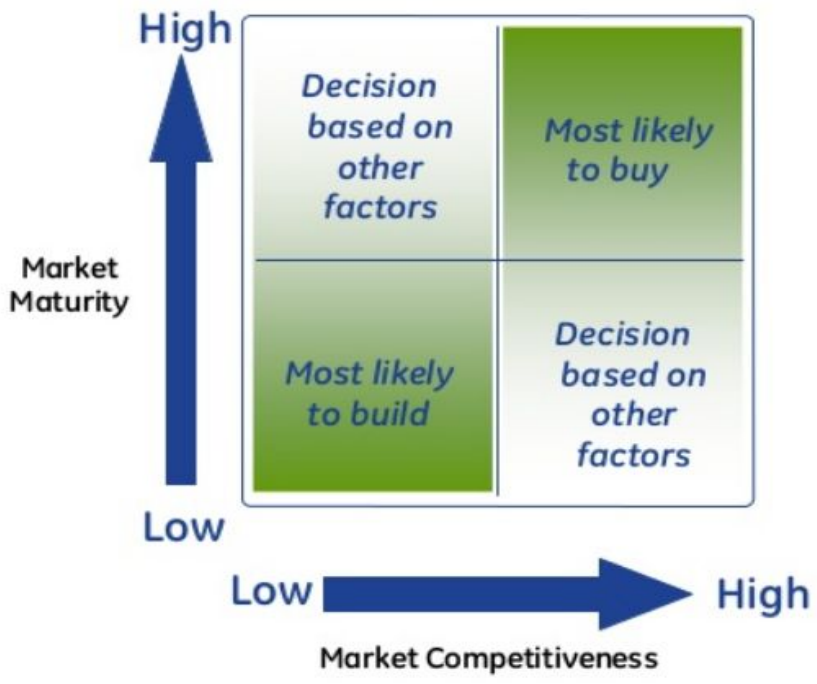
Make-or-Buy Decision : Strategic Considerations

Project Impact vs. Complexity



Application complexity is a factor in the decision, as IT organizations are more unlikely to build highly complex applications. However, several financial services firms build wealth-management software in-house, few organizations develop proprietary Enterprise Resource Planning (ERP) Systems.

Market Maturity vs. Competitiveness



Mature markets are more likely to offer sufficient, industry-specific functionality than newer less mature markets.
Competitive markets are more likely to offer low software pricing than markets dominated by vendors.

MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

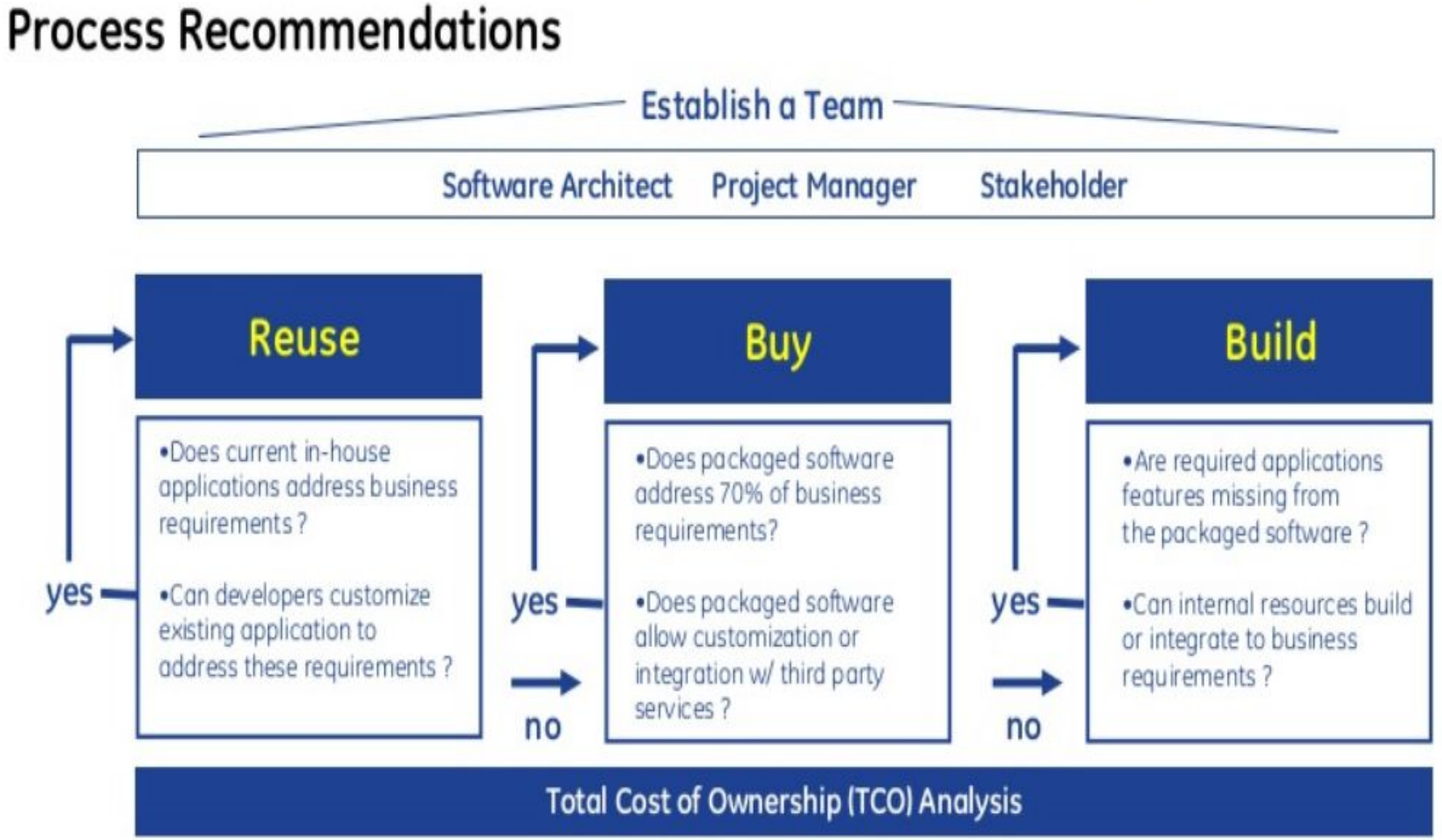
Make-or-Buy Decision : Evaluating Cost of Ownership

A simple method of evaluating the Total Cost of Ownership is to align Lifecycle Milestones side-by-side.

Where: TCO = Capital Costs (one-time) + Operating Costs (annual)

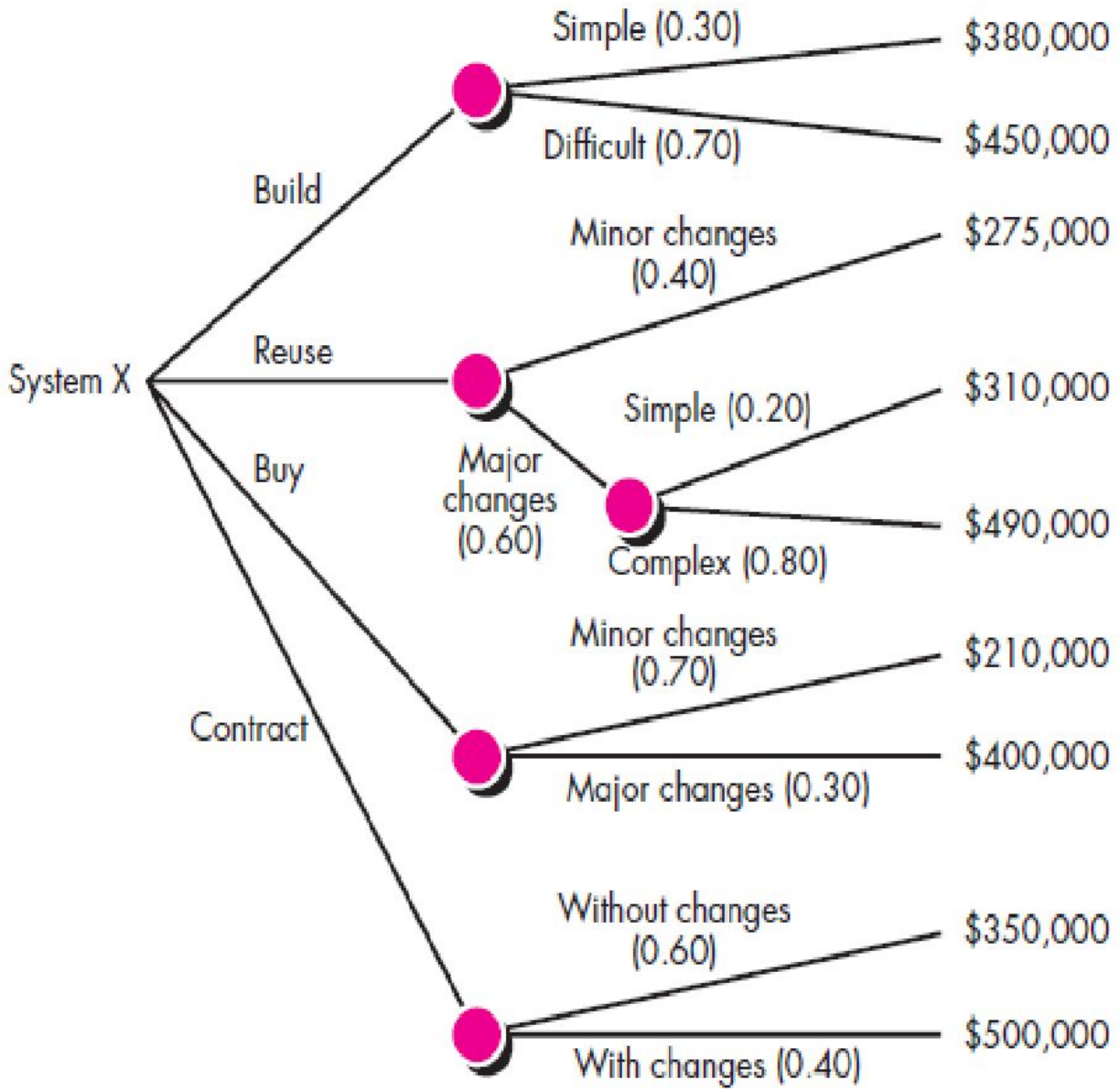
Build Cost Factors	Cost($)	Buy Cost Factors	Cost($)
Software Development Resources	$ -	Software Licensing	$ -
Software Quality Control & Testing	$ -	Software Implementation & Integration	$ -
Software Configuration & Deployment	$ -	Application Customization	$ -
End-User Training	$ -	End-User Training	$ -
Ongoing Maintenance & Enhancements (RTS)	$ -	Ongoing Maintenance & Support Fees	$ -
Software End of Life	$ -	Software End of Life	$ -

Make-or-Buy Decision : Process

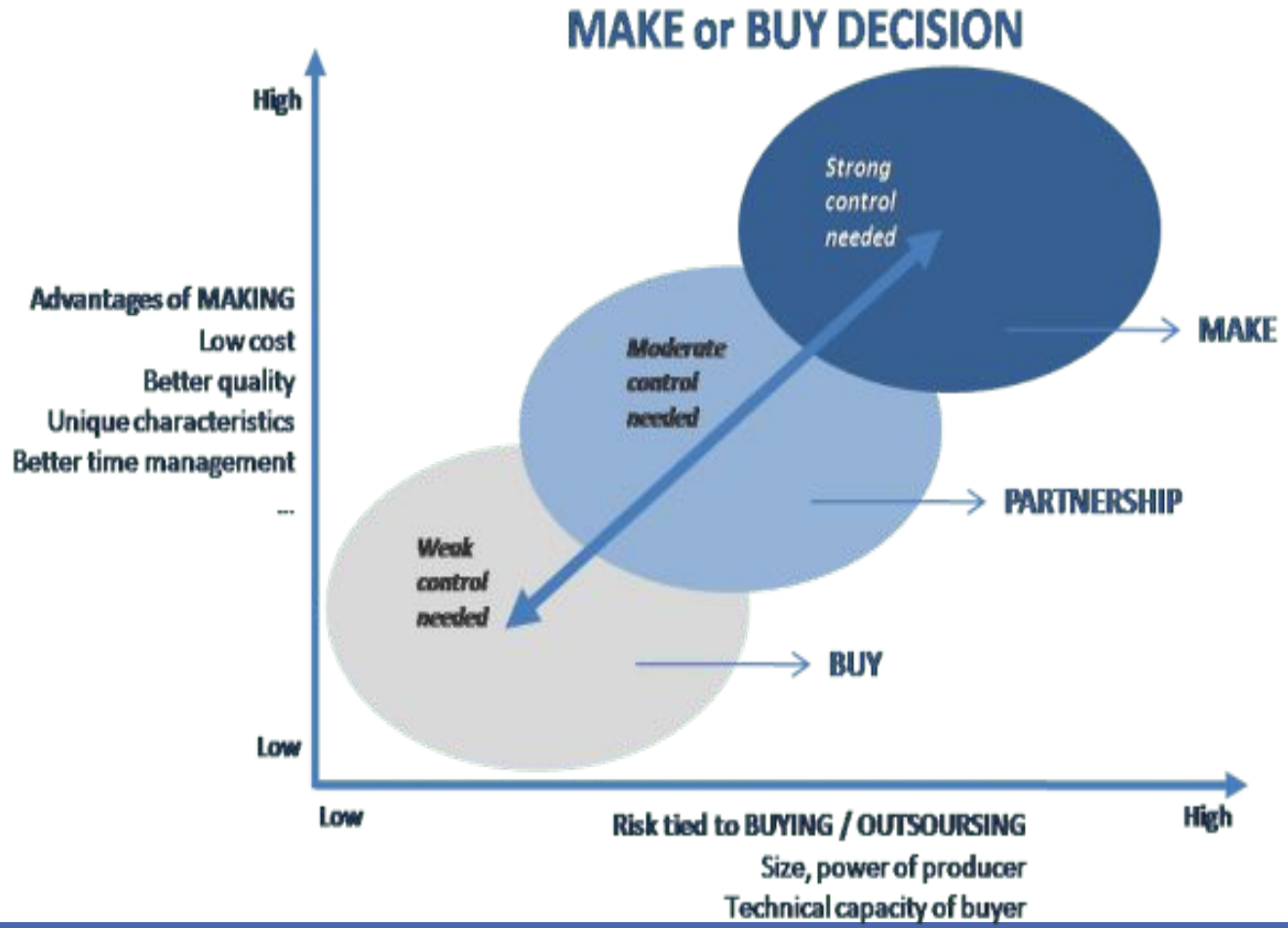


Creating a Decision Tree

1. Built system X from scratch.
2. reuse existing partial-experience components to contract the system.
3. Buy an available software product and modify it to meet local needs.
4. Contract the software development to an outside vendor.



Make-or-Buy Decision



MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

COCOMO II - Constructive Cost **Model**

COCOMO - Project Planning

The Constructive Cost **Model** (**COCOMO**) is a procedural software cost estimation **model** developed by Barry W. Boehm.

COCOMO-II by Barry Boehm

Has three types of model:-

Application Composition Model- Used during the early stages of software engineering.

Early design stage Model- Used once requirements have been stabilized and basic software architecture has been established .

Post-architecture stage Model –Used during the construction of the software.

The sizing information followed by this model is the direct software measure **'object points'.**

COCOMO II - Project Planning

- Object Point is computed using counts of the number of
  - Screens (at the user interface)
  - Reports
  - Components likely to be printed to build the application.
- Each object instance (e.g. a screen or report) is classified into one of three complexity levels (i.e. simple , medium, difficult)
- In essence, complexity is a function of
  - Number and source of the client and server data tables that are required to generate the screen or report.
  - Number of views or sections presented as part of the screen or report.

COCOMO II - Project Planning

Once complexity is determined, the number of screens reports, components are weighted according to following table:

Object type	Complexity weight		
	Simple	Medium	Difficult
Screen	1	2	3
Report	2	5	8
3GL component			10

COCOMO II - Project Planning

- The object point count is then determined by multiplying the original number of object instances by the weighting factor in the figure and summing to obtain a total object point count.
- When components based development or general software reuse is to be applied, the percent of reuse (% reuse) is estimated and the object point count is adjusted:

NOP= (object points) * [(100-%reuse)/100]

Where New Object Points NOP is defined as new object points.

COCOMO II - Project Planning

- Now the estimate of project effort is computed as follows:

Estimated effort= NOP/PROD

Productivity rate (PROD) can be derived from following table based on developer experience and organization maturity.

Developer's experience/capability	Very low	Low	Nominal	High	Very high
Environment maturity/capability	Very low	Low	Nominal	High	Very high
PROD	4	7	13	25	50

COCOMO II Example

- Use the COCOMO II model to estimate the effort required to build software for a simple ATM that produces 12 screens, 10 reports, and will require approximately 80% as new software components. Assume average complexity and average developer/environment maturity. Use the application composition model with object points.

COCOMO II Example

- Given

Object	Count	Complexity	Weight Factor	Total Objects
Screen	12	Simple	1	12
Report	10	Simple	2	20
3GL Components	0	NA	NA	0
			Total Objects Points :	32

COCOMO II Example

- It is given that 80% of components have to be newly developed. So remaining 20% can be reused
- Now compute new object points as

NOP = (object points) * [(100 - %reuse)/100]

NOP = 32 * (100-20)/100 = 32*80 / 100

NOP = 25. 6 object points

- Since productivity is given average, we can assume PROD = 13
- Hence , effort = NOP/PROD

effort = 25.6/13

effort = 1.96 person months

MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

COCOMO II Summary

- Size of project can be listed as object points, function points or source lines of code (SLOC)

Example 2 :

For a given IIST airline sales system, at the early stage, we need 3 screens and 1 report:

1. a booking screen to record a new advertising sale booking
2. a pricing screen showing the advertising rate for each day and each flight
3. an availability screen showing which flights are available

1. a sales report showing total sales for the month and year, and comparing them with previous months and years

Consider the developer experience and organization maturity as very low and requires 70% as a new software component.

The booking screen is classified as simple. Similarly, the levels of difficulty of the pricing screen, the availability screen and the sales report are classified as simple, medium and medium respectively. There is no 3GL component.

COCOMO II Example 2

Table 1 Ratings for IIST airline sales system

Objects		Complexity	Weight
Booking Screen	(1)	Simple	1
Pricing Screen	(1)	Simple	1
Availability Screen	(1)	Medium	2
Report	(1)	Medium	5
Total	**9**		

Object type	Complexity weight		
	Simple	Medium	Difficult
Screen	1	2	3
Report	2	5	8
3GL component			10

COCOMO II Example 2

NOP= (object points) * [(100-%reuse)/100]
NOP =9 * (100-30)/100
=9 * 0.7
= 6.3 object points.

Effort= NOP /PROD
= 6.3 / 4
= 1.575

Developer's experience/capability	Very low	Low	Nominal	High	Very high
Environment maturity/capability	Very low	Low	Nominal	High	Very high
PROD	4	7	13	25	50

According to COCOMO II, the project requires approx. 1.57 person-months.

MIT-WPU

।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

SWOT Analysis

MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

SWOT Analysis

Purpose of a **SWOT Analysis**:

The **purpose** is to get managers thinking about everything that could potentially impact the success of a new project.

It is a study undertaken by an organization to identify its internal strengths and weaknesses, as well as its external opportunities and threats.

SWOT Analysis

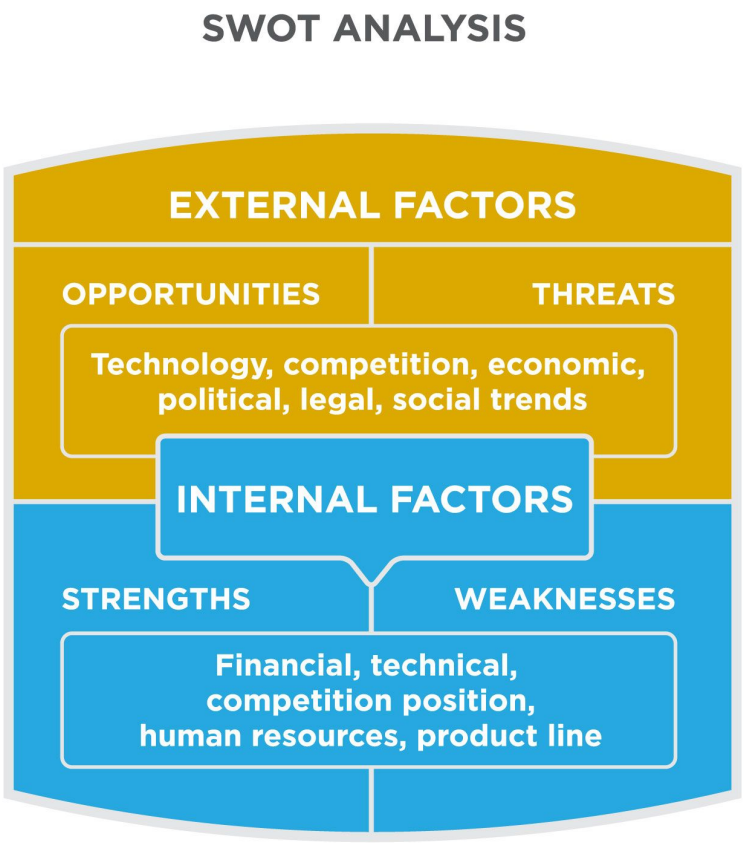
Objectives :

1. To make a summary analysis of external and internal factors.
2. To identify key items for the management of the organization, which involves establishing priorities for action.
3. To prepare strategic options: **risks** and problems to solve.
4. To conduct a sales forecast in agreement with market conditions and study the capabilities of the company in general.

Internal and External Factors

Internal factors — the strengths and weaknesses **internal** to the organization.

External factors — the opportunities and threats presented by the environment **external** to the organization.



SWOT Analysis

Strengths: characteristics of the business or project that give it an advantage over others

Weaknesses: characteristics of the business that place the business or project at a disadvantage relative to others

Opportunities: elements in the environment that the business or project could exploit to its advantage

Threats: elements in the environment that could cause trouble for the business or project

Example of SWOT Analysis

Example of SWOT Analysis

MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

Functions of Manager

Functions of Manager

1. P- Planning
2. O- Organizing
3. S- Staffing
4. D- Directing
5. CO- Controlling
6. R- Reporting
7. B- Budgeting

MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

PLANNING

PLANNING

- Planning means setting an organization’s goal and deciding how best to achieve them.
- Planning is decision making, regarding the goals and setting the future course of action from a set of alternatives to reach them.
- The plan helps to maintain the managerial effectiveness as it works as a guide for the personnel for the future activities.

MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

ORGANISING

ORGANISING

- Is the process of grouping together of men and establishing relationship among them, defining the authority and responsibility of personnel by using the company's other basic resources to reach predetermined goals or objectives.

MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

STAFFING

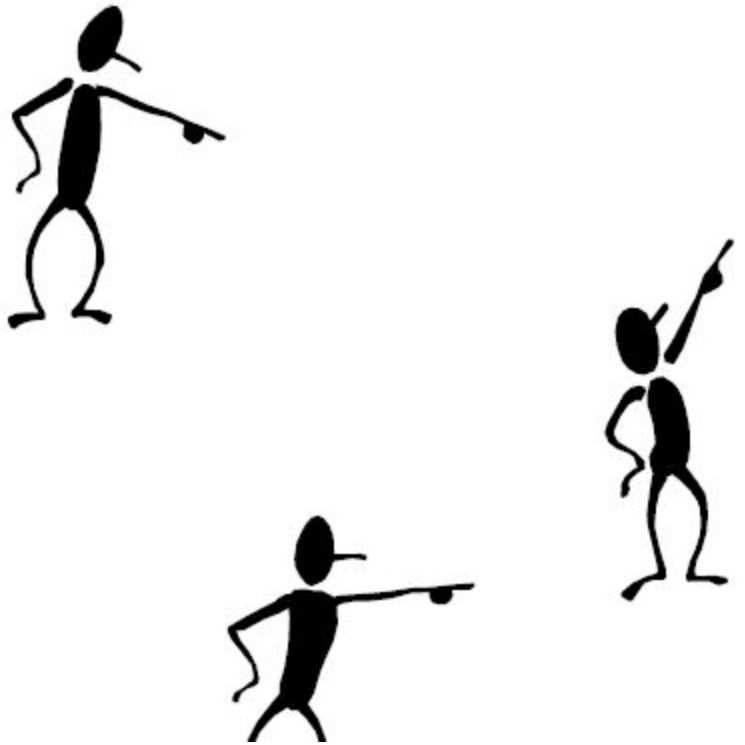
STAFFING

- Filling and keeping filled with qualified people all positions in the nosiness.
- Recruiting, hiring, training, evaluating and compensating are the specific activities included in the function.
- In the family business, staffing includes all paid and unpaid positions held any family members including the owner/operators.

Staffing Process

MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

DIRECTING



DIRECTING

- Refers to the process of motivation, communication and leadership.
- The purpose of directing is to channel the behavior of all personnel to accomplish the organization's mission and objectives while simultaneously helping them.

CONTROLLING

Process of evaluating and correcting activities to keep organization on course.

- Measuring performance
- Comparing performance against standards
- Identifying deviation from standards
- Investigating causes of deviations
- Taking Corrective Action

Reporting

- It includes daily follow up of activities with help of reports which are submitted by subordinates to his/her superior.
- Reporting keeps him/her informed with day to day activities.

Budgeting

- Budget is an estimate of future needs covering all the activities of an enterprise for a definite period of time.
- A budget is prepared for each separate activity of business.
- This is done to control the expenses of organizations within certain limit.

MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

Team Building & Development

Team Building and Development

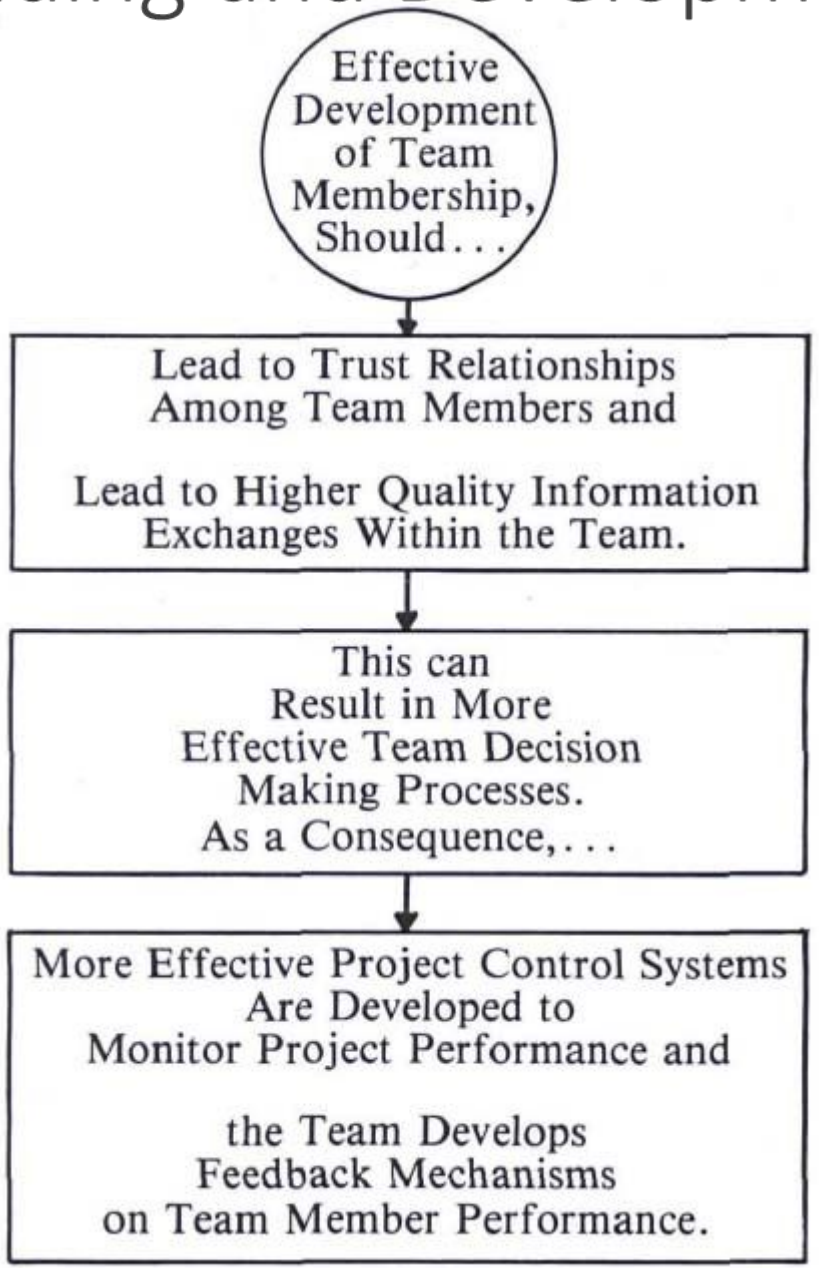
Selecting the project Team

- At what point is the project team formed?
- Who should select the project team?
- What types of people should be on the team?
- How do the team members get started?

Choosing Effective Team Leader

- Excellent Communicator
- Knowledge of Project Management Principles
- Highly Organized
- Strong Ability to Read People
- Accurate Estimating Skills
- Self-Assured

Team Building and Development



MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

Characteristics of Effective Teams

An effective project team has:

- A clear understanding of the project objective
- Clear expectations of each person's role and responsibilities
- A results orientation
- A high degree of cooperation and collaboration
- An atmosphere of open communication
- A high level of trust

MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

Barriers to Team Effectiveness

- Unclear goals
- Unclear definitions of roles and responsibilities
- Lack of project structure
- Lack of commitment by team members
- Poor communication
- Poor leadership
- Turnover of team members
- Dysfunctional behavior

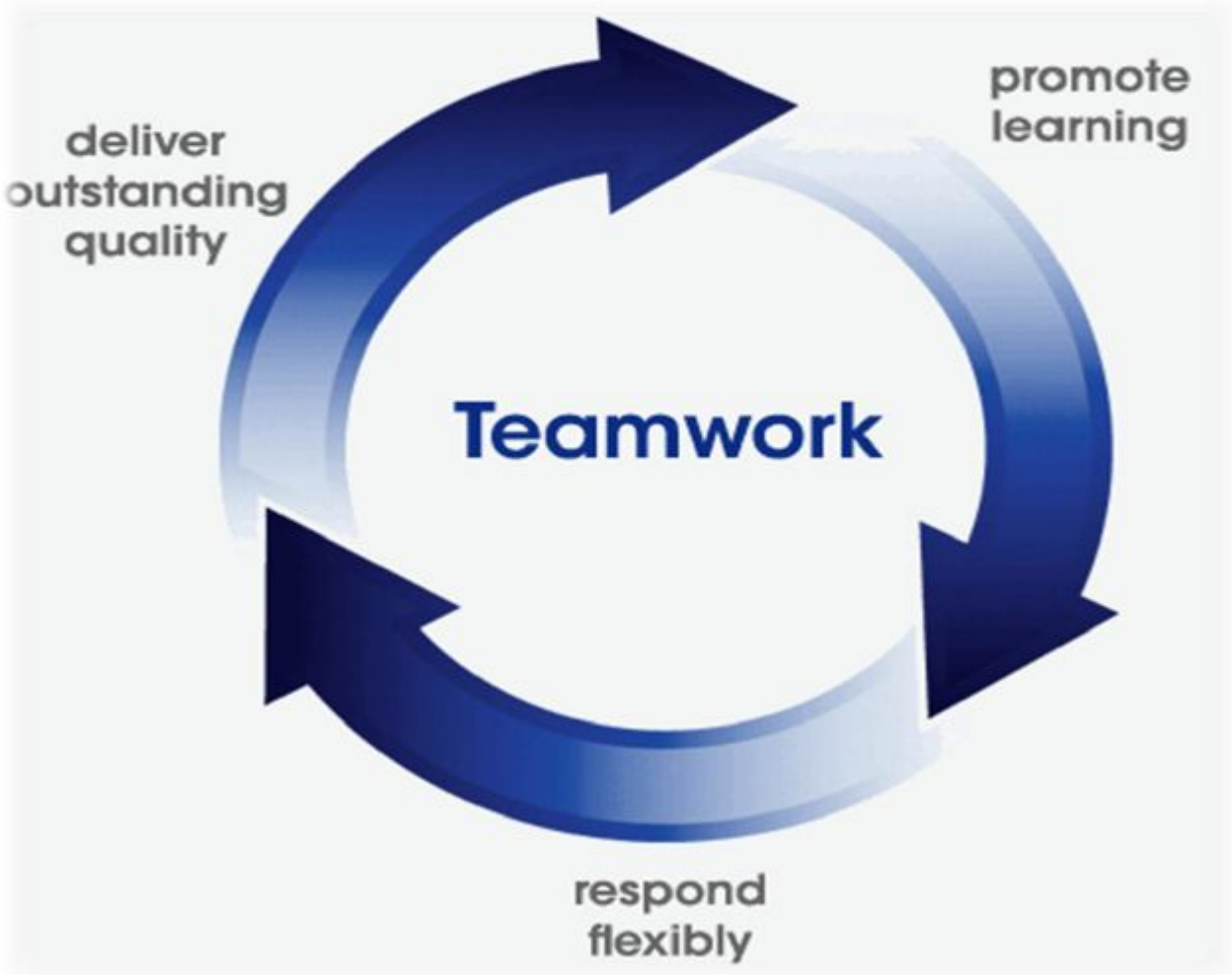
MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

Teams are Most Effective When:

- There are 10 or fewer members on the team
- Members volunteer to serve on the team
- Members serve on the project from beginning to end
- Members are assigned to the project full time
- Organization culture promotes cooperation and trust
- Members report solely to the project manager
- All relevant functional areas are represented on team

MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

Teamwork Cycle



MIT-WPU

।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

Team Building

Team Building -Assess

- Look for strengths and weaknesses in team members
- For a team to be successful the following characteristics are needed:
  - A clear direction that is understood by all team members
  - Team players
  - Understood and accepted accountability measures.

Team Building - Plan

- Planning
  - Based on the results of needs assessment
  - Activities should be based on the strengths and weaknesses of the needs assessment.

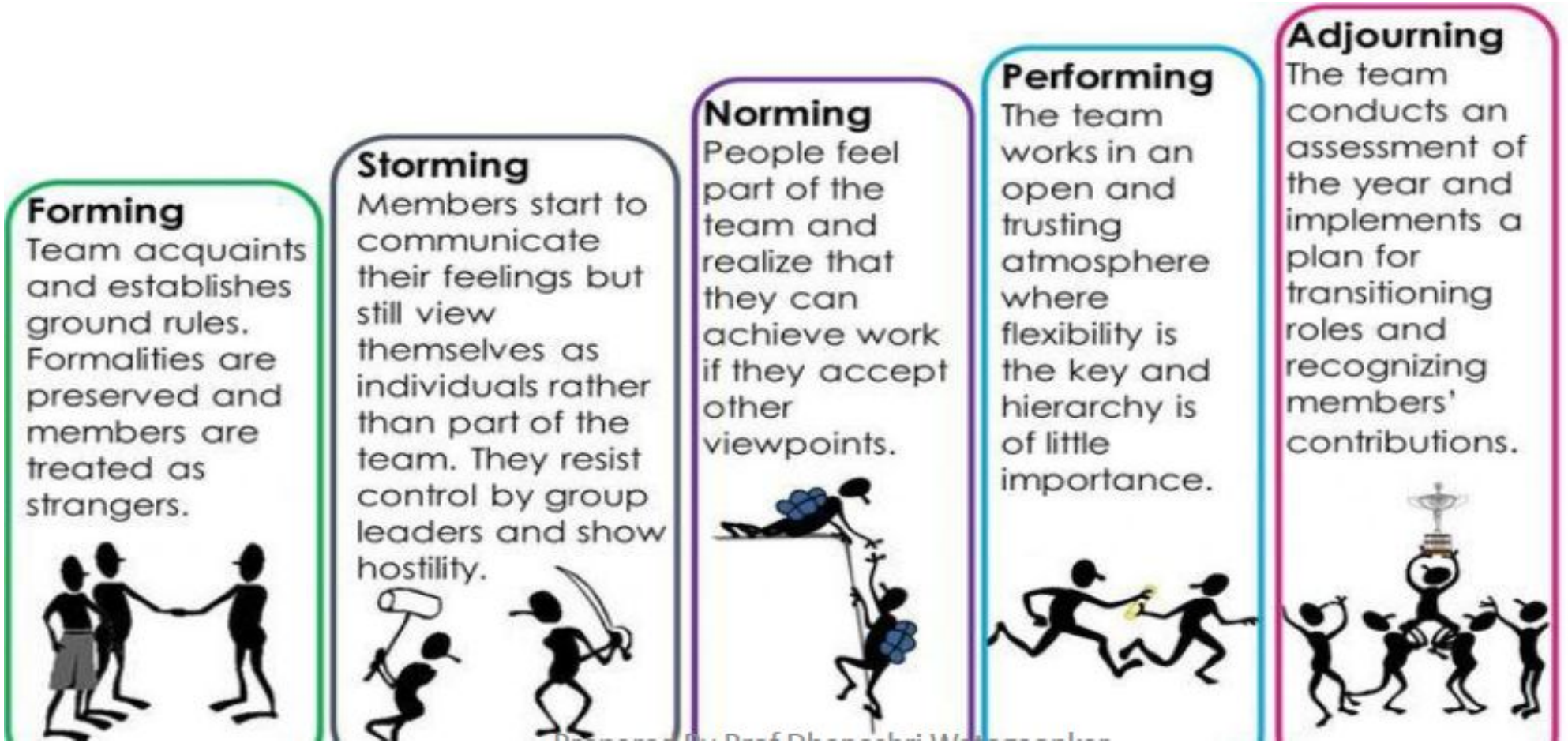
Team Building - Execute

- Execution
  - Just-in-time
  - Continuous improvement

Team Building - Evaluate

- Evaluation
  - Effectiveness can be measured based on how well weaknesses identified in the needs assessment were strengthened.
  - Re-administer the needs assessment.

Stages of Team Development



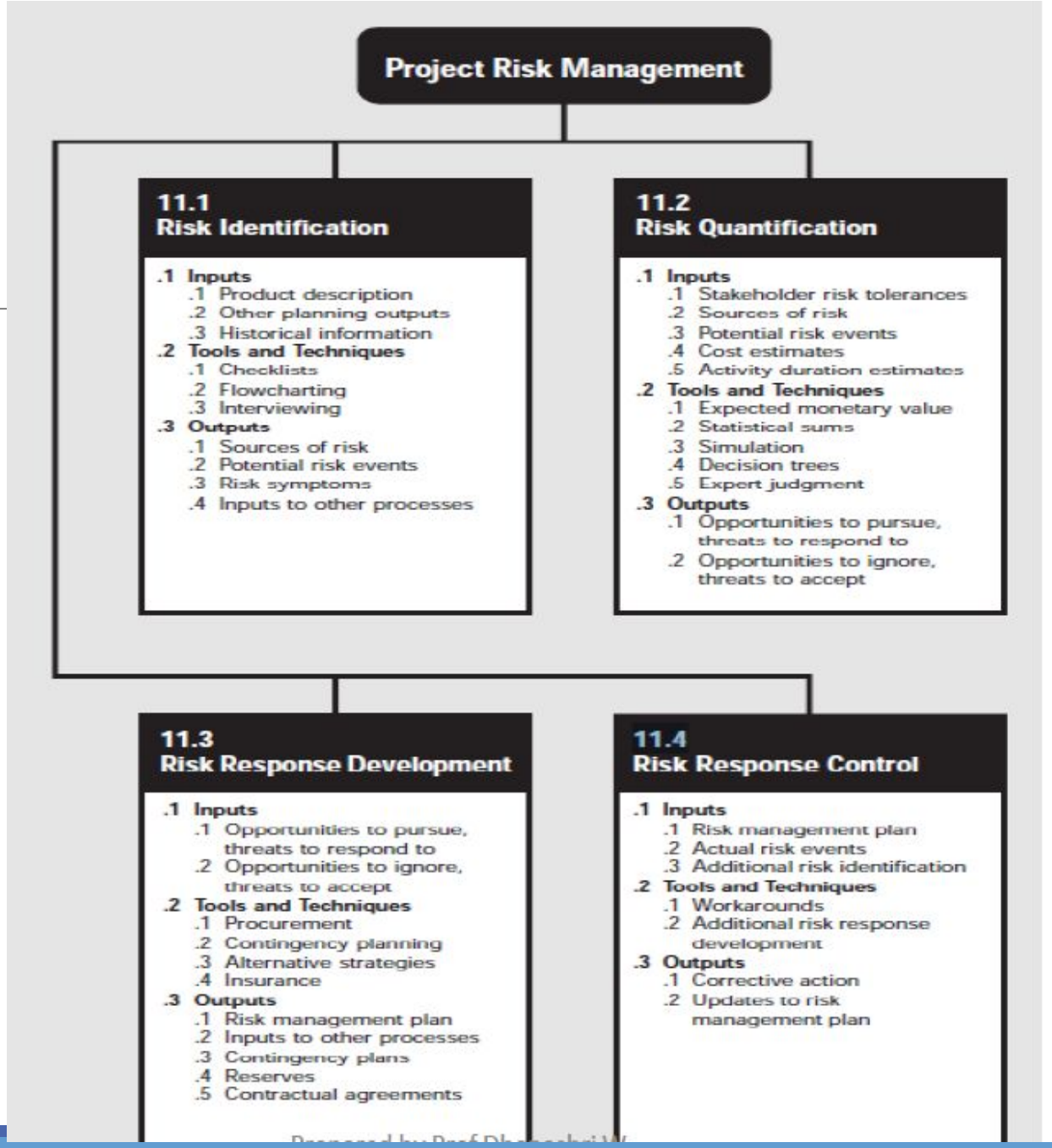
Risk Management

Risk management means risk containment and mitigation.

First, you've got to identify and plan. Then be ready to act when a risk arises, drawing upon the experience and knowledge of the entire team to minimize the impact to the project.

MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

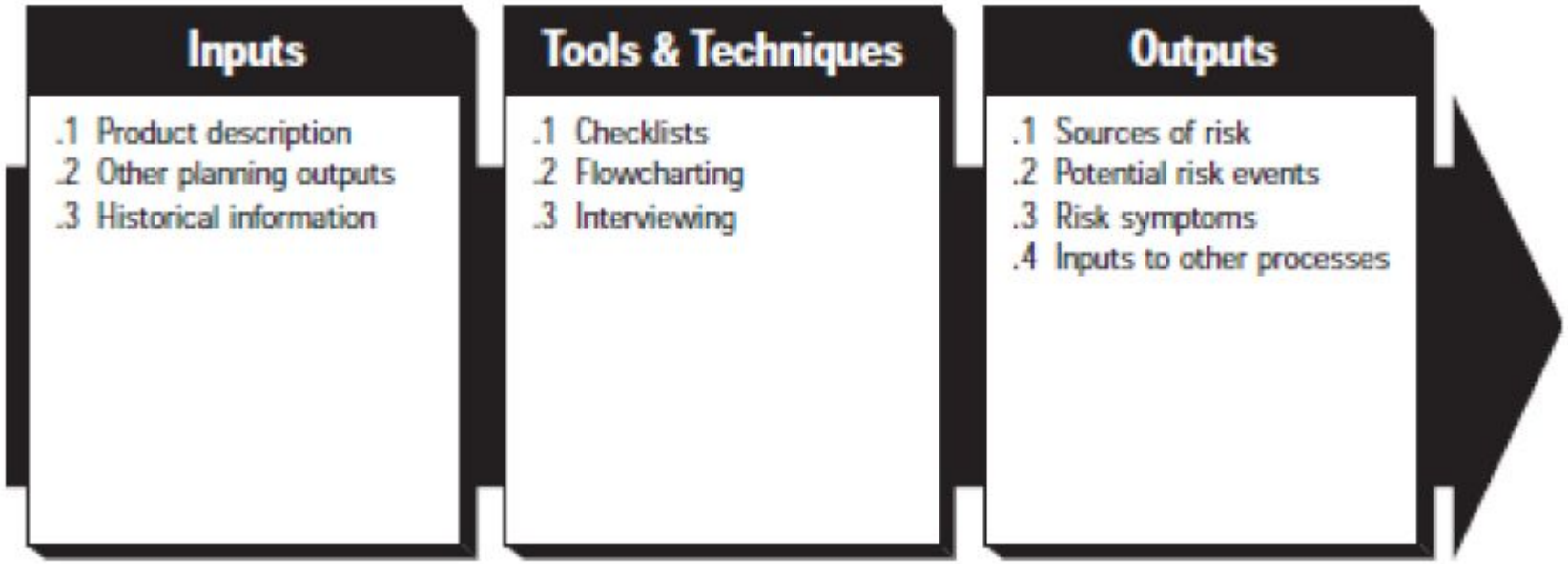
Risk Management



Risk Management

- **Risk Identification-** determining which risks are likely to affect the project and documenting the characteristics of each.
- **Risk Quantification-** evaluating risks and risk interactions to assess the range of possible project outcomes.
- **Risk Response Development-** defining enhancement steps for opportunities and responses to threats.
- **Risk Response Control-** responding to changes in risk over the course of project.

Risk Identification



Inputs

Inputs

- Product description
- Other planning outputs:
  - WBS
  - Cost Estimates
  - Staffing plan
  - Procurement management plan
- Historical Information

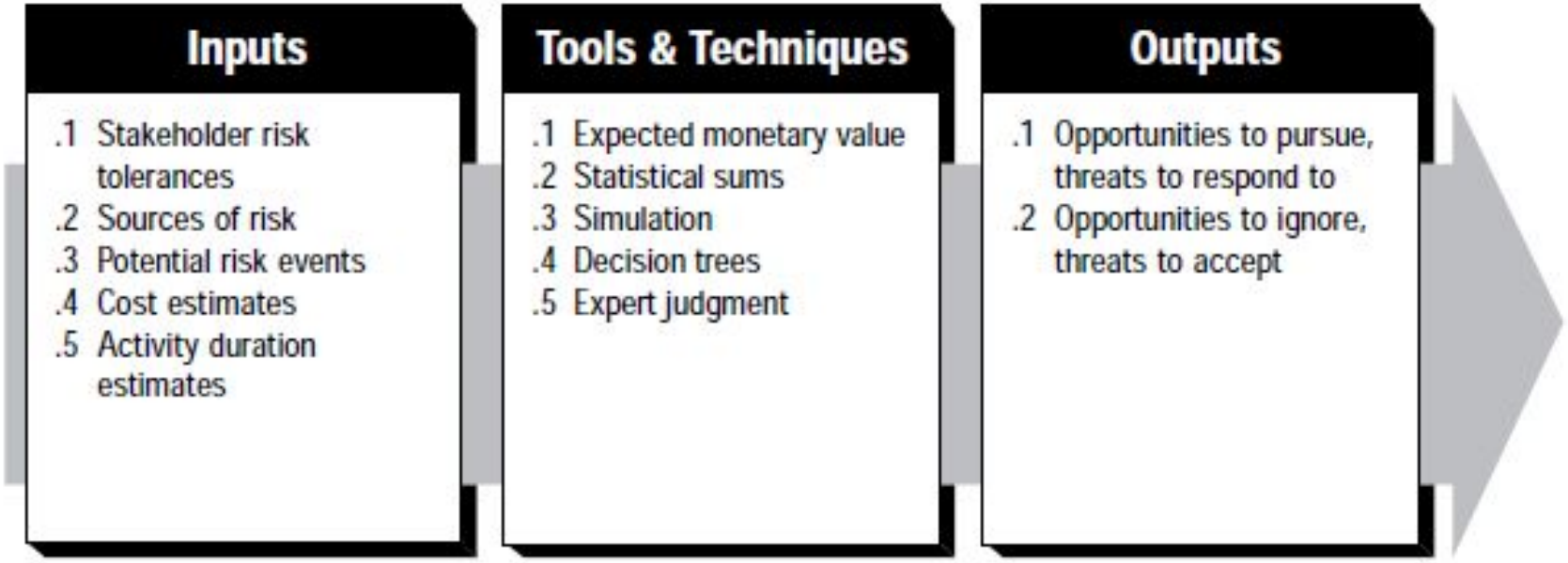
Tools & Techniques

- Checklists
- Flowcharting
- Interviewing : Risk oriented interviews with various stakeholders.

Outputs

- Sources of risk
  - Change in requirements
  - Design errors , omissions and misunderstandings
  - Poorly defined or understand roles and responsibilities
  - Poor estimates
  - Insufficient skilled staff
- Possible risk events
- Risk symptoms
- Inputs to other processes

Risk Quantification



Risk Quantification

Inputs

- Stakeholder risk tolerance: Different organizations and different individuals have different tolerances for risk.
- Source of risk
- Potential risk events
- Cost estimates
- Activity duration estimates.

Tools & Techniques

Expected monetary value.

- Risk event probability—an estimate of the probability that a given risk event will occur.
- Risk event value—an estimate of the gain or loss that will be incurred if the risk event does occur.

Statistical sums. The range of total project costs can be used to quantify the relative risk of alternative project budgets or proposal prices.

Simulation: It uses a representation or model of a system to analyze the behavior or performance of the system.

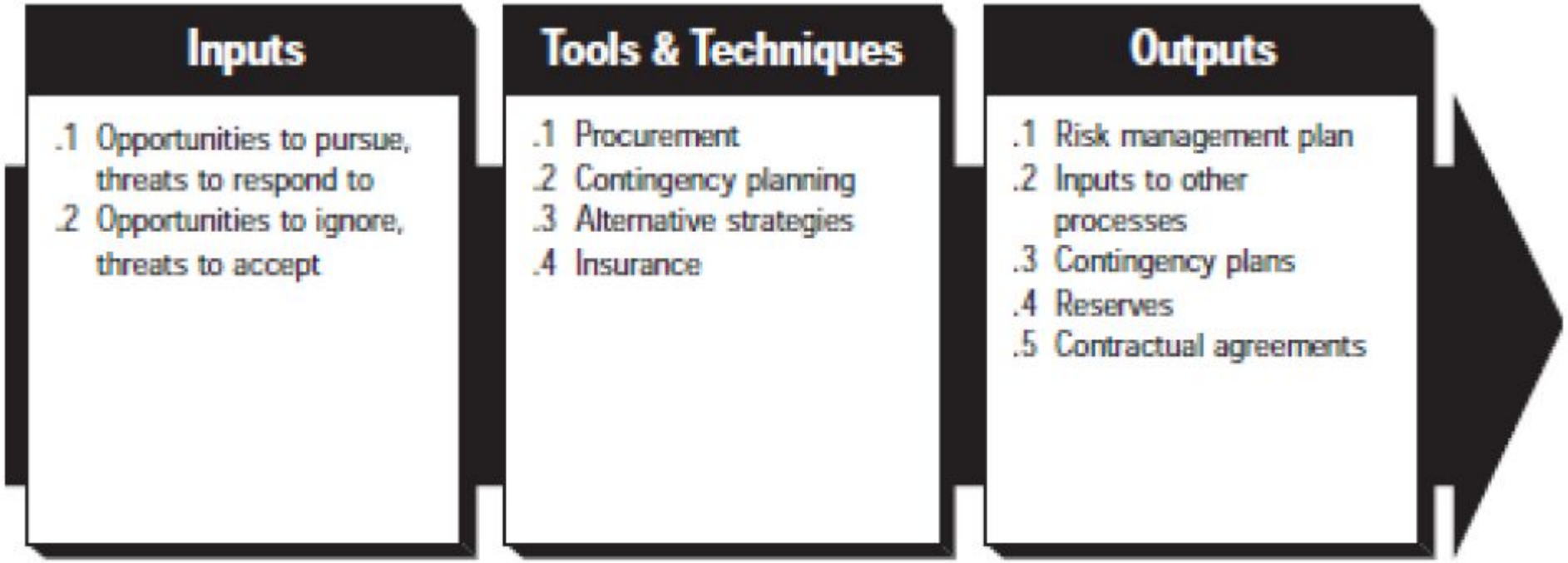
Decision trees. A decision tree is a diagram that depicts key interactions among decisions and associated chance events as they are understood by the decision maker.

Expert judgment. Risk events could be described as having a high, medium, or low probability of occurrence

Outputs

- Opportunities to pursue, threats to respond to: The major output from risk qualification is a list of opportunities that should be pursued and threats that require attention.
- Opportunities to ignore, threats to accepts: The risk quantification process should also document
  - Those sources of risk and risk events that the project management team has consciously decided to accept or ignore.
  - Who made the decision to do so.

Risk Response Development



Inputs

- Opportunities to pursue, threats to respond to
- Opportunities to ignore, threats to accepts

Tools & Techniques

- Procurement
- Contingency planning
- Alternative Strategies: Risk event can often be prevented or avoided by changing the planned approach
- Insurance.

Outputs

Risk management plan. It should document the procedure that will be used to managed risk throughout the project.

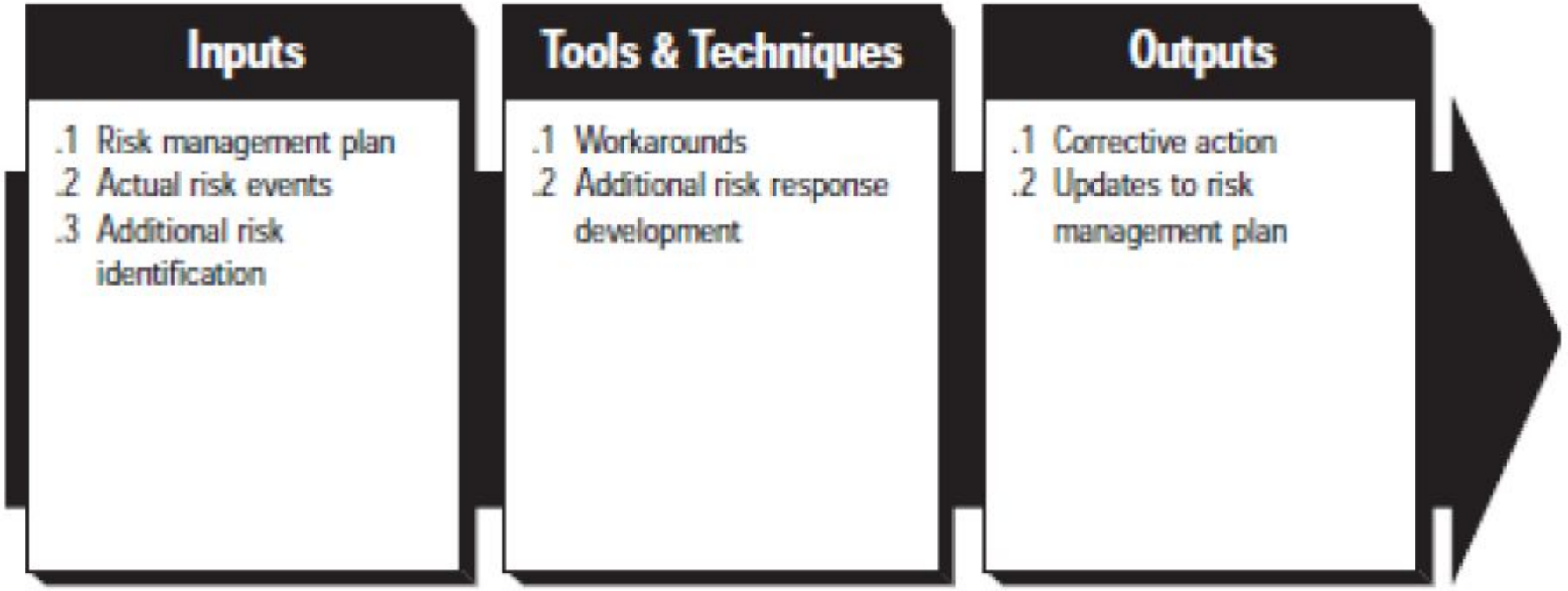
Inputs to other processes. Suggested alternative strategies, contingency plans, anticipated procurements, and other risk-related outputs must all be feedback.

Contingency plans. Contingency plans are pre-defined action steps to be taken if an identified risk event should occur.

Reserves. A reserve is a provision in the project plan to mitigate cost and/or schedule risk.

Contractual agreements. Insurance, services.

Risk Response Control



Inputs

- Risk management plan
- Actual risk events
- Additional risk identification

Tools & Techniques

- Workarounds: Workarounds are unplanned responses to negative risk events means the responses was not defined in advanced of the risk event occurring.
- Additional risk response development: If the effect is grater than expected, the planned responses may not be adequate and it will be necessary to repeat the response development process and perhaps the risk quantification process as well.

Outputs

- Corrective action
- Updates to risk management plan

MIT-WPU
।। विश्वशान्तिर्ध्रुवं ध्रुवा ।।

Gantt Chart

Gantt charts are **useful** for planning and scheduling projects. They help you assess how long a project should take, determine the resources needed, and plan the order in which you'll complete tasks. They're also **helpful** for managing the dependencies between tasks.

A **Gantt Chart** is a timeline that is used as a project management tool to illustrate how the project will run. You can view individual tasks, their durations and the sequencing of these tasks. View the overall timeline of the project and the expected completion date.

A **Gantt Chart** is a horizontal bar **chart** that visually represents a project plan over time. Modern **gantt charts** typically show you the status of—as well as who's responsible for—each task in the project. **Gantt charts** contain the following **features**: Start and end dates for tasks

MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

Gantt Chart

References

[1] https://www.simplilearn.com/project-and-process-metrics-article

[2] https://www.youtube.com/watch?v=mx3DejbTnSQ

[3] https://online.visual-paradigm.com/tutorials/swot-analysis-tutorial/

[4] https://webcache.googleusercontent.com/search?q=cache:YZXp7NA4mocJ:https://www8.cs.umu.se/kurser/TDBB12/HT05/Lectures/PVKHT05project%2520management.ppt+&cd=10&hl=en&ct=clnk&gl=in

[5]https://webcache.googleusercontent.com/search?q=cache:J-emu92YVAQJ:https://www.softwareresearch.net/fileadmin/src/docs/teaching/SS06/PM/PMBOK11.PDF+&cd=9&hl=en&ct=clnk&gl=in

[6] https://en.wikipedia.org/wiki/Source_lines_of_code

[7] https://www.slideshare.net/nagendraamatya/applied-research-methodology-lecture-1-10496165

Disclaimer:

a. Information included in this slides came from multiple sources. We have tried our best to cite the sources. Please refer to the References to learn about the sources, when applicable.

b. The slides should be used only for academic purposes (e.g., in teaching a class), and should not be used for commercial purposes.