Project Integration Management

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清華大學
Tsinghua University

Coordination



Boss

Sports Bracelet

Alice

Nick

Contents

- What is Project Integration Management
- Strategic Planning and Project Selection
- Develop a Project Management Plan
- Direct and Manage Project Work
- Manage Project Knowledge
- Monitor and Control Project Work
- Perform Integrated Change Control
- Close Projects or Phases
- Use Software to Assist in PIM

Must take responsibility for coordinating all of the people, plans, and work required to complete a project.

Must focus on the big picture of the project and steer the project team toward successful completion

Must make the final decisions when conflicts occur among project goals or people

Must communicate key project information to top management

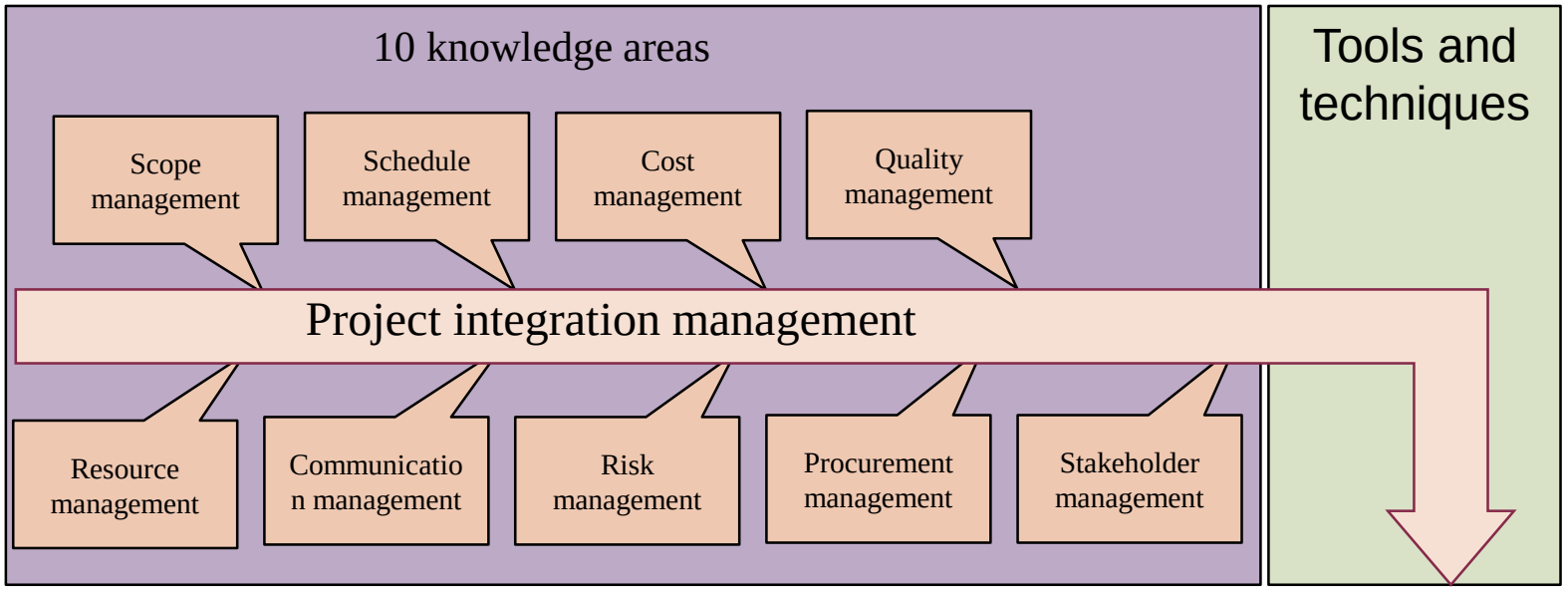
Project Integration Management

Includes the processes and activities to identify, define, combine, unify, and coordinate the various processes and project management activities.

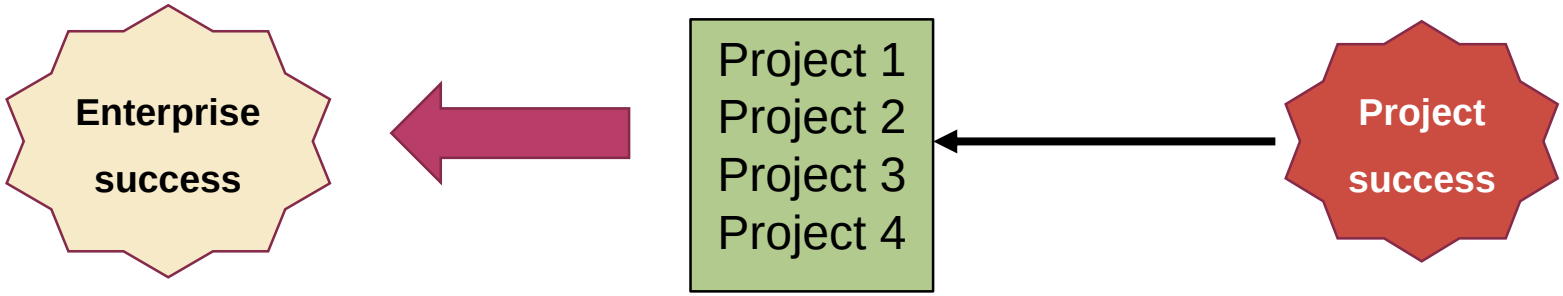
Coordinate all of the other project management knowledge areas throughout a project's life cycle

Project integration vs Software integration

Project Management Framework



Stakeholders' needs and expectations



Project portfolio

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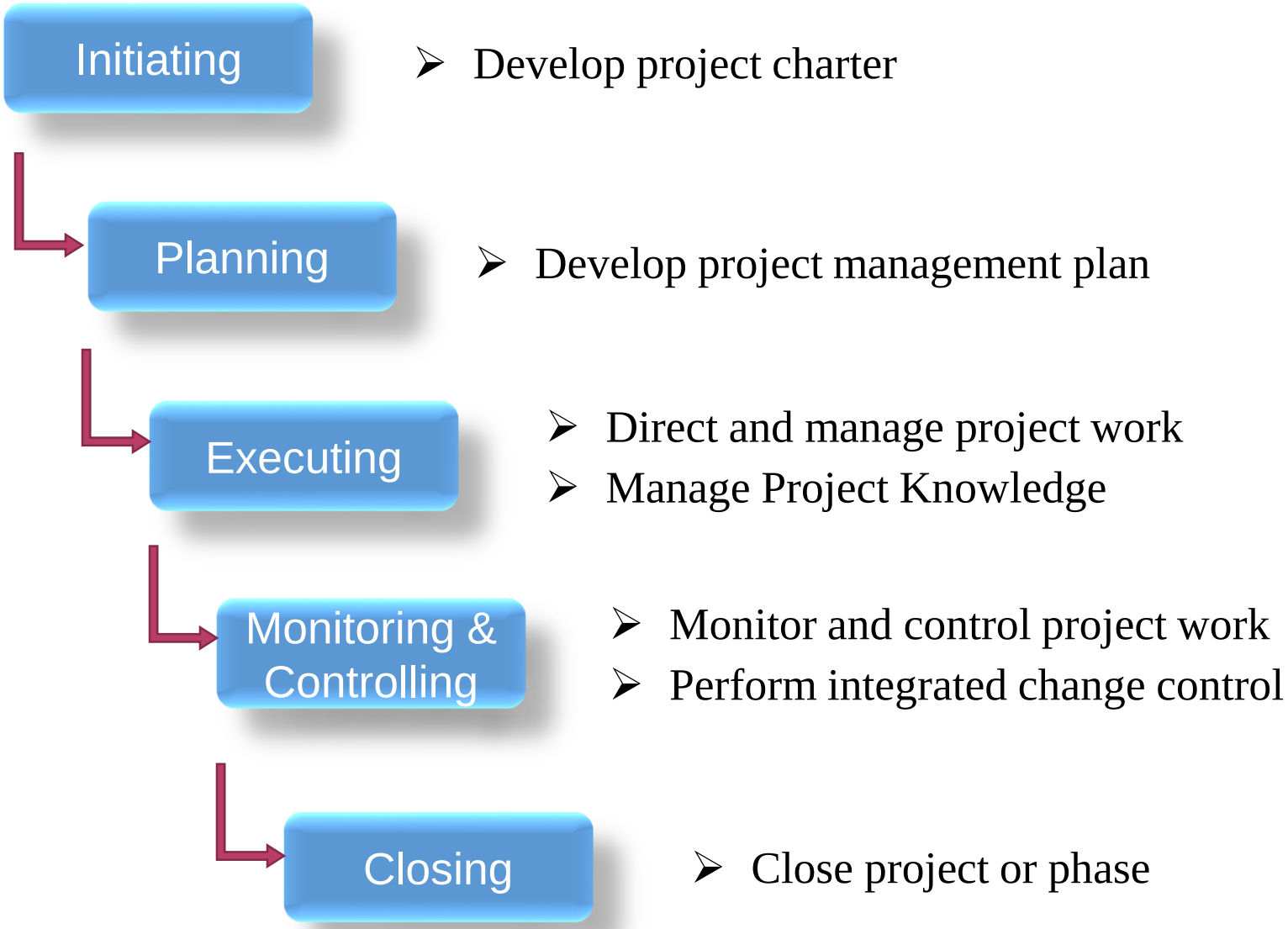


Main Elements

Plan Plan Plan Plan Plan Plan Plan Plan Plan

Charter Plan

Document Knowledge Change

Activity

Work

Project Integration Management Processes

- **Develop the project charter**: working with stakeholders to create the document that formally authorizes a project — the charter
- **Develop the project management plan**: coordinating all planning efforts to create a consistent, coherent document — the project management plan
- **Direct and manage project work**: carrying out the project management plan by performing the activities included in it

- **Manage project knowledge**: using existing knowledge and creating new knowledge to achieve project objectives while also contributing to organizational learning
- **Monitor and control project work**: overseeing project work to meet the performance objectives of the project
- **Perform integrated change control**: identifying, evaluating, and managing changes throughout the project life cycle
- **Close the project or phase**: finalizing all activities to formally close the project or phase

Interface Management

Identifying and managing the points of interaction between various elements of the project

- The number of interfaces can increase exponentially as the number of people involved in the project increases

Primary tools?

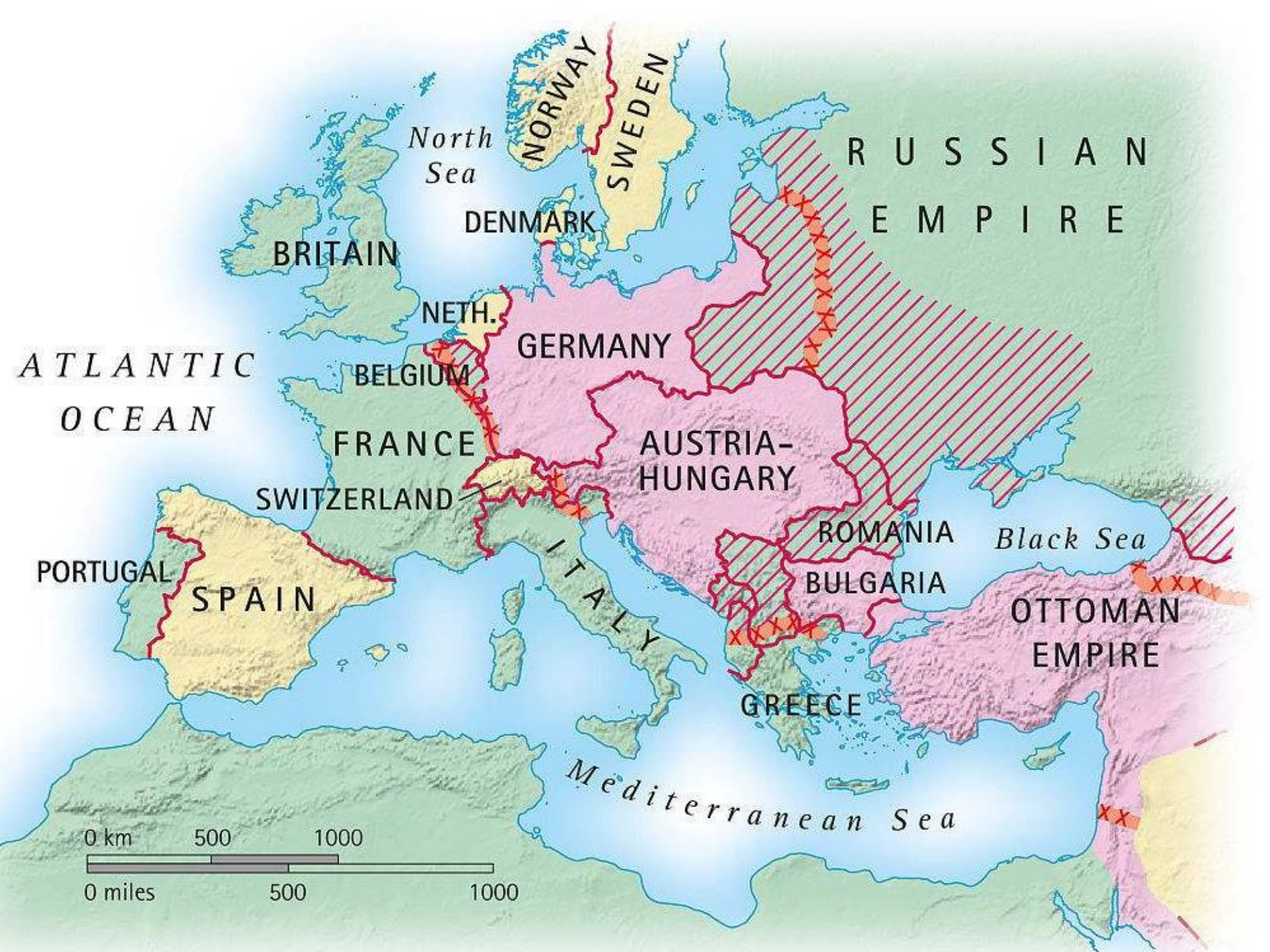
1. **Communication**
2. **Relationships**

Where is it?

What Went Wrong?

- The Airbus A380 megajet project was two years behind schedule in Oct. 2006, causing Airbus' parent company to face an expected loss of $6.1 billion over the next four years

Matlack, Carol. "First, Blame the Software," *BusinessWeek Online* (October 5, *2006).


NORWAY
SWEDEN
North Sea
RUSSIAN EMPIRE
DENMARK
BRITAIN
NETH.
GERMANY
ATLANTIC OCEAN
BELGIUM
FRANCE
AUSTRIA-HUNGARY
SWITZERLAND
ROMANIA
Black Sea
PORTUGAL
SPAIN
ITALY
BULGARIA
OTTOMAN EMPIRE
GREECE
Mediterranean Sea
0 km 500 1000
0 miles 500 1000

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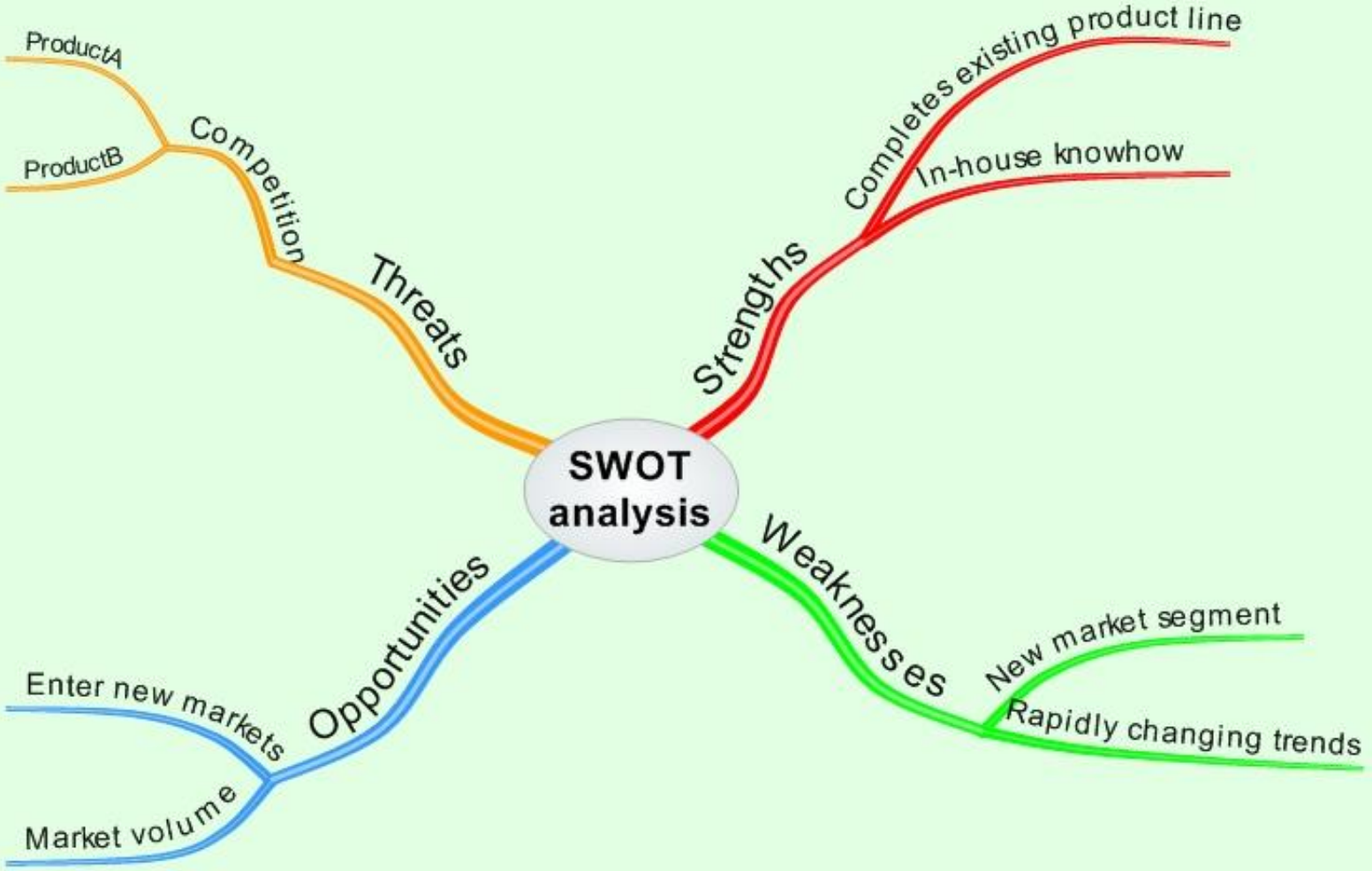
Should PM be involved in Strategic Planning and Project Selection?

Strategic Planning

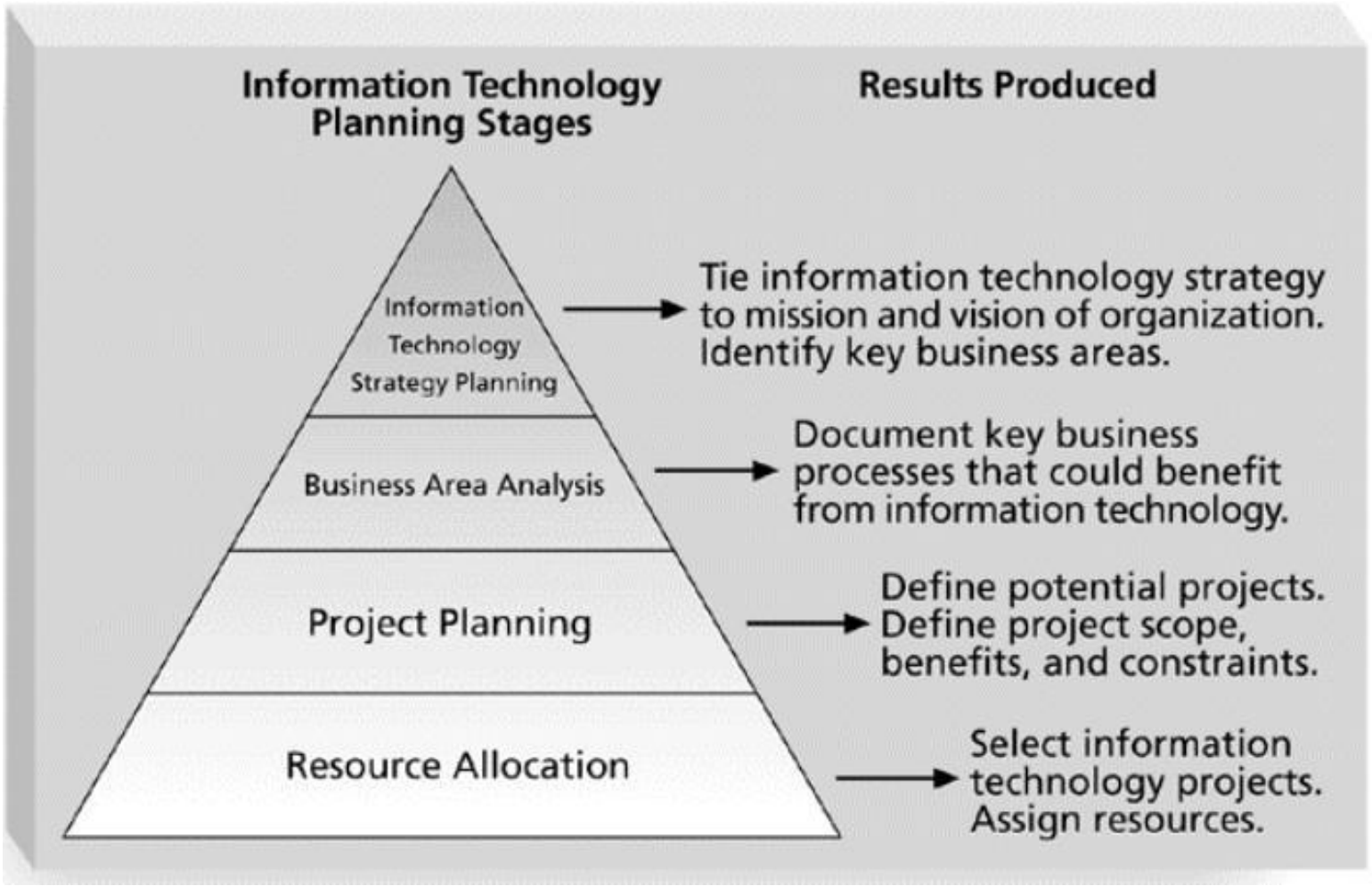
Strategic planning involves determining long-term objectives by

- Analyzing the strengths and weaknesses of **an organization**
- Studying opportunities and threats in the **business environment**
- Predicting future trends
- Projecting the need for new products and services

SWOT ANALYSIS


SWOT analysis
Threats
Competition
ProductA
ProductB
Strengths
Completes existing product line
In-house knowhow
Weaknesses
New market segment
Rapidly changing trends
Opportunities
Enter new markets
Market volume

IT Planning Process



Aligning IT with Business Strategy

- This is consistently the top concern for CIOs
- Research shows that supporting explicit business objectives is the number one reason cited for why organizations invest in IT projects
  - An organization's strategic plan should guide the IT project selection process
- Many IT systems are "strategic" because they directly support key business strategies
  - Wal-Mart's inventory control system
  - Fed-Ex's online package tracking system

Best Practice

- Only one in seven product concepts comes to fruition
  - Companies like Proctor & Gamble, Johnson and Johnson, Hewlett Packard, and Sony are consistently successful in New Product Development (NPD) because they use a disciplined, systematic approach to NPD projects based on best practices

- Four important forces behind NPD success include the following:
  1. A product innovation and technology strategy for the business
  2. Resource commitment and focusing on the right projects, or solid portfolio management
  3. An effective, flexible and streamlined idea-to-launch process
  4. The right climate and culture for innovation, true cross-functional teams, and senior management commitment to NPD

Methods for Selecting Projects

- There are usually more projects than available time and resources to implement them
- Methods for selecting projects include:
  - Focusing on broad organizational needs
  - Categorizing projects
  - Performing net present value or other financial analyses
  - Using a weighted scoring model
  - Implementing a balanced scorecard
- In practice, organizations usually use a combination of these approaches to select projects. Each approach has its pros and cons

Focusing on Broad Organizational Needs

- Three important criteria for projects:
  - There is a ***need*** for the project
  - There are ***funds*** available
  - There's a strong ***will*** to make the project succeed

Categorizing IT Projects

- One categorization is the impetus for a project i.e., responding to :
  - A **problem** is an undesirable situation that prevents an org. from achieving its goals – system slow, needs upgrades
  - An **opportunity** is a chance to improve the org. – creating a new product
  - A **directive** is a new requirement imposed by management, govt or some external influence – medical technologies must meet govt requirements
- Another categorization is how long it will take to do and when it is needed
- Another is the overall priority of the project

Which is first?

high-priority project

vs

low- or medium-priority project could be finished in less time

"Projects are never ends in themselves. Financially they are always a means to an end, ????" Dennis Cohen and Robert Graham , *The Project Manager's MBA*

CASH

Financial Analysis of Projects

- PMs must become familiar with the language/vocabulary of business executives in order to make their case

- Three primary methods for determining the projected financial value of projects
  - Net present value (NPV) analysis
  - Return on investment (ROI)
  - Payback analysis

Beijing Duck
30$

Roasted quail
9$

A dollar earned today is worth more than a dollar earned five years from now

Net Present Value Analysis

- **Net present value** (NPV) analysis is a method of calculating the expected net monetary gain or loss from a project by discounting all expected future cash inflows and outflows to the present point in time
- The higher the NPV, the better

How do you deal with your money?

Net Present Value Analysis

- NPV = Net Present Value = Present value of net cash flows
  - Each cash inflow/outflow is discounted back to its PV and then they are summed.

$$\mathrm{NPV} = C_0 + \sum_{t=1}^{N} \frac{C_t}{(1+r)^t}$$

or shortened

$$\mathrm{NPV} = \sum_{t=0}^{N} \frac{C_t}{(1+r)^t}$$

t - the time of the cash flow

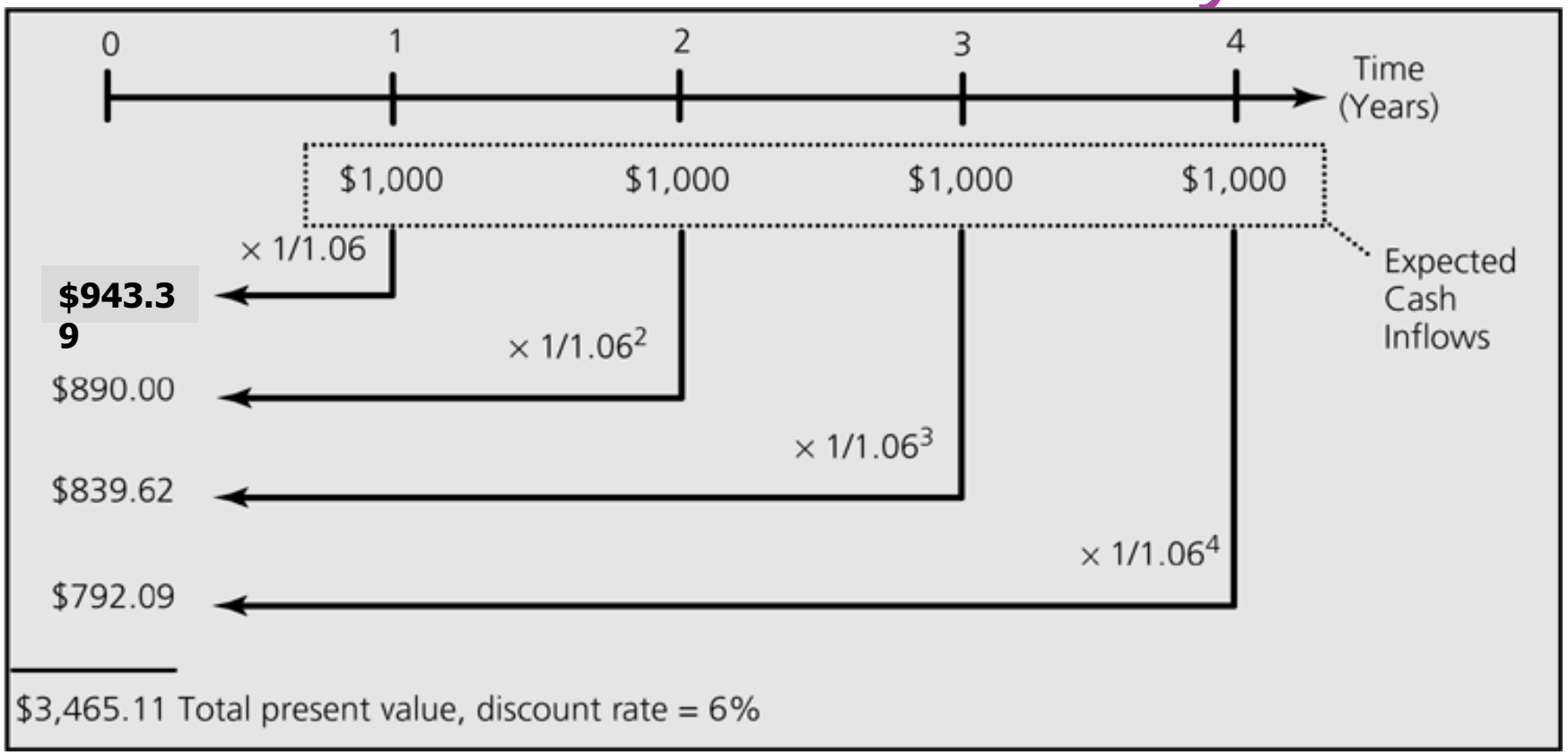
N - the total time of the project

r - the discount rate (the rate of return that could be earned on an investment in the financial markets with similar risk.)

C_t - the net cash flow (the amount of cash) at time t

C_0- the initial investment

Net Present Value Analysis



Net Present Value Example

	A	B	C	D	E	F	G
1	Discount rate	10%					
2							
3	PROJECT 1	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
4	Benefits	$0	$2,000	$3,000	$4,000	$5,000	$14,000
5	Costs	$5,000	$1,000	$1,000	$1,000	$1,000	$9,000
6	Cash flow	($5,000)	$1,000	$2,000	$3,000	$4,000	$5,000
7	NPV →	$2,316					
8		Formula =npv(b1,b6:f6)					
9							
10	PROJECT 2	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
11	Benefits	$1,000	$2,000	$4,000	$4,000	$4,000	$15,000
12	Costs	$2,000	$2,000	$2,000	$2,000	$2,000	$10,000
13	Cash flow	($1,000)	$0	$2,000	$2,000	$2,000	$5,000
14	NPV →	$3,201					
15		Formula =npv(b1,b13:f13)					
16							

Note that totals are equal, but NPVs are not because of the time value of money

Return on Investment

- **Return on investment** (ROI)

  = (total discounted benefits - total discounted costs) / discounted costs

- The higher the ROI, the better

Discount Rate

JWD Consulting NPV Example

Multiply by the discount factor each year, then take cum. benefits – costs to get NPV

Discount rate	**8%**					
Assume the project is completed in Year 0			**Year**			
	0	**1**	**2**	**3**	**Total**	
Costs	140,000	40,000	40,000	40,000		
Discount factor	1	0.93	0.86	0.79		
Discounted costs	**140,000**	**37,200**	**34,400**	**31,600**	**243,200**	
Benefits	0	200,000	200,000	200,000		
Discount factor	1	0.93	0.86	0.79		
Discounted benefits	**0**	**186,000**	**172,000**	**158,000**	**516,000**	
Discounted benefits - costs	(140,000)	148,800	137,600	126,400	**272,800**	← **NPV**
Cumulative benefits - costs	(140,000)	8,800	146,400	272,800		
ROI →	**112%**					
	Payback In Year 1					

Internal Rate of Return

The discount rate that makes the net present value of investment zero.

NPV ? IRR

Value **Efficiency**

Internal Rate of Return

To find the internal rate of return, find the value(s) of r that satisfies the following equation:

$$\mathrm{NPV} = C_0 + \sum_{t=1}^{N} \frac{C_t}{(1+r)^t} = 0$$

(See net present value for details on this formula.)

Example

Year	Cash Flow
0	-100
1	+30
2	+35
3	+40
4	+45

Internal Rate of Return (IRR)

$$\mathrm{NPV} = -100 + \frac{30}{(1+r)^1} + \frac{35}{(1+r)^2} + \frac{40}{(1+r)^3} + \frac{45}{(1+r)^4} = 0 \Rightarrow r \approx 17.09$$

IRR = r,
IRR = 17.09%

Net Present Value (NPV)

Thus using r = IRR = 17.09%,

$$\mathrm{NPV} = -100 + \frac{30}{(1+17.09\%)^1} + \frac{35}{(1+17.09\%)^2} + \frac{40}{(1+17.09\%)^3} + \frac{45}{(1+17.09\%)^4} = 0.00$$

$$c_0 + \sum_{t=1}^{N} \frac{C_t}{(1+r)^t} = 0$$

N → r IRR

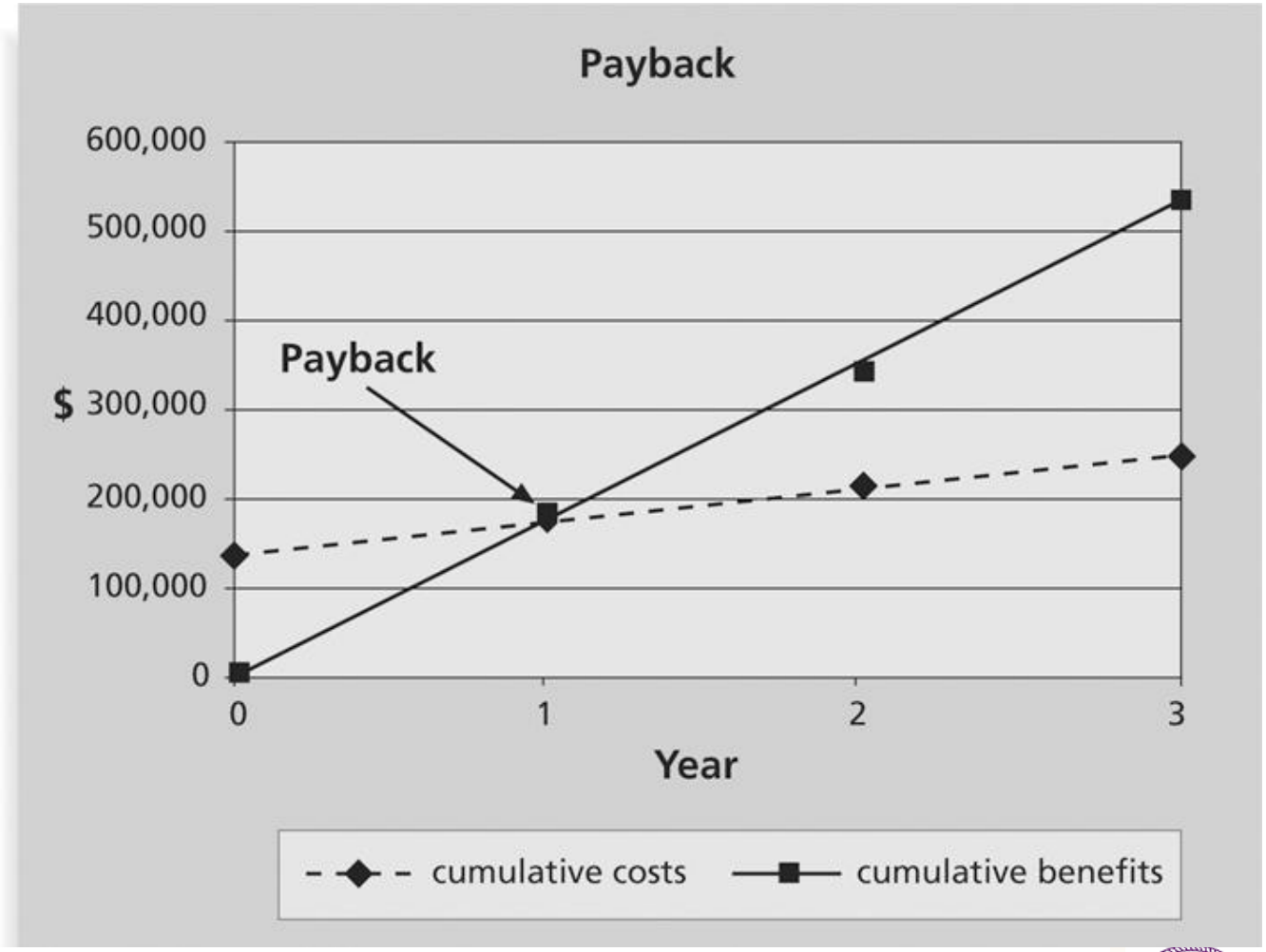
r → N ?

Payback Analysis

- The **payback period** is the amount of time it will take to recoup, in the form of net cash inflows, the total dollars invested in a project
- Payback occurs when the net cumulative benefits equals the net cumulative costs

The shorter, the better?

Charting the Payback Period

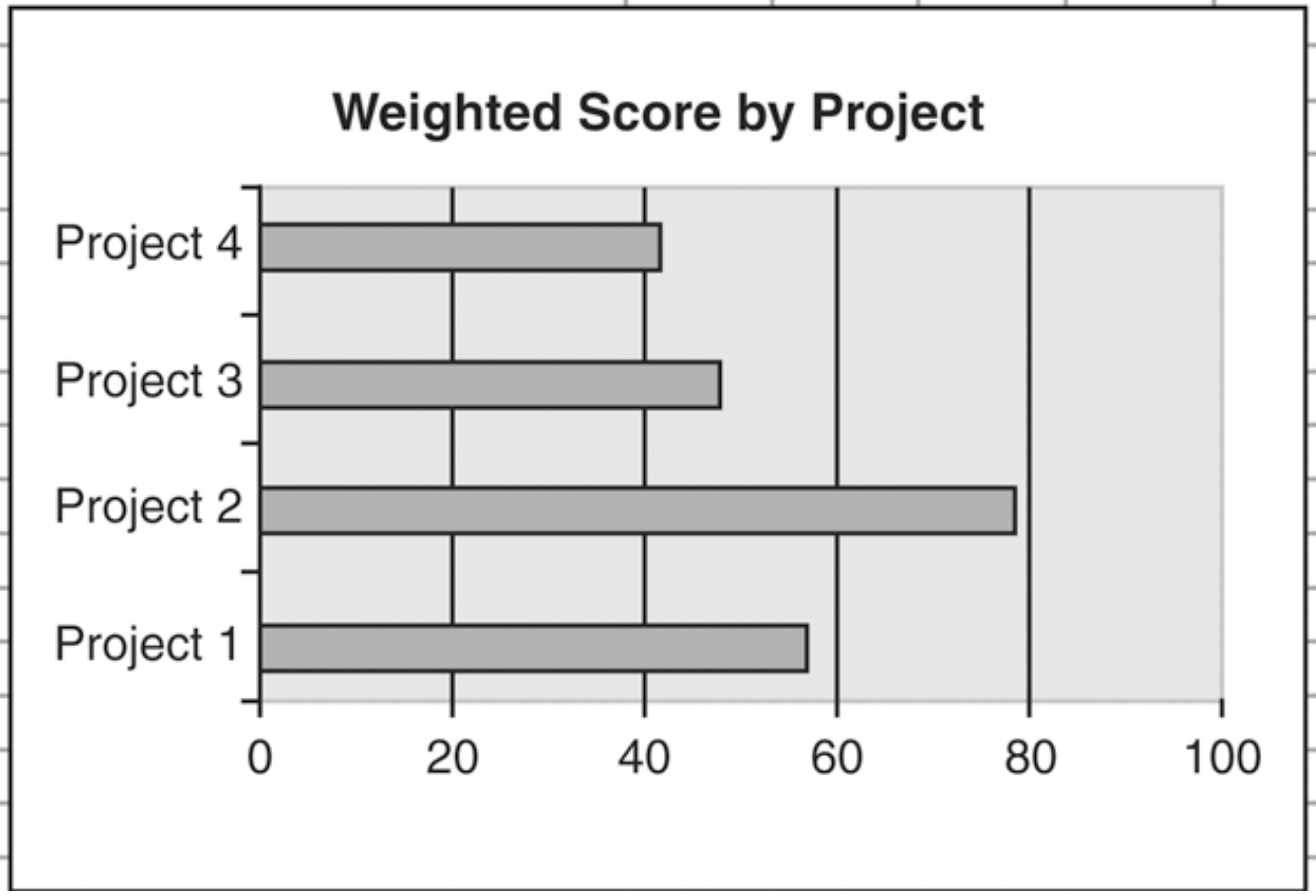


Weighted Scoring Model

A weighted scoring model is a tool that provides a systematic process for selecting projects based on many criteria

How to select a programing language?

	A	B	C	D	E	F
1	**Criteria**	**Weight**	**Project 1**	**Project 2**	**Project 3**	**Project 4**
2	Supports key business objectives	25%	90	90	50	20
3	Has strong internal sponsor	15%	70	90	50	20
4	Has strong customer support	15%	50	90	50	20
5	Uses realistic level of technology	10%	25	90	50	70
6	Can be implemented in one year or less	5%	20	20	50	90
7	Provides positive NPV	20%	50	70	50	50
8	Has low risk in meeting scope, time, and cost goals	10%	20	50	50	90
9	**Weighted Project Scores**	**100%**	**56**	**78.5**	**50**	**41.5**

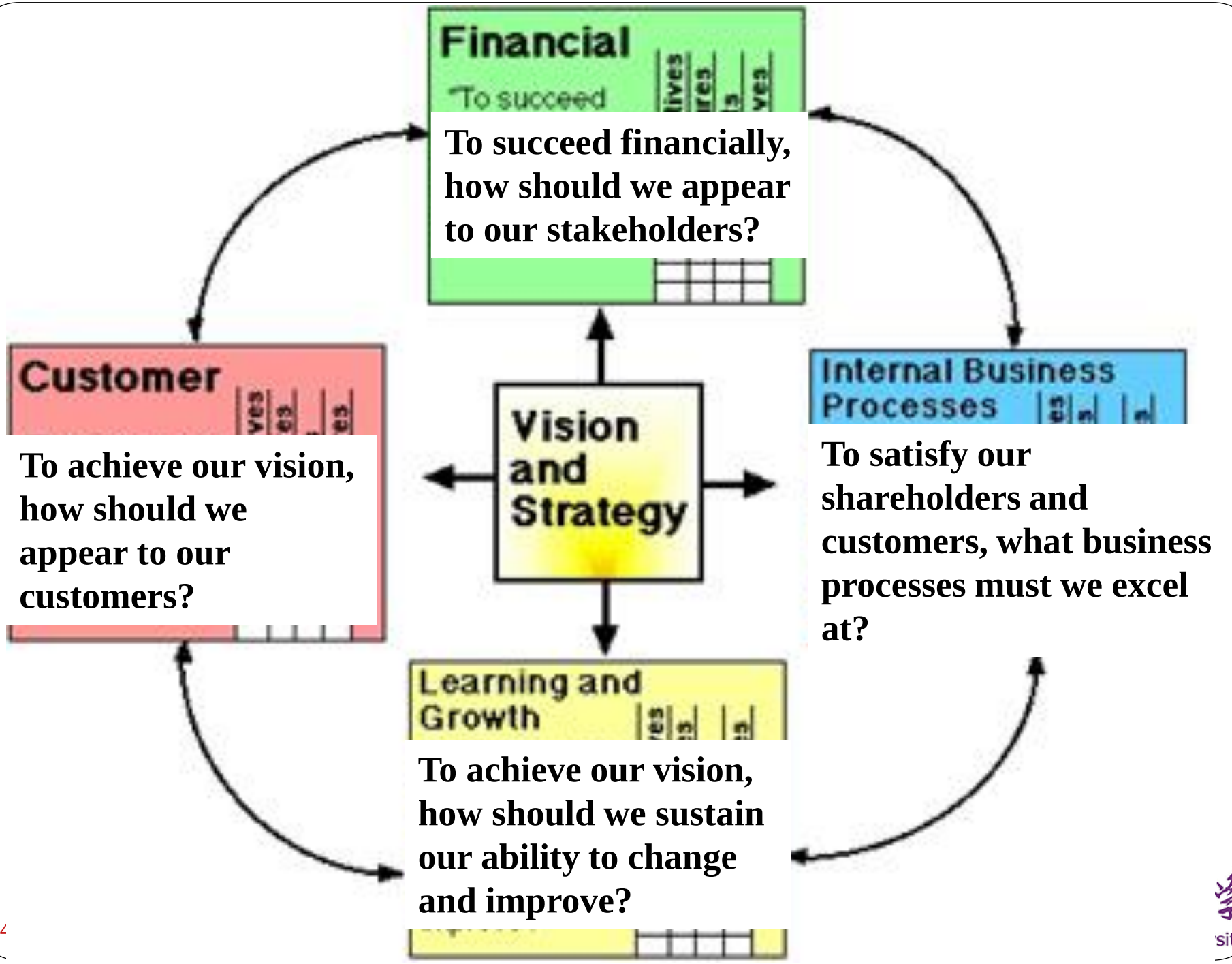


The higher, the better?

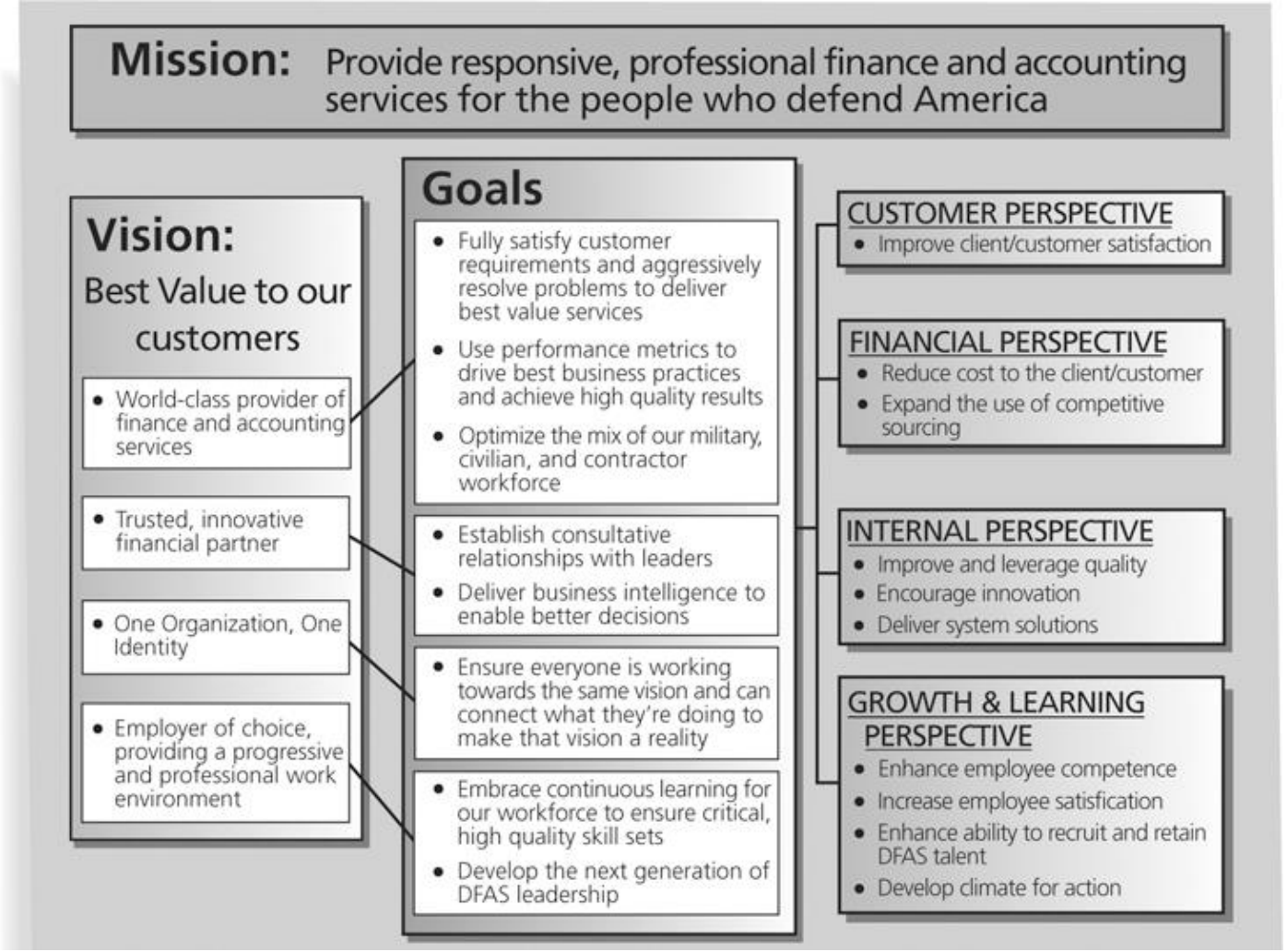
Skyline search?

Balanced Scorecard

The balanced scorecard suggests that we view the organization from four perspectives, and to develop metrics, collect data and analyze it relative to each of these perspectives

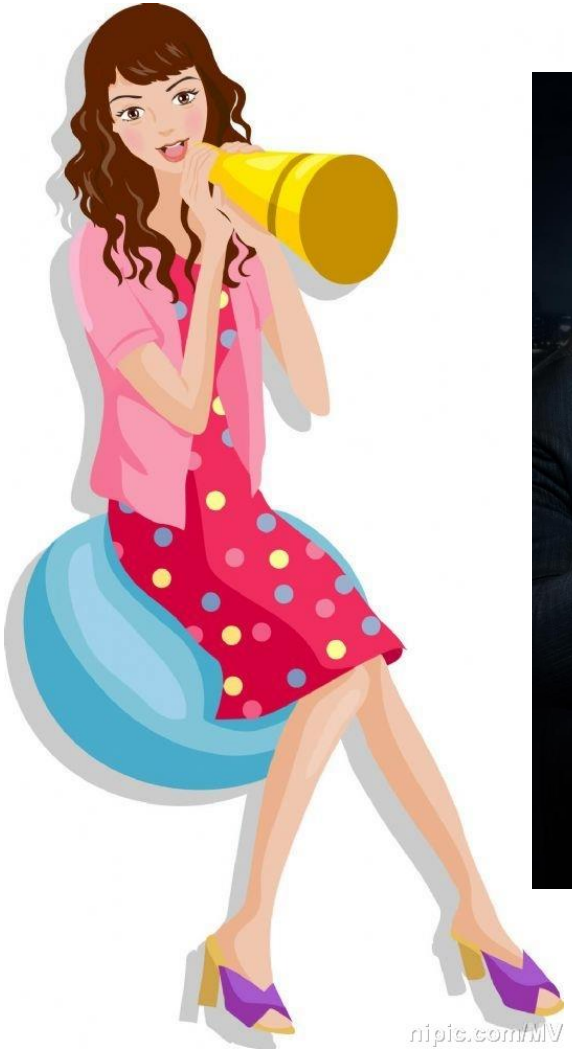

Financial
To succeed
To succeed financially, how should we appear to our stakeholders?
Customer
To achieve our vision, how should we appear to our customers?
Vision and Strategy
Internal Business Processes
To satisfy our shareholders and customers, what business processes must we excel at?
Learning and Growth
To achieve our vision, how should we sustain our ability to change and improve?

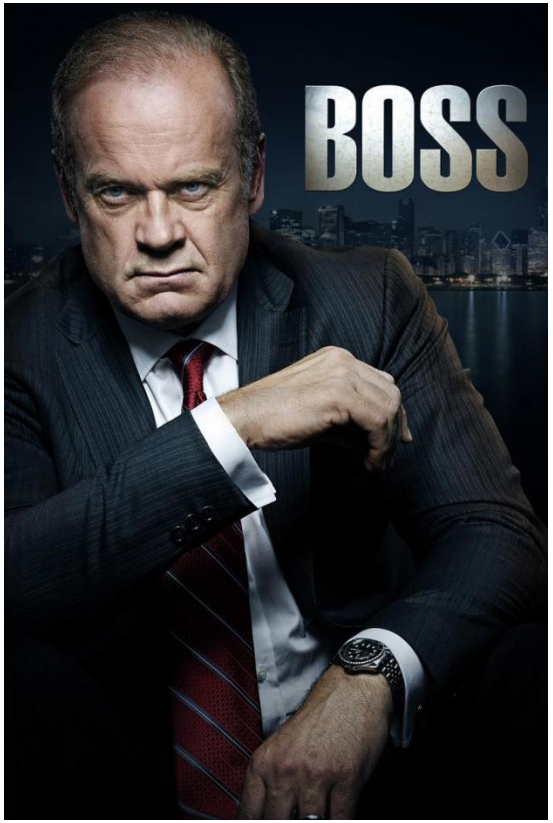
Balanced Scorecard Example



Defense Finance and Accounting Service, "DFAS Strategic Plan," Nov 2001
(http://balancedscorecard.org/files/DFAS-strategic-plan.pdf), p. 13.

Project selected, next?





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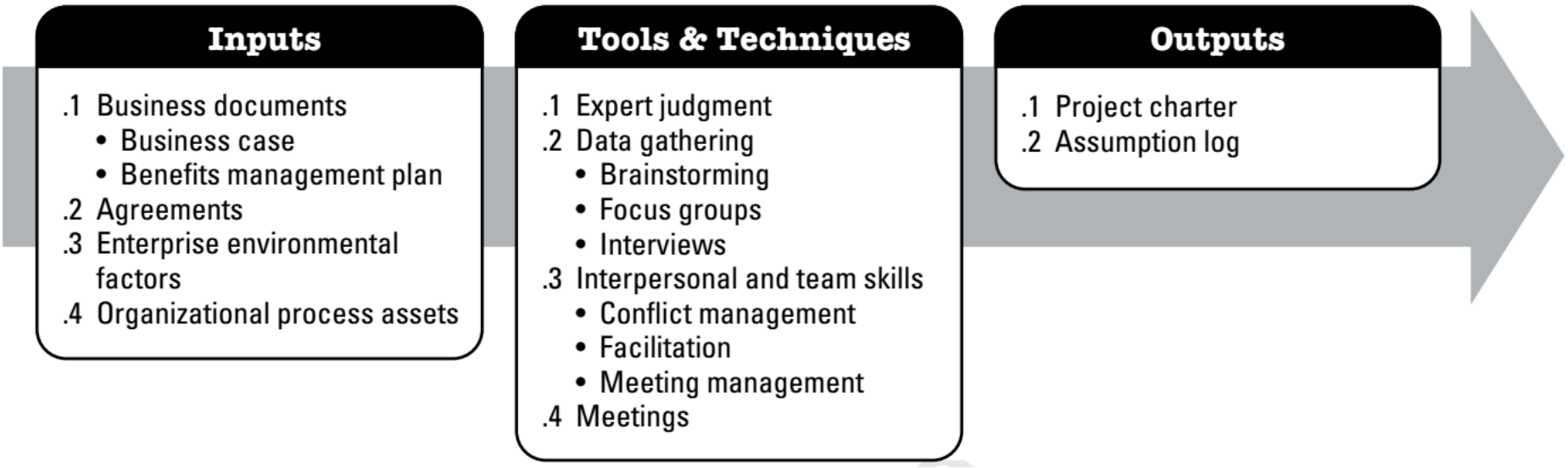
Project Charters

- A **project charter** is a document that formally recognizes the existence of a project and provides direction on the project's objectives and management

- Key project stakeholders should sign a project charter to acknowledge agreement on the need and intent of the project; a signed charter is a key output of project integration management

How to get a Project Charter



Assumption Log

- Assumption ID
- Date
- Source
- Category
- Description
- Status

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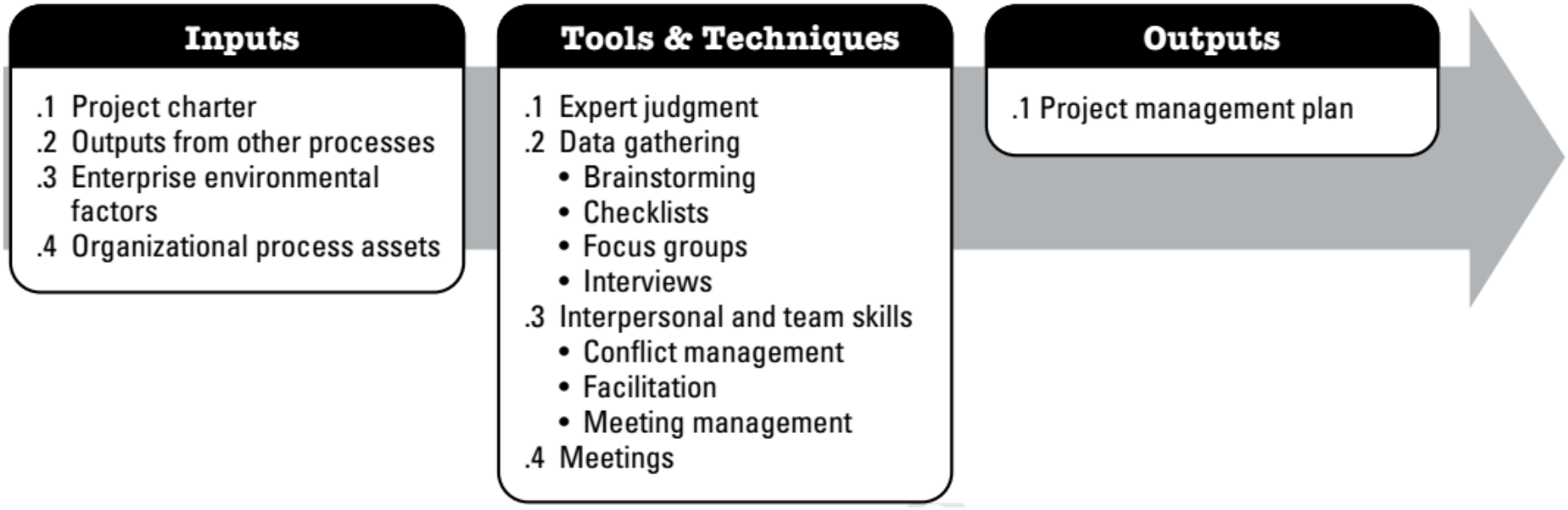
Inputs
.1 Project charter
.2 Outputs from other processes
.3 Enterprise environmental factors
.4 Organizational process assets
Tools & Techniques
.1 Expert judgment
.2 Data gathering
• Brainstorming
• Checklists
• Focus groups
• Interviews
.3 Interpersonal and team skills
• Conflict management
• Facilitation
• Meeting management
.4 Meetings
Outputs
.1 Project management plan

Project Management Plan

- A document used to coordinate all project planning documents and help guide a project's execution and control

Change

Project Management Plan

1. Scope MP (Management Plan)
2. Requirements MP
3. Schedule MP
4. Cost MP
5. Quality MP
6. Resource MP
7. Communications MP
8. Risk MP
9. Procurement MP
10. Stakeholder engagement Plan
11. Change MP
12. Configuration MP
13. Scope baseline
14. Schedule baseline
15. Cost baseline
16. Performance measurement baseline
17. Project life cycle description
18. Development approach

Software Project Management Plan

Major Section Headings	Section Topics
Overview	Purpose, scope, and objectives; assumptions and constraints; project deliverables; schedule and budget summary; evolution of the plan
Project Organization	External interface; internal structure; roles and responsibilities
Managerial Process Plan	Start-up plans; work plan; control plan; risk management plan; closeout plan
Technical Process Plans	Process model; methods, tools and techniques; infrastructure plan; product acceptance plan
Supporting Process Plans	Configuration management plan; verification and validation plan; documentation plan; quality assurance plan; reviews and audits; problem resolution plan; subcontractor management plan; process improvement plan

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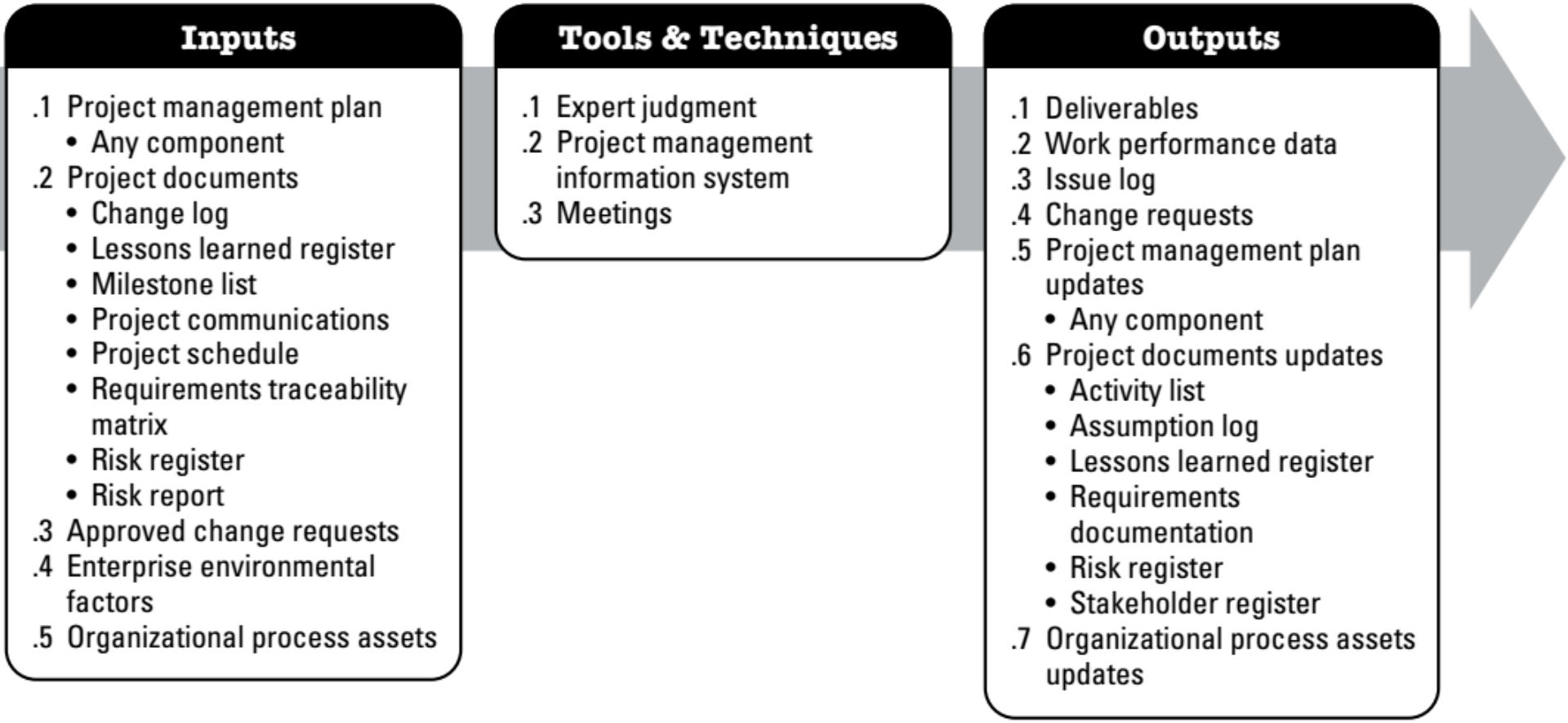
Inputs
.1 Project management plan
• Any component
.2 Project documents
• Change log
• Lessons learned register
• Milestone list
• Project communications
• Project schedule
• Requirements traceability matrix
• Risk register
• Risk report
.3 Approved change requests
.4 Enterprise environmental factors
.5 Organizational process assets
Tools & Techniques
.1 Expert judgment
.2 Project management information system
.3 Meetings
Outputs
.1 Deliverables
.2 Work performance data
.3 Issue log
.4 Change requests
.5 Project management plan updates
• Any component
.6 Project documents updates
• Activity list
• Assumption log
• Lessons learned register
• Requirements documentation
• Risk register
• Stakeholder register
.7 Organizational process assets updates

Project Execution

- Project execution involves managing and performing the work described in the project management plan
- The majority of **time** and **budget** is usually spent on execution
- Many unique situations occur during project execution, so project managers must be **flexible** and **creative** in dealing with them.

Coordinating Planning and Execution

- Project planning and execution are intertwined and inseparable activities

How to improve the Coordination?

Those who will do the work should plan the work

Providing Leadership and a Supportive Culture

- Project managers must **lead by example**. How?
- Organizational culture can help project execution by:
  - Providing guidelines and templates
  - Tracking performance based on plans
- Can PM break some rules?

Capitalizing on Product, Business, and Application Area Knowledge

- It is often helpful for IT project managers to have prior technical experience or at least a working knowledge of IT products
- For small projects, PMs may be required to perform some technical work or mentor team members to complete
- For large projects, PMs must understand the business and application area of the project

Project Execution Tools & Techniques

- Expert judgment
- Meetings
- Project management information systems

On large projects, 90% of the PMs job is?

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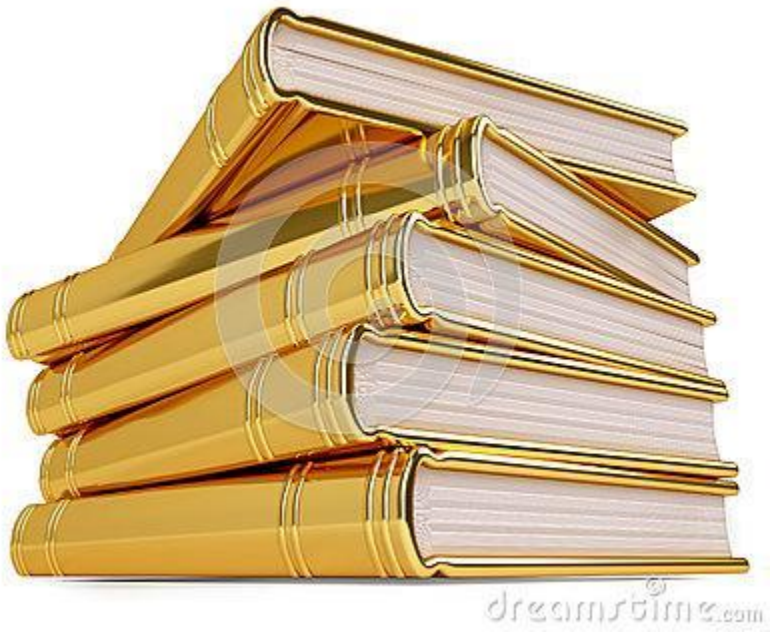
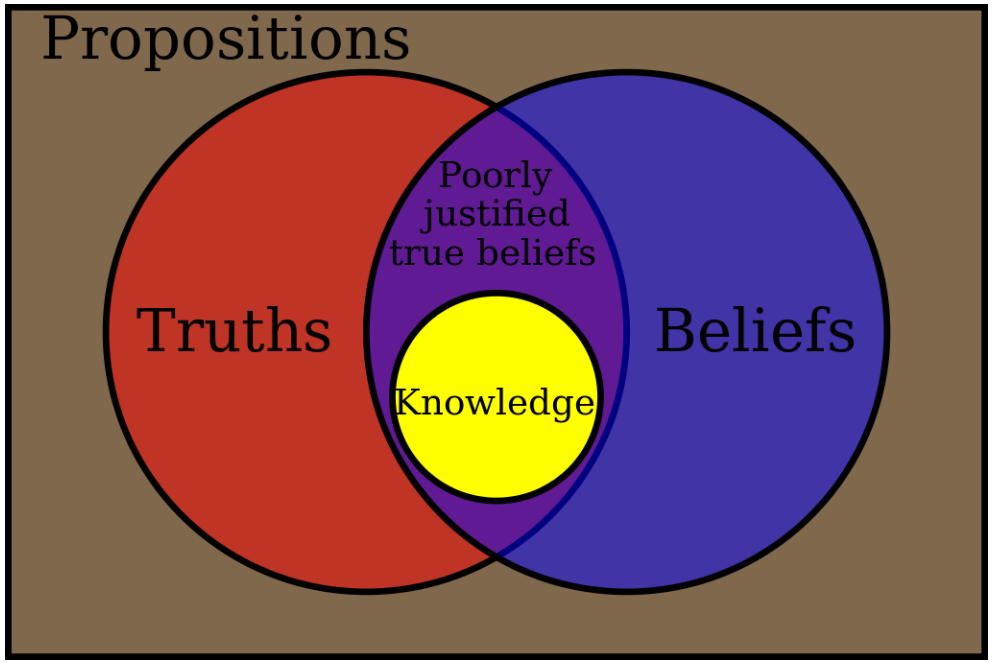


IF （1==length）

IF （length==1）

Knowledge

- **Explicit** knowledge: easily explained and easy to communicate, store and distribute, such as textbook
- **Tacit** knowledge: difficult to express and highly personal, such as beliefs, insights, experience and "know-how"



Manage Project Knowledge

- The process of using knowledge and creating new knowledge to achieve the project's objectives and contribute to organizational learning
- Key benefits:
  - Prior organizational knowledge is leveraged to produce or improve the project outcomes
  - Knowledge created by the project is available to support organizational operations and future projects or phases.

Knowledge Management

- Manage both tacit and explicit knowledge for two purpose
  - reusing existing knowledge
  - creating new knowledge
- Key activities
  - knowledge sharing
  - knowledge integration
- Misconceptions
  - Managing knowledge involves just documenting it so it can be shared
  - Managing knowledge involves just obtaining lessons learned by the end of the project

Inputs	Tools & Techniques	Outputs
.1 Project management plan • All components .2 Project documents • Lessons learned register • Project team assignments • Resource breakdown structure • Source selection criteria • Stakeholder register .3 Deliverables .4 Enterprise environmental factors .5 Organizational process assets	.1 Expert judgment .2 Knowledge management .3 Information management .4 Interpersonal and team skills • Active listening • Facilitation • Leadership • Networking • Political awareness	.1 Lessons learned register .2 Project management plan updates • Any component .3 Organizational process assets updates

Inputs

- Project management plan
  - All components
- Project documents
  - Lessons learned register
  - Project team assignments
  - Resource breakdown structure
  - Stakeholder register
- Deliverables
- Enterprise environmental factors
- Organizational process assets

Tools & Techniques

- Expert judgment
- Knowledge management
- Information management
- Interpersonal and team skills
  - Active listening
  - Facilitation
  - Leadership
  - Networking
  - Political awareness

Knowledge Management Tools and Techniques

- Connects people so they can work together to create new knowledge, share tacit knowledge, and integrate the knowledge of diverse team members
- Networking
- Communities of practice
- Meetings
- Work shadowing and reverse shadowing
- Discussion forums such as focus groups
- Knowledge-sharing events
- Workshops
- …

Outputs

- Lessons learned register
- Project management plan updates
  - Any component
- Organizational process assets updates

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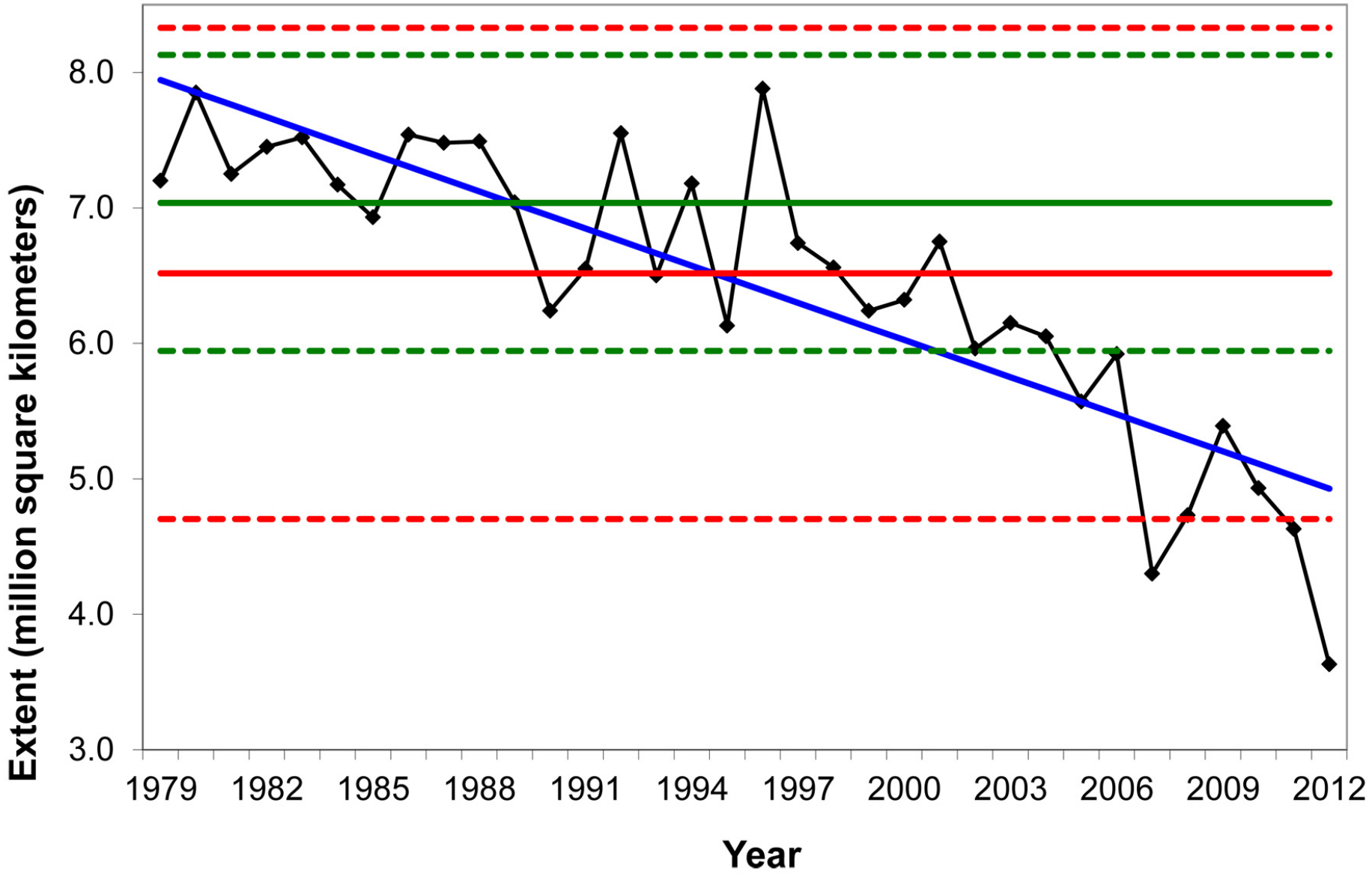
Inputs	Tools & Techniques	Outputs
.1 Project management plan • Any component .2 Project documents • Assumption log • Basis of estimates • Cost forecasts • Issue log • Lessons learned register • Milestone list • Quality reports • Risk register • Risk report • Schedule forecasts .3 Work performance information .4 Agreements .5 Enterprise environmental factors .6 Organizational process assets	.1 Expert judgment .2 Data analysis • Alternatives analysis • Cost-benefit analysis • Earned value analysis • Root cause analysis • Trend analysis • Variance analysis .3 Decision making .4 Meetings	.1 Work performance reports .2 Change requests .3 Project management plan updates • Any component .4 Project documents updates • Cost forecasts • Issue log • Lessons learned register • Risk register • Schedule forecasts

Monitoring & Controlling Project Work

- Changes are inevitable on most projects, so it's important to develop and follow a process to monitor and control changes
- Monitor: collecting, measuring, and assessing measurements and trends to effect process improvements
- Control: determining corrective or preventive actions or replanning and following up on action plans to determining whether the actions taken resolved the performance issue

Baseline


Extent (million square kilometers)
8.0
7.0
6.0
5.0
4.0
3.0
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
Year

Monitoring & Controlling Project Work

- Two important outputs are change requests and work performance reports:
- Change requests include recommended corrective and preventive actions and defect repairs
  - Corrective actions result in improvements in project performance
  - Preventive actions reduce the chances of negative consequences associated with project risks
  - Defect repairs involve bringing defective deliverables into conformance with requirements.
- Work performance reports include status reports, progress reports, memos, and other documents used to communicate performance.

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Who wants change?
Who wants *to* change?

Inputs	Tools & Techniques	Outputs
.1 Project management plan • Change management plan • Configuration management plan • Scope baseline • Schedule baseline • Cost baseline .2 Project documents • Basis of estimates • Requirements traceability matrix • Risk report .3 Work performance reports .4 Change requests .5 Enterprise environmental factors .6 Organizational process assets	.1 Expert judgment .2 Change control tools .3 Data analysis • Alternatives analysis • Cost-benefit analysis .4 Decision making • Voting • Autocratic decision making • Multicriteria decision analysis .5 Meetings	.1 Approved change requests .2 Project management plan updates • Any component .3 Project documents updates • Change log

Change Control on Information Technology Projects

- 1950s - 1970s: the project team should strive to do exactly what was planned on time and within budget

- 1990s - : project management is a process of constant communication and negotiation

Three main objectives

Identify, evaluate, and manage changes throughout the project life cycle.

- Influencing the factors that create changes to ensure that changes are beneficial
  - Tradeoff on scope, time and cost and quality
- Determining that a change has occurred
  - PM must be on top of the status of key project areas at all times and communicate changes to top management and stakeholders
- Managing actual changes as they occur
  - Change is unavoidable so careful change control is a critical success factor to a project

Changes

- Oral
- Written
- Formal
- Informal

Which one is good?

Change Control System

- A formal, documented process that describes when and how official project documents may be changed
  - Change is necessary but it needs to be properly managed and controlled
- Describes the people authorized to make changes, the paperwork required for these changes, and any automated or manual tracking systems the project will use.
  - Change Control Board
  - Configuration management
  - A process for communicating changes

Change Control Board (CCB)

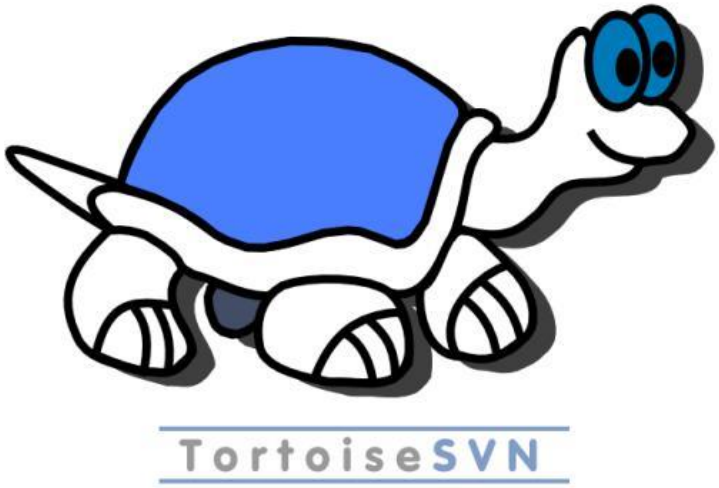
- A formal group of people responsible for approving or rejecting changes to a project
- CCBs provide guidelines for preparing change requests, evaluate change requests, and manage the implementation of approved changes
- Includes stakeholders from the entire organization

Making Timely Changes

- Some CCBs only meet occasionally, so it may take too long for changes to occur
- Some organizations have policies in place for time-sensitive changes
  - "48-hour policy" allows project team members to make decisions, then they have 48 hours to reverse the decision pending senior management approval
  - Delegate changes to the lowest level possible, but keep everyone informed of changes

Configuration Management

- Ensures that the descriptions of the project's products are correct and complete
- Involves identifying and controlling the functional and physical design characteristics of products and their support documentation
- Configuration management specialists identify and document configuration requirements, control changes, record and report changes, and audit the products to verify conformance to requirements
- See Institute of Configuration Management (www.icmhq.com)



maven

Enhance Communication

- Version control: If two programmers are allowed to check out the same file, they must coordinate to merge their changes.

- Requiring participants to stand keeps meetings short and forces everyone to focus on the most important project events.

Suggestions for Performing Integrated Change Control

- View project management as a process of constant communication and negotiation
- Plan for change
- Establish a formal change control system, including CCB
- Use effective configuration management
- Define procedures for making timely decisions about smaller changes
- Use written and oral performance reports to help identify and manage change
- Use project management software and other software to help manage and communicate changes
- Focus on leading the project team and meeting overall project goals and expectations

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Close ?= Finish

Closing Project or Phase

- The process of finalizing all activities for the project, phase, or contract.

- To close a project, you must finalize all activities and transfer the completed or cancelled work to the appropriate people

Inputs	Tools & Techniques	Outputs
.1 Project charter .2 Project management plan • All components .3 Project documents • Assumption log • Basis of estimates • Change log • Issue log • Lessons learned register • Milestone list • Project communications • Quality control measurements • Quality reports • Requirements documentation • Risk register • Risk report .4 Accepted deliverables .5 Business documents • Business case • Benefits management plan .6 Agreements .7 Procurement documentation .8 Organizational process assets	.1 Expert judgment .2 Data analysis • Document analysis • Regression analysis • Trend analysis • Variance analysis .3 Meetings	.1 Project documents updates • Lessons learned register .2 Final product, service, or result transition .3 Final report .4 Organizational process assets updates

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Using Software to Assist in PIM

- Documents can be created with word-processing software
- Presentations are created with presentation software
- Tracking can be done with spreadsheets or databases
- Communication software like e-mail and Web authoring tools facilitate communications
- Project management software can pull everything together and show detailed and summarized information
- Business service management tools help align projects with business strategy

Thanks!

清華大學
Tsinghua University