Software Project Management

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Objectives

- To monitor and track development *progress*
- To control project *changes*
- To report project *status*
- To evaluate project *result*
- To present *what* is software project management
- To present *basic concepts* of software project management
- To present *tools* and *techniques* for software project management

References

1. Roger S. Pressman. Software Engineering: A Practitioner's Approach. 7th Edition. McGraw-Hill. 2010.
2. Jennifer Greene and Andrew Stellman. Applied Software Project Management. 2005.
3. Project Management Institute. Practice Standard for Earned Value Management. 2005.
4. http://spectrum.ieee.org/computing/software/why-software-fails/3
5. Project Management Institute. A Guide to the Project Management Body of Knowledge. 5th Edition. 2013.
6. Kathy Schwalbe. An Introduction to Project Management. Fifth Edition. 2015.

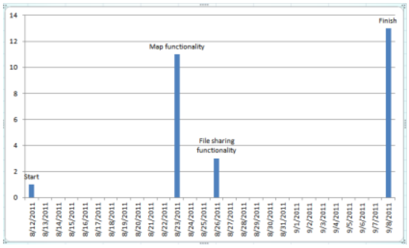
How to Execute a Project?

What is the Input? [1]

- A *project plan* is produced as management activities commence.
- The plan defines
  - *the process* and *tasks* to be conducted,
  - *the people* who will do the work, and
  - the mechanisms for *assessing risks*, *controlling change*, and *evaluating quality*.

Project Timeline

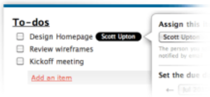
Establish the timeline for *deliverables* and tasks for each phase of the project.



Tasking

- When assigning any task please always clearly *define*
  - a purpose/objective/*problem*,
  - a (recommended) *solution*,
  - an *expected output/result* (installed software or source code and deployed application or a document) and
  - a expected *deadline*.
- Please ensure that the assignee understands all the 4 elements before doing any task so that effort will not be *wasted* on unnecessary things.

Task Monitoring and Time Tracking


To-dos

□ Design Homepage Scott Upton
□ Review wireframes
□ Kickoff meeting

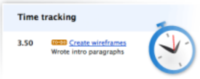
Add an item

Assign this

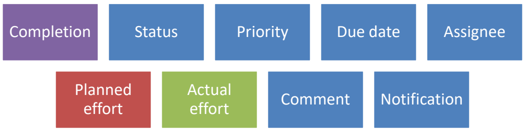
Scott Upton

The person you
notified by email

Set the due


Time tracking

3.50 To-do Create wireframes
Wrote intro paragraphs


Completion
Status
Priority
Due date
Assignee
Planned effort
Actual effort
Comment
Notification

Trust Your Team [2]

- Do not *blindly* trust your team.
- Understand at least the basic principles of software *requirements* engineering, *design* and architecture, *programming*, and software *testing* in order to guide a software project through all of the phases of development.

Review Everything, Test Everything

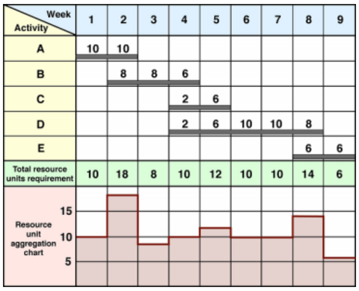
- It's much easier to fix something *on paper* than it is to build it first and fix it later.
- Testing must be planned *from the beginning* and then supported throughout the entire project.

Effort Creep

- http://agilekiwi.com/estimationandpricing/effort-creep
- It takes you *longer* than expected to do one stuff.
- **Solutions:**
  - Underestimation: risk reserve (how much? - old projects cost)
  - Over engineering: solution understanding prior implementation, project status should be visible
  - Explosion of implicit requirements: "derived requirements" caused by the complexity of the solution process.
  - Fuzzy grey boundaries: relationship between customer and supplier

How is Your Project Going?

Total Planned Work and Completed Work

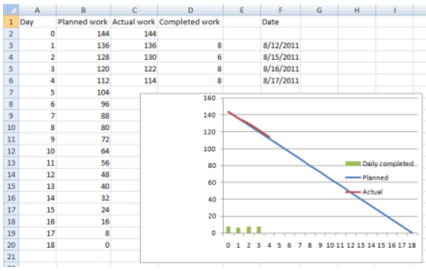


Week / Activity	1	2	3	4	5	6	7	8	9
A	10	10							
B		8	8	6					
C				2	6				
D				2	6	10	10	8	
E								6	6
Total resource units requirement	10	18	8	10	12	10	10	14	6

Resource unit aggregation chart
15
10
5

Burn Down Chart

A *burn down chart* is graphical representation of work left to do versus time.



	A	B	C	D	E	F	G	H	I
1	Day	Planned work	Actual work	Completed work		Date			
2	0	144	144						
3	1	136	136	8		8/12/2011			
4	2	128	130	6		8/15/2011			
5	3	120	122	8		8/16/2011			
6	4	112	114	8		8/17/2011			
7	5	104							
8	6	96							
9	7	88							
10	8	80							
11	9	72							
12	10	64							
13	11	56							
14	12	48							
15	13	40							
16	14	32							
17	15	24							
18	16	16							
19	17	8							
20	18	0							
21									

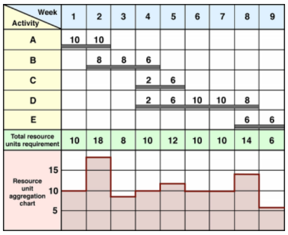
How is Your Project Going? [3]

By *this reporting date*:

- Are we *ahead of* or *behind* schedule?
- *How efficiently* are we using our time?
- *When* is the project likely to be completed?
- Are we currently under or over our budget?
- How efficiently are we using our resources?
- What is the remaining work likely to cost?
- What is the entire project likely to cost?
- How much will we be under or over budget at the end?

Planned Value

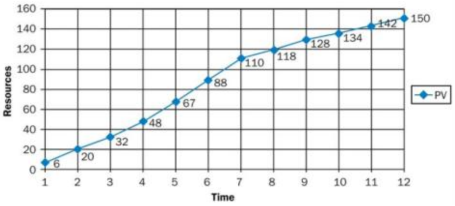
Planned Value (PV) describes how far along project work is supposed to be at any given point in the project schedule. It is a *numeric* reflection of the budgeted work that is scheduled to be performed ($). Also *known as* the Budgeted Cost of Work Scheduled (BCWS).



Week / Activity	1	2	3	4	5	6	7	8	9
A	10	10							
B		8	8	6					
C				2	6				
D				2	6	10	10	8	
E								6	6
Total resource units requirement	10	18	8	10	12	10	10	14	6

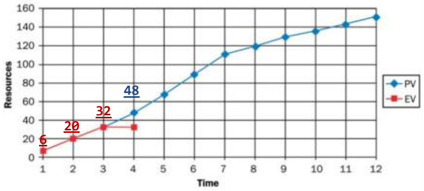
Resource unit aggregation chart
15
10
5

Planned Value Example



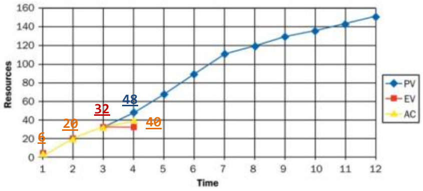
Earned Value

Earned Value (EV) is a snapshot of work progress at a given point in time. Also known as the Budgeted Cost of Work Performed (BCWP).

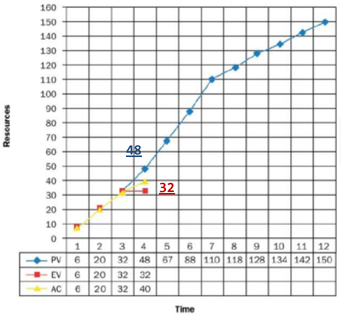


Actual Cost

Actual Cost (AC), also known as the Actual Cost of Work Performed (ACWP), is an indication of the level of resources that have been expended to achieve the actual work performed to date (or in a given time period).



Schedule Variance

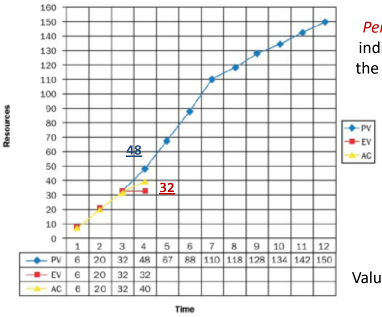


	1	2	3	4	5	6	7	8	9	10	11	12
PV	6	20	32	48	67	88	110	118	128	134	142	150
EV	6	20	32	32								
AC	6	20	32	40								

The Schedule Variance (SV) determines whether a project is ahead of or behind schedule.

SV = EV – PV
= 32 – 48
= – 16

Schedule Performance Index



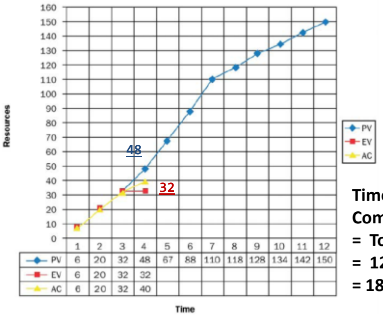
	1	2	3	4	5	6	7	8	9	10	11	12
PV	6	20	32	48	67	88	110	118	128	134	142	150
EV	6	20	32	32								
AC	6	20	32	40								

The Schedule Performance Index (SPI) indicates how efficiently the project team is using its time.

SPI= EV/PV
= 32/48
= 0.67

SPI is calculated by dividing the Earned Value(EV) by the Planned Value (PV).

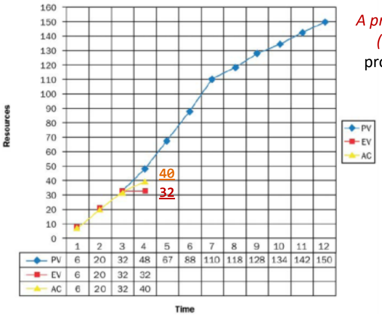
Time Estimate at Completion



	1	2	3	4	5	6	7	8	9	10	11	12
PV	6	20	32	48	67	88	110	118	128	134	142	150
EV	6	20	32	32								
AC	6	20	32	40								

Time Estimate at Completion
= Total Time/SPI
= 12/0.67
= 18 months

Cost Variance

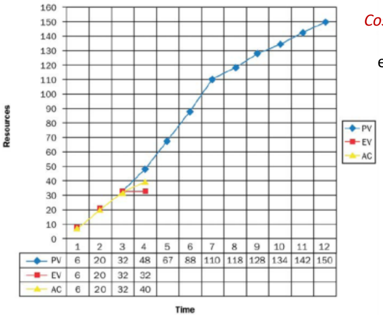


	1	2	3	4	5	6	7	8	9	10	11	12
PV	6	20	32	48	67	88	110	118	128	134	142	150
EV	6	20	32	32								
AC	6	20	32	40								

A project's Cost Variance (CV) shows whether a project is under or over budget.

CV = EV – AC
= 32 – 40
= – 8

Cost Performance Index

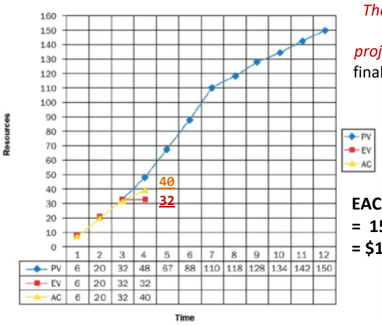


	1	2	3	4	5	6	7	8	9	10	11	12
PV	6	20	32	48	67	88	110	118	128	134	142	150
EV	6	20	32	32								
AC	6	20	32	40								

Cost Performance Index (CPI) gauges how efficiently the team is using its resources.

CPI = EV/AC
= 32/40
= 0.8

Estimate at Completion



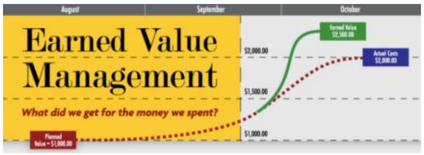
	1	2	3	4	5	6	7	8	9	10	11	12
PV	6	20	32	48	67	88	110	118	128	134	142	150
EV	6	20	32	32								
AC	6	20	32	40								

The calculated Estimate at Completion (EAC) projects for the team the final cost of the project if current performance trends continue.

EAC = BAC/CPI
= 150/0.8
= $187.5

Earned Value Management

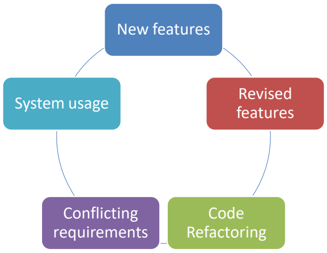
Earned value management (EVM) is a project management technique for measuring project performance and progress in an objective manner.

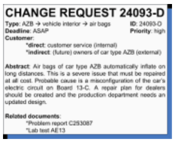


Good metrics let us see if we are doing the right things and doing them well.

Software Changes [2]

Software changes are the modifications of system for a specific purpose.





CHANGE REQUEST 24093-D

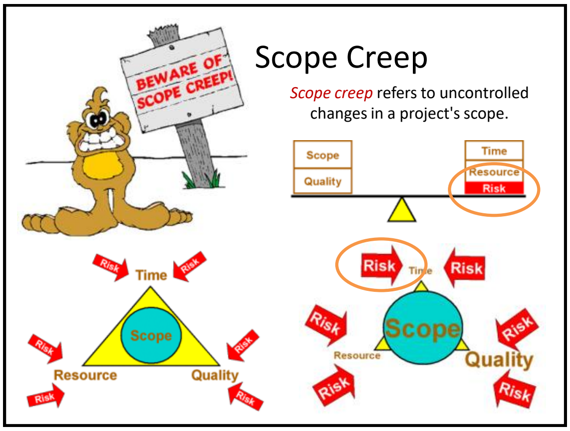
Type: AZB → vehicle interior → air bags **ID**: 24093-D
Deadline: ASAP **Priority**: high
Customer:
*direct: customer service (internal)
*indirect: (future) owners of car type AZB (external)

Abstract: Air bags of car type AZB automatically inflate on long distances. This is a severe issue that must be repaired at all cost. Probable cause is a misconfiguration of the car's electric circuit on Board 13-C. A repair plan for dealers should be created and the production department needs an updated design.

Related documents:
*Problem report C253087
*Lab test AE13

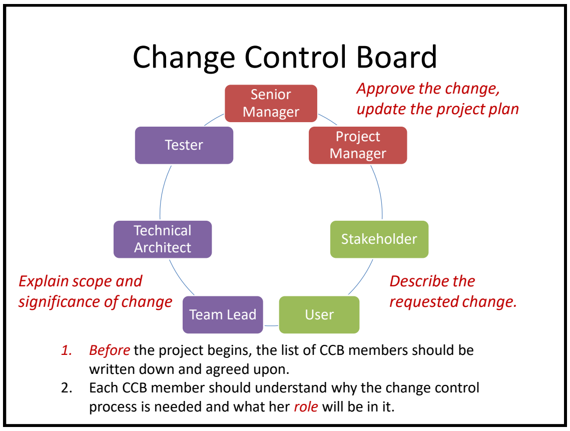
Basic Principles

- Change often involves a loss, and people go through the "loss curve" (*SARAH* - Shock, Anger, Rejection, Acceptance, Healing)
- *Fears* have to be dealt with
- Different people *react* differently to change
- Everyone has *fundamental needs* that have to be met
- Expectations need to be managed *realistically*
- Give people *information*
- Give people *choices* to make, and be honest about the possible consequences of those choices
- Give people *time*, to express their views, and support their decision making, providing coaching, counseling or information as appropriate
- Provide *reassurances*
- Make time for *informal discussion* and feedback



Scope Creep

Scope creep refers to uncontrolled changes in a project's scope.



Change Control Board

Senior Manager

Approve the change, update the project plan

Tester

Project Manager

Technical Architect

Stakeholder

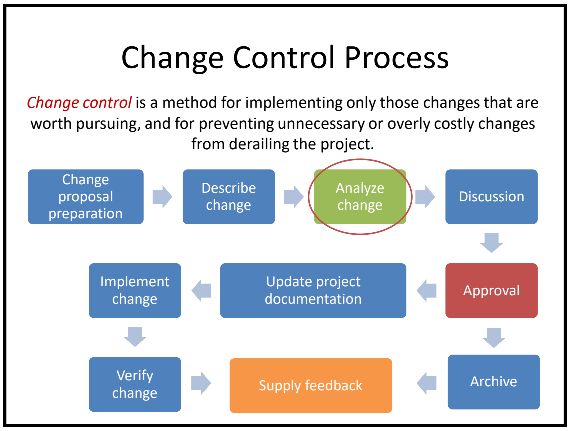
Explain scope and significance of change

Describe the requested change.

Team Lead

User

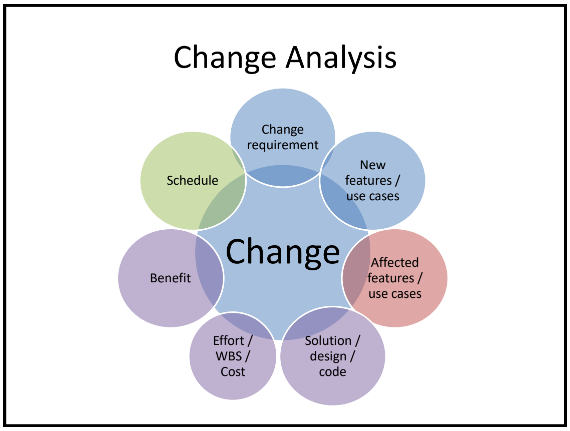
1. *Before* the project begins, the list of CCB members should be written down and agreed upon.
2. Each CCB member should understand why the change control process is needed and what her *role* will be in it.



Change Control Process

Change control is a method for implementing only those changes that are worth pursuing, and for preventing unnecessary or overly costly changes from derailing the project.

Change proposal preparation → Describe change → Analyze change → Discussion → Approval → Update project documentation → Implement change → Verify change → Supply feedback ← Archive ← Approval



Change Analysis

Change

Change requirement

New features / use cases

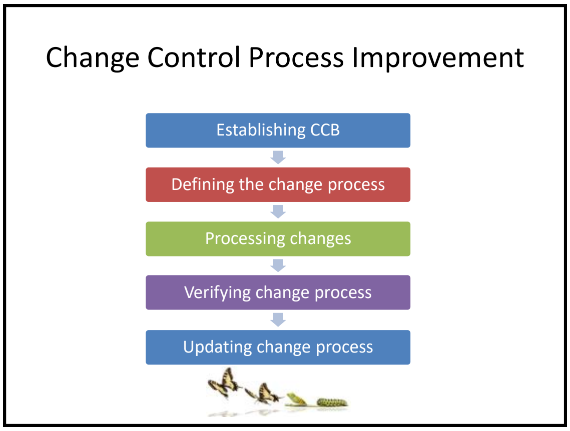
Affected features / use cases

Solution / design / code

Effort / WBS / Cost

Benefit

Schedule



Change Control Process Improvement

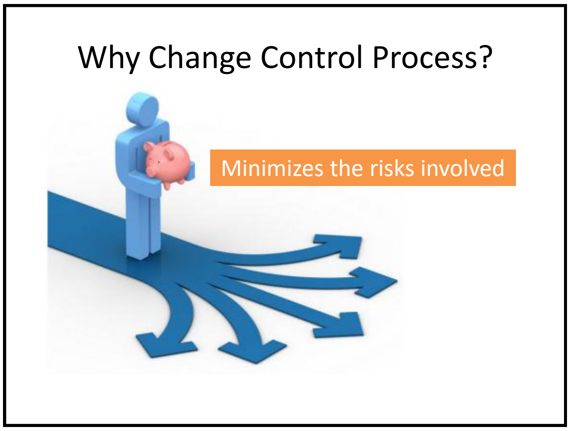
Establishing CCB

Defining the change process

Processing changes

Verifying change process

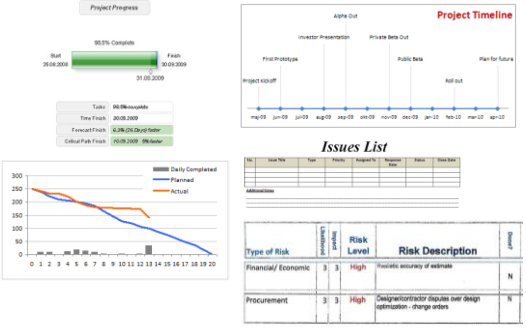
Updating change process



Why Change Control Process?

Minimizes the risks involved

Weekly Status Report (1)



Issues List

No.	Issue Title	Type	Priority	Assigned To	Response Date	Status	Close Date

Additional Notes

Type of Risk	Likelihood	Impact	Risk Level	Risk Description	Done?
Financial/ Economic	3	3	High	Realistic accuracy of estimate	N
Procurement	3	3	High	Designer/contractor disputes over design optimization - change orders	N

Weekly Status Report (2)

- Project: ....
- *Start*: MM/DD/YYYYY. *Finish*: MM/DD/YYYY.
- *Total effort*: N man-day. *Duration*: D days. *Cost*: $M
- *Week ending*: MM/DD/YYYY. *Schedule variance*: X. *Cost variance*: Y.
- *Schedule status*: P% completed. *Remaining effort*: R man-day. See the attached schedule for details.
- *Issues*: .... Resolution:....
- *Changes*: ....
- *Next milestone*: MM/DD/YYYY – Goal: P% completed.
- *Activities for next week*: ....
- *Risks*: .... Resolution:...

Additional Effort Request

Project name: XYZ

Additional effort request: (days)

Issues/Reasons:

+) Issue 1/Reason 1

+) Issue 2/Reason 2

Things needed to be completed (Additional effort will be spent on):

+) Task 1

+) Task 2

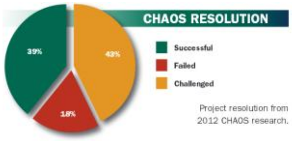
• *Original total effort*: (days) • *Original finish date*: MM/DD/yyyy	• *New total effort*: (days) • *New finish date*: MM/DD/yyyy

Tell Everyone the Truth [2]

- **DO NOT**
  - Put *pressure* on the team to work late and make up the time.
  - Trim the *scope*, gut quality tasks, start eliminating *reviews*, inspections, and pretty much any *documentation*, and just
  - Stop *updating the schedule* entirely.
  - Wait until the *very last minute* to tell everyone that the project is late

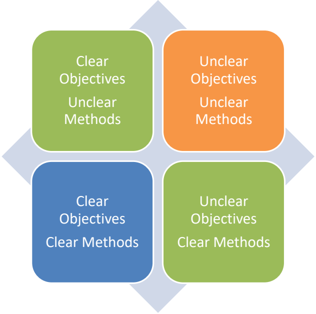
Projects Success and Failure

- *Success*: The project is completed on time and on budget, with all features and functions originally specified.
- *Challenged*: The project is completed and operational, but over budget, late, and with fewer features and functions than initially specified.
- *Failure*: The project is canceled before completion, or never implemented.



Project resolution from 2012 CHAOS research.

Causes of Project Failure



Clear Objectives Unclear Methods

Unclear Objectives Unclear Methods

Clear Objectives Clear Methods

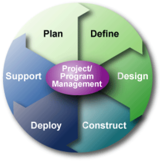
Unclear Objectives Clear Methods

Why Projects Fail? [4]

- Unrealistic or unarticulated project *goals*
- Badly defined system *requirements*
- Inaccurate *estimates* of needed resources
- Poor *reporting* of the project's status
- Poor *communication* among customers, developers, and users
- Use of immature *technology*
- Inability to handle the project's *complexity*
- Sloppy development *practices*
- Unmanaged *risks*
- Constant *change* of requirements
- Poor project *management*
- Stakeholder *politics*
- Commercial *pressures*

Software Project Management [5]

- *Project management* is the discipline of planning, organizing, securing and managing resources to bring about the successful completion of specific project goals and objectives. [Longman Dictionary of Business English, 1996]



Plan

Define

Design

Construct

Deploy

Support

Project/ Program Management

Project Manager's Responsibilities

- Define the *scope* and analyze the *feasibility* of your project
- Estimate the *effort* required to do the work and schedule your project
- Manage the *requirements*, specifications, design, programming, and testing of the software or items purchases
- Manage the *development process* of project
- Liaison with *customer* and management about the project
- Provide *guidance* if your project runs into quality problems
- Make *effective changes* to the way projects are run in your organization

Project Manager's Skill Set

- *Planning*, estimating
- Problem solving, time management
- *People management* (customers, suppliers, functional managers and project team)
- Negotiation, conflict management
- Effective communication (verbal and written)
- Influencing
- Contract management
- Creative thinking
- Leadership

Project Manager Hiring

- Education: Bachelor of IT/Software Engineering or Information System.
- *Language*: Excellent in English (4 skills) & all communication skills.
- Have *knowledge and experience* in Web development and some technologies (.NET or PHP or JAVA).
- Strong knowledge in *software engineering process* (such as Agile, XP, and/or CMMi) and tools (MS project).
- Strong and confident in problem solving, conflict resolution, negotiation and customer *management skills*.
- Personality: Dedicated, confident, *business-minded*, pro-active, self-organized, hard-working.

Who are Interested in Project Management?

Project manager

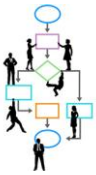
Programmer, designer, business analyst, architect, tester, or other member of a software team

Researcher, consultant or quality assurance manager

Why Project Management?

- Projects must be *within cost*.
- Projects must be delivered *on time*.
- Projects must be *within scope*.
- Projects must meet customer *quality requirements*.

- Project management *reduces* risks and *increases* the chance of success.
- A good project management discipline will *not* eliminate all risks, issues and surprises but it will provide standard processes and procedures to deal with them.

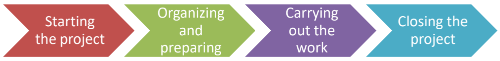


How to Manage a Project? [1]

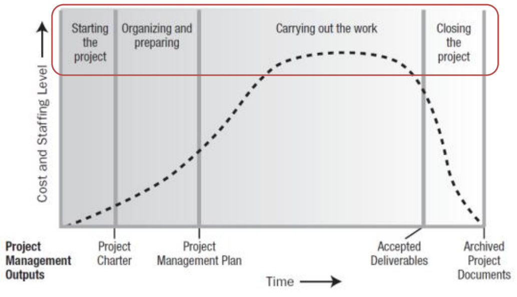
- Understand the four P's—*product*, *process*, *project* and *people.*
- Communication with the customer and other stakeholders must occur so that *product* scope and requirements are understood.
- A *process* that is appropriate for the people and the product should be selected.
- The *project* must be planned by estimating effort and calendar time to accomplish work tasks: defining work products, establishing quality checkpoints, and identifying mechanisms to monitor and control work defined by the plan.
- *People* must be organized to perform software work effectively.

Project Life Cycle [5]

- *Project management* is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements.
- How *many* activities are there? – Understand the project life cycle.
- A *project life cycle* is the series of phases that a project passes through from its initiation to its closure.
- *Project phases* are divisions within a project where extra control is needed to effectively manage the completion of a major deliverable.

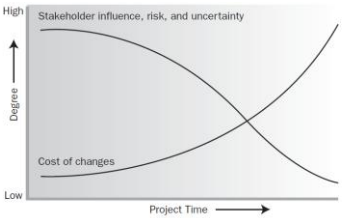


How to Organize Cost, Staffing and Work Products ?



Typical Cost and Staffing Levels Across the Project Life Cycle

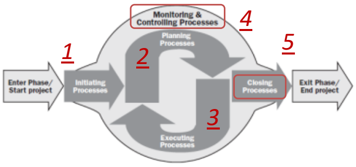
How to Manage Changes and Risks?



Impact of Variables Based On Project Time

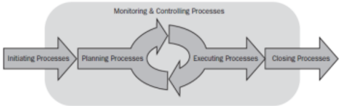
How to Manage a Phase? [5]

- Effectively *use* appropriate processes.
- *Project management processes* are grouped into five categories known as Project Management Process Groups (or Process Groups)



How to Manage a Typical Project?

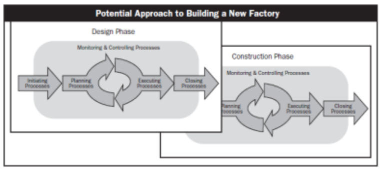
- Project phases are typically completed *sequentially*.
- Effectively *use* appropriate processes.



Example of a Single-Phase Project

How to Manage a Complex Project?

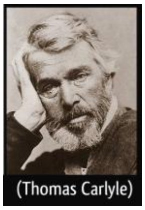
- The phase structure allows the project to be segmented into logical subsets for *ease of management, planning*, and *control*.
- The number of phases, the need for phases, and the degree of control applied depend on *the size, complexity,* and *potential impact* of the project.



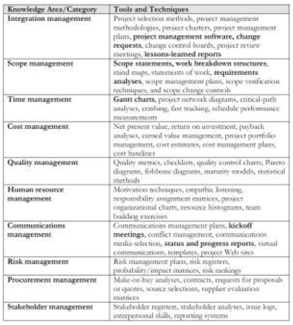
A Project with Overlapping Phases

Project Management Tools and Techniques [6]

**Man is a tool-using animal.
Without tools he is nothing, with tools he is all.**



(Thomas Carlyle)



Knowledge Area/Category	Tools and Techniques
Integration management	Project selection methods, project management methodologies, project charters, project management plans, **project management software, change requests**, change control boards, project review meetings, **lessons-learned reports**
Scope management	**Scope statements, work breakdown structures**, mind maps, statements of work, **requirements analyses**, scope management plans, scope verification techniques, and scope change controls
Time management	**Gantt charts**, project network diagrams, critical-path analyses, crashing, fast tracking, schedule performance measurements
Cost management	Net present value, return on investment, payback analyses, earned value management, project portfolio management, cost estimates, cost management plans, cost baselines
Quality management	Quality metrics, checklists, quality control charts, Pareto diagrams, fishbone diagrams, maturity models, statistical methods
Human resource management	Motivation techniques, empathic listening, responsibility assignment matrices, project organizational charts, resource histograms, team building exercises
Communications management	Communications management plans, **kickoff meetings**, conflict management, communications media selection, **status and progress reports**, virtual communications, templates, project Web sites
Risk management	Risk management plans, risk registers, probability/impact matrices, risk rankings
Procurement management	Make-or-buy analyses, contracts, requests for proposals or quotes, source selections, supplier evaluation matrices
Stakeholder management	Stakeholder registers, stakeholder analyses, issue logs, interpersonal skills, reporting systems

Thank You for Your Time