Project execution, monitoring and control

Management processes are based on PDCA cycle

- PLAN: Design or revise a process to achieve the desired results
- DO: Implement the plan and measure its performance
- CHECK: Analyze the metrics and review the results
- ACT: Decide what changes are needed to improve the process

Pictorially:

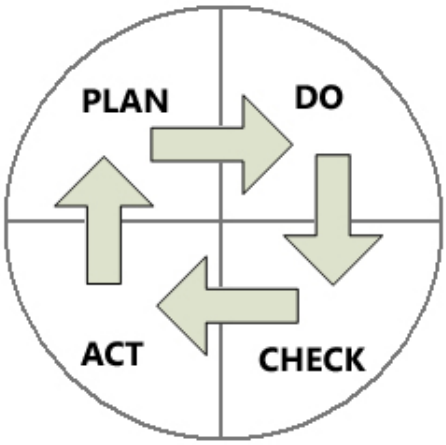

Figure 1. PDCA Cycle

In context of information system development

- planning is design or revise a information system development process to achieve the desired information system
- doing is developing information system and measuring its performance
- checking is analyzing of metrics and reviewing development results
- acting is deciding what changes are needed to improve development process

Project execution

- Perform the activities that produce deliverables
- Obtain vendor quotes, bids, and offers
- Staff, train, and manage human resources needed for the project team
- Incorporate approved changes into the project, which includes approved process improvement activities, approved corrective actions, approved preventative actions, and approved defect repair requests
- Collect and report on work performance information, such as status, cost, schedule, quality.

The main purpose is to get job done and primary goal for project manager is to buffer project team from unnecessary distractions and meetings. The team's focus needs to be on performing the work that fulfills the scope

Monitoring and controlling project work

- Comparing the work that is occurring to the project management plan
- Assessing work performance information to determine if any corrective or preventative actions are necessary
- Analyzing, tracking, monitoring, and reporting on project risks
- Providing status reports, accomplishments, and issue reports
- Monitoring the implementation of approved changes
- Making sure that approved defect repairs have been made

The main purpose is to make sure that the project plan is being followed and also forecast future performance on the project - to ensure quality of deliverables and processes to get them

Processes over management aspects (PMBOK)

Table 1. Executing & Monitoring & Controlling Processes over Aspects

Management aspect	Executing processes	Monitoring & controlling processes
Integration	Direct and Manage Project Execution	Monitor and Control Project Work Perform Integrated Change Control
Scope		Verify Scope Control Scope
Time		Control Schedule
Cost		Control Costs
Quality	Quality Assurance	Quality Control
Human Resource	Acquire Project Team Develop Project Team Manage Project Team	

Communications	Distribute Information Manage Stakeholder Expectations	Report Performance
Risks		Monitor and Control Risks
Procurement	Conduct Procurements	Administer Procurements

Process of monitoring consists of:

- Determination of aspects we need to monitor and control – deliverable, process, resource usage etc
- Determination of characteristics or metrics we want to measure – defect rate, velocity, productivity etc and raw data or primitive metrics on what measurement of these metrics are based
- Setting performance standards - criteria against what we need to compare actual measurement results
- Setting up methods and tools to measure and get these raw data
- Measurement of actual performance
- Setting up status reporting: status reporting from team to project manager; from project manager to steering commitee or customer

Continuous monitoring gives the project management team insight into the health of the project, and identifies any areas that can require special attention

Things to be measured by RUP

- The Process - the sequence of activities invoked to produce the software product (and other artifacts)
- The Product - the artifacts of the process, including software, documents and models
- The Project - the totality of project resources, activities and artifacts
- The Resources - the people, methods and tools, time, effort and budget, available to the project

Characteristics in measuring the process

- Duration - elapsed time for the activity
- Effort - staff effort units (staff-hours, staff-days, ...)

- Output - artifacts and their size and quantity (note this will include defects as an output of test activities)
- Staff turnover - a useful metric which may explain at a post-mortem review why a process went particularly well, or badly
- Effort application - the way effort is spent during the performance of the planned activities (against which time is formally recorded for cost account management)
    - training, familiarization, administration, research lost time, meetings etc

Characteristics in measuring the product

- Progress – number of implemented code, components etc
- Quality – number of defects and type
- Completeness – results accordance to requirements
- Stability – number of changes in requirements or realization, quantity or complexity
- Maturity – frequency of discovered defects
- Effort – amount of work for obtaining result

Characteristics in measuring the project

- Modularity - average breakage (NCNB*) per perfective or corrective change on implementation model
- Adaptability - average effort per perfective or corrective change on implementation model
- Maturity - active test time/number of corrective changes
- Maintainability - Maintenance Productivity/Development Productivity = [actual cumulative fixes/cumulative effort for perfective and corrective changes]/[estimated number of NCNB at completion/estimated production effort at completion]
- Rework stability - cumulative breakage-cumulative fixes
- Rework backlog - [cumulative breakage-cumulative fixes]/NCNB unit tested

* NCNB is non-comment, non-blank code size

Characteristics in measuring the resources

- Velocity of team(member)
- People - experience, skills, cost, performance, planned value, earned value
- Methods and tools - effect on productivity and quality, cost
- Budget - resources consumed, resources remaining

Agile monitoring and control

- Product owner has interest of:
  - Progress of Sprint– how team works to accomplish Sprint goals
  - Progress of release – will quality and functional release be ready for due date
  - Product progress – how product will be ready as needed
- To answer these questions we need to assess
  - Product backlog
  - Release backlog
  - Sprint backlog
- To assess backlogs Burn-Down chart – we get
  - Trends of backlog
  - Team velocity = actual work hours /remaining work hours

Status report

To project manager:

- During reporting period finished tasks and consumed work hours
- Estimations for unfinished tasks and expendable work hours
- Emerging problems

To Steering Committee (or customer):

- Technical progress – obtained results, changes in scope
- Budgetary progress – made costs to status date
- Temporal progress – milestones hit rate
- Actual project scope – corrected estimations for achieved so far and yet achievable
- Raise problems, what are in authority of steering commitee

Project work control

- Purpose: To observe project execution so that potential problems can be identified in a timely manner and corrective action can be taken, when necessary, to control the execution of the project
- Control in management means setting standards, measuring actual performance and taking corrective action.
- Includes:
  - Compairing actual performance with standards

  - Analysing deviations
  - Correcting deviations

Schedule control

Is concerned with

- Determining the current status of the project schedule
- Influencing the factors that create schedule changes
- Determining that the project schedule has changed
- Managing actual changes as they occur

Inputs

- Schedule baseline
- Performance reports
- Approved change request

Outputs

- Performance measurements
- Calculated schedule variance (SV)
- Schedule performance index (SPI)
- Updated schedule baseline
- Recommended corrective actions
- Lessons learned documentation

Tools and techniques

- Performance measurement
- Variance analysis
- Progress reporting

Methods for threatened schedule

- Shortening duration of critical path tasks:
  - raising effectiveness;
  - increasing useful resources
- Reducing amount of planned work
- Changing work sequence:
  - putting tasks in parallel or partly parallel
  - reducing tasks splitting
- Shifting deadlines

Cost control

- Monitoring cost performance to detect and understand variances from the cost baseline

- Searching out the causes of positive and negative variances to avoid inappropriate responses to cost variances that can cause
- Quality or schedule problems
- Produce an unacceptable level of risk later in the project
- Acting to bring expected cost overruns within acceptable limits
- Preventing incorrect, inappropriate, or unapproved changes from being included in the reported cost or resource usage
- Informing appropriate stakeholders of approved changes

Inputs

- Cost baseline
- Project funding requirements
- Performance reports
- Approved change requests

Outputs

- Updated cost estimates
- Performance measurements
- CV, SV, CPI, SPI
- Forecasted completion
- EAC
- Requested changes and recommended corrective actions

Tools and techniques

- Earned Value Analysis

Quality assurance and control

Quality as conformance to requirements and fitness for use. From a customer`s standpoint, quality is the customer`s perceived value of the product he or she purchased, based on a variety of variables such as price, performance, reliability and satisfaction

The Perform Quality Assurance process executes the quality management plan and the process improvement plan, and by doing so ensures that the project's quality processes are aligned with the plans. The premise behind quality assurance is that if the quality of the project processes are improved then the quality of the deliverables will be subsequently improved

Quality assurance is concerned with quality processes while quality control is concerned with quality deliverables. Another way for us to remember this is that Perform Quality Assurance is an executing process while Perform Quality Control is a monitoring and control process.

Project vital signs

Comprehensive method for monitoring, reporting, and taking timely actions to correct problems during IT project. By Gopal K. Kapur - ProjectHALT Methodology

- Status of the Critical Path
- Mileston Hit Rate
- Deliverable Hit Rate
- Issues
- Cost-to-Date vs. Estimated Cost-to-Date
- Actual Resources vs. Planned Resources
- High Probability, High Impact Risk Events
- General Disposition of the Team
- Sponsor's Commitment and Time

Status of the critical path

Communicates whether the project is on schedule, ahead of schedule, or behind of it.
Delay, what is:

- < 10% - a fairly normal fluctuation from the norm and can usually be recovered with strong guidance from the project manager and focused by the team
- 10% - 20% - problems resulting in the breach of the critical path are beyond the control of the team, and the project manager and the sponsor need to make sure the team has a viable plan to recover the delay
- > 20% - extremely difficult to recover from such delays without compromising the other 3 key components of the project – scope (functionality), budget, and quality. Unless the underlying problems are corrected, the project is sure to continue on its downward slide

Milestone hit rate

Indicates the number of milestones the team was planning to hit and the number of milestones they actualy hit during a specific reporting period
Methodology authors recommend 2 separate monitoring cycles:

- To-date performance - the total number of milestones planned to be hit vs. The total number of milestones actually hit
- A shorter monitoring cycle - every 2 weeks: the total number of milestones planned to be hit vs. The total number of milestones actually hit

The to-date hit rate tells of the overall speed and progress of the team, and the shorter monitoring cycle indicates the team´s recent progress

- A gap of 10% to 20% - the team is beginning to fall. Project manager need to review the situation, devise a plan for recovery, and work with the team to ensure it begins to increase its milestone hit rate

- > 20% - there is little progress on the project, the team is barely crawling, it has lost its focus and momentum. This type of slow down is sure to result in considerable delay in the currently promised delivery date of the project

Deliverable hit rate

Deliverables tell us about team´s accomplishments. It is important to monitor the team´s accomplishments in terms of deliverables planned for completion versus the number of deliverables actually completed. The failure of the team to maintain a consistent deliverable hit rate suggests that there are deep rooted issues that need to be resolved
2 separate monitoring cycles:

- To-date performance: the total number of deliverables planned to be completed to-date vs. The total number of deliverables actually completed
- A shorter monitoring cycle – every 4 weeks: the total number of deliverables planned to be completed vs. The total number of deliverables actually completed

The to-date completion rate of deliverables tells about the rate of the "build" of the project, and the shorter monitoring cycle indicates the ongoing progress
The total number of deliverables planned to be completed vs. The total number of deliverables actually completed, what has/is:

- A gap of 10% to 20% - some of the team members are encountering obstacles which are keeping them form finishing their deliverables. Critical path will soon be breached
- > 20% - too many delievrables are remain incomplete or have not yet been started. This could be due to such problems as shortage of resources, lack of appropriate skills, poor specifications, ad hoc change management process, or discovery of new functionality

Cost-to-date vs. estimated cost-to-date

As the project proceeds down its development path, it is imperative that the actual cost-to-date be compared to the estimated cost. Project manager must carefully monitor any overspending
If the actual cost-to-date is:

- Between 10% to 20% higher than the estimated cost-to-date
    - The return on investment (ROI) will be affected
    - The benefit to the bottom line will be considerably less than what was promised to the client at the time of original estimates
- > 20% higher than estimated cost
    - The projects actual cost is running at a rate that may fail to return any financial benefits at all

For organizations that do not monitor the total cost, emthodology authors suggest capturing Effort-to-Date vs. Estimated Effort-to-Date
If the actual effort-to-date is:

- Between 10% to 20% higher than the estimated effort-to-date

    - Original estimates were too optimistic, or
    - The team members are discovering complexities they had not forecast at the start of the project, or
    - Work environment is not very productive and too much time is being lost due to interruptions, or
    - Scope creep
- > 20% higher than estimated effort
    - Any return on investment promised to management at the time of project approval is breached
    - Overtime by the project team is present; excessive overtime, in turn leads to eventual low productivity and low quality of the end product as well team burnout

Actual resources vs. planned resources

There are 2 measurements of resources

- The gap between the number of full time equivalent (FTE) team members actually working on the project vs. The number of FTE team members initially planned
- The amount of unplanned turnover – the number of FTE team members that have left the team unexpectedly

The gap of less than 10% - If short term, usually does not result in any appreciable hit on schedule, functionality, or quality of the end product

If the project is under resourced by 10 to15% - serious hit on the quality of the end product, as there will be a little less testing, a little less documentation, and little less prototyping as planned

A resource gap > 15 % - in addition to a hit on the quality of the product, there will be a hit on the scope of the project: client does not get what was promised

A resource gap > 20 % - SOS – the schedule, scope, and quality of the project are all in jeopardy

Unplanned staff turnover

Based on 41 medium to large projects

- Unplanned turnover of a core team member causes the critical path to slip behind schedule by 4 to 6 weeks
- Unplanned turnover of a project manager delays a project by 6 to 9 weeks
- The change of a sponsor jeopardizes the entire project, as a new sponsor often wants to re-approve the projects budget, schedule, and mission

Project health report card

Table 2. Project vital signs

Vital Sign	Variance	Value
1. Status of the Critical Path (Delay)	‹10%	0
	10% to 20%	1
	›20%	2
2. Milestone Hit Rate (Gap)	‹10%	0
	10% to 20%	1
	›20%	2
3. Deliverable Hit Rate (Gap)	‹10%	0
	10% to 20%	2
	›20%	4
4. Issues	No Issues	0
	Issues ‹ Deliv.	1
	Issues › Deliv.	2
5. Cost-to-Date vs. Estimated Cost-to-Date (Higher)	‹10%	0
	10% to 20%	1
	›20%	2
6. Actual Resources vs. Planned Resources (Shortage)	‹10%	0
	10% to 15%	2
	›15%	4

7. High Probability, High Impact Risk Events	1-3 Risks	1
	4-5 Risks	3
	6-7 Risks	4
Assessment: 1-5 Green; 6-10 Yellow; 11-20 Red	Total	

Summary

- One thing is plan, another thing is acting according to that plan
- To ensure that project is under control, project manager must have overview of what is happening and knowledge about what should be happening
- Project manager must track "signs" of projects health or powerlessness and have knowledge and wisdom to act respectivelly

Used literature

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