

# Data Analysis Tools & Techniques in Project Management

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Data analysis tools give perspective to the raw project data, which helps the project manager make decisions on the project.



*On the project, the decision to use a specific data analysis technique may depend on the quality of data you have, and the best practices and tools support your organization can provide. In some cases this decision could be driven by the customer too.*



# Common Data Analysis Tools and Techniques in Project Management

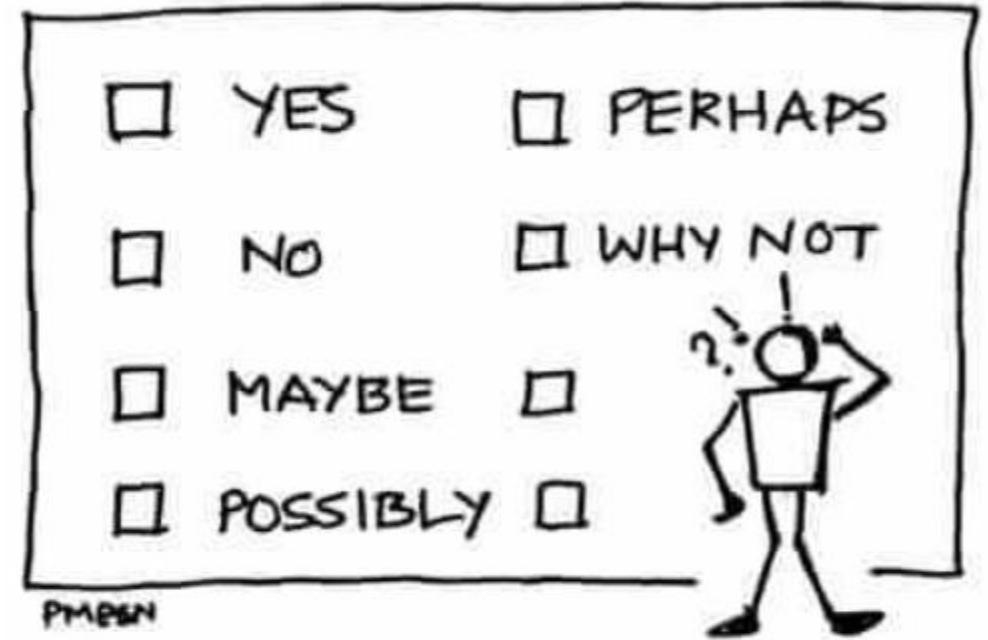
- [Alternatives analysis](#)
- [Assessment of other risk parameters](#)
- [Assumption and constraint analysis](#)
- [Cost of Quality \(CoQ\)](#)
- [Cost-benefit analysis \(CBA\)](#)
- [Decision tree analysis](#)
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# 1. Alternatives analysis

- Most of the decisions can be arrived at by identifying alternative approaches to solve the problem.
- Alternatives give us the opportunity to weigh in pros and cons and choose the ones that solve the problem most effectively.
- Many a decisions can be taken by using gut feel to analyze the alternatives.
- Some take more than that and need the use of advanced techniques such as Multi-Criteria Decision Analysis.



ALTERNATIVES ANALYSIS



# 1. Alternatives analysis

- In its simple form Alternatives analysis contains these steps –
  1. Identify the problem
  2. Note down the alternatives to arrive at the solution
  3. Identify evaluation criteria for each of these alternatives
  4. Conduct market research for each of the criteria, and/or have numerical rating. You can also apply techniques such as cost-benefit analysis.
  5. Recommend solution based on the alternative that scores high

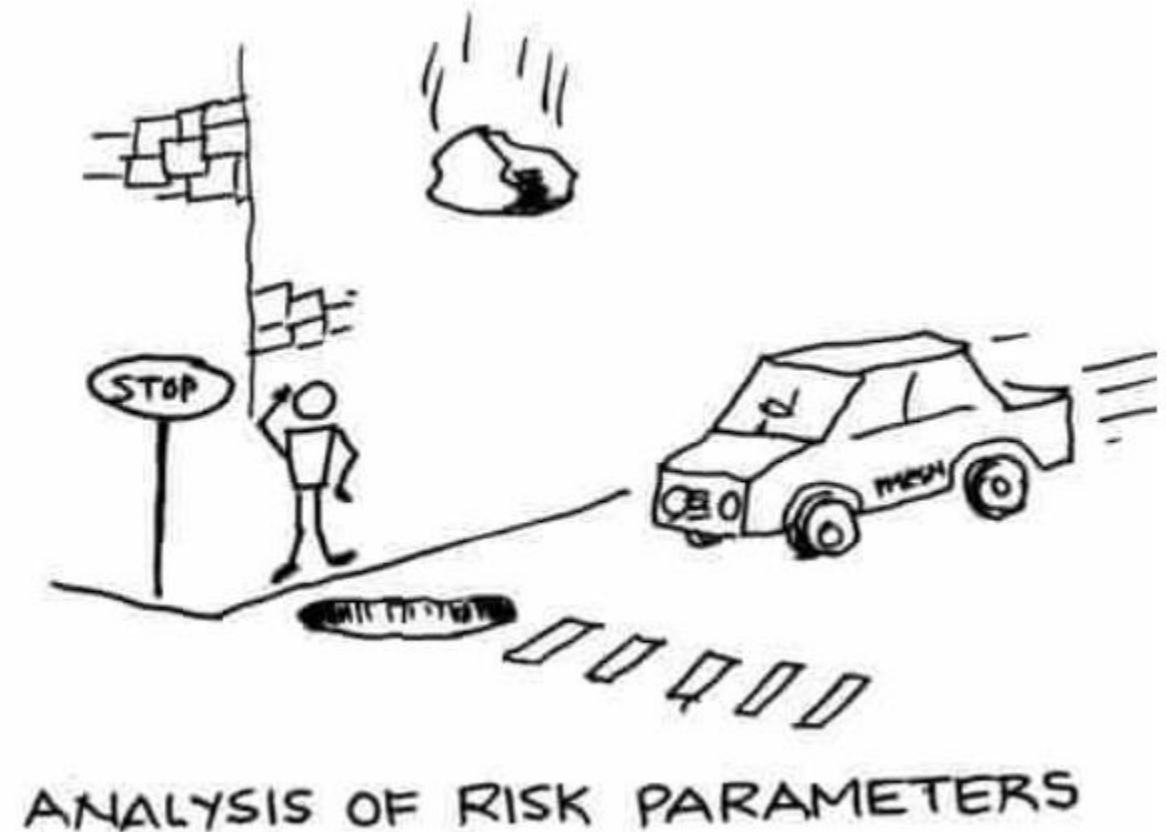


ALTERNATIVES ANALYSIS



## 2. Assessment of other risk parameters

- This technique is used only in one process – [Perform Qualitative Risk Analysis](#).
- In essence, this technique is about analyzing other parameters than just the Probability and Impact of a risk.

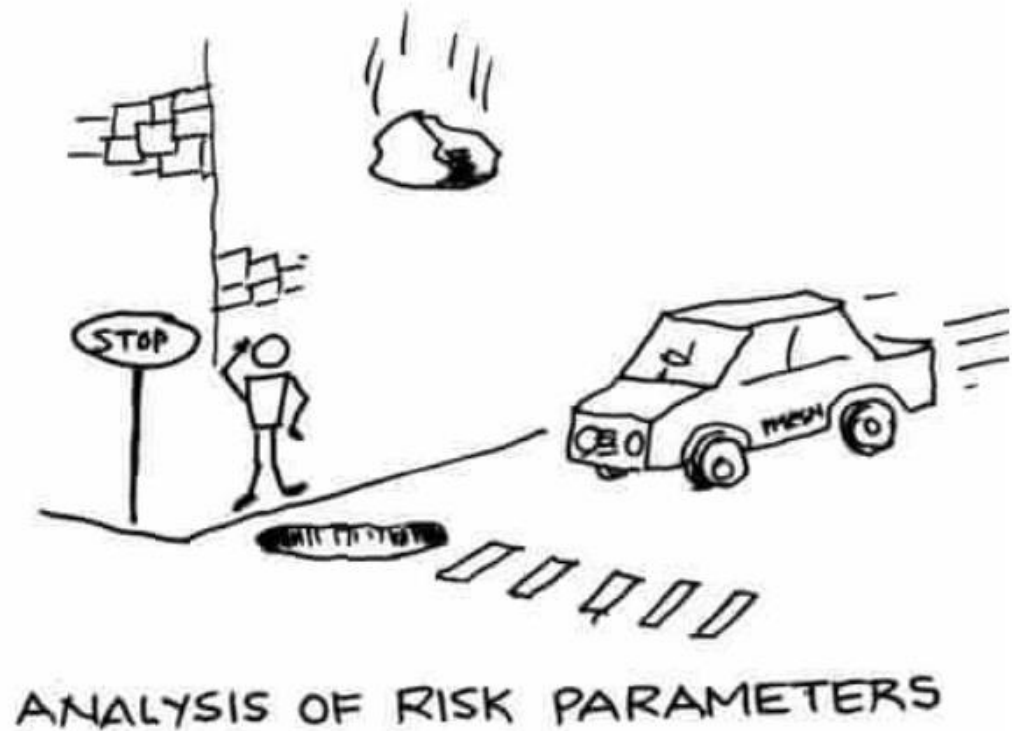




# 2. Assessment of other risk parameters

## Which are they?

- *Controllability* – the extent to which one can control the outcome of a risk
- *Connectivity* – the extent to which current risk is connected with other project risks
- *Detectability* – the ability to detect a risk when it materializes or is about to materialize
- *Dormancy* – the duration after a risk is materialized that its impact is discovered
- *Manageability* – the ability to manage the impact once a risk materializes
- *Propinquity* – the extent to which a risk impact is perceived by stakeholders. Propinquity is low if risk is considered to be non significant.
- *Proximity* to project objectives – the duration from the point or risk materialization to the point when it impacts one of project objectives
- *Strategic Impact* – the potential for the materialized risk to impact one or more of strategic objectives of the project
- *Urgency* – the duration from point of risk materialization in which risk response strategy must be applied to manage the risk.

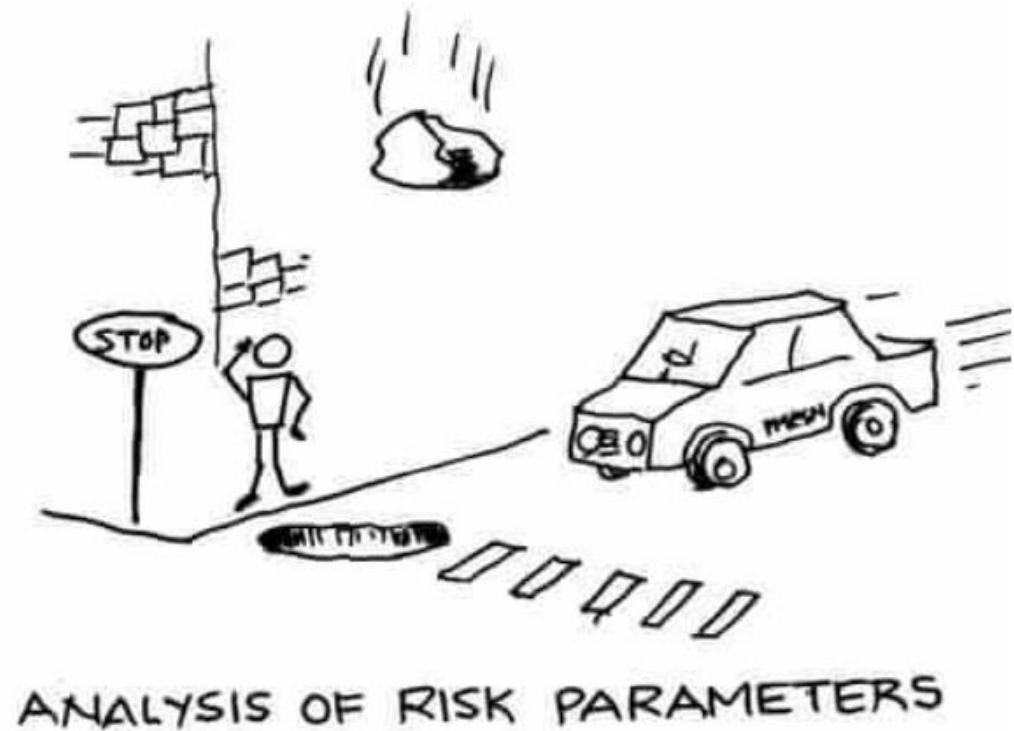




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[Review: How to calculate Critical Path](#)



# 3. Assumption and constraint analysis

- This again is one off technique that is used only in [Identify Risks](#) process.
- Every project works under certain constraints.
- And no plan has 100% certainty and so they are made under certain assumptions.
- Both these – constraints and assumptions – are made during project plan and/or project estimates.



# 3. Assumption and constraint analysis

In this analysis, we may figure that,

- Some of the constraints are no longer applicable. This may lead to positive risks (opportunities) and reduce costs, relax schedule, or benefit in other ways.
- Some of the assumptions are no longer valid and so can be removed. Again, these may be beneficial to the project and help achieve project objectives in a better way.
- Some new constraints and/or assumptions could be discovered, which would unearth new risks or secondary risks.



ASSUMPTION AND  
CONSTRAINT  
ANALYSIS





## 4. Cost of Quality (CoQ)

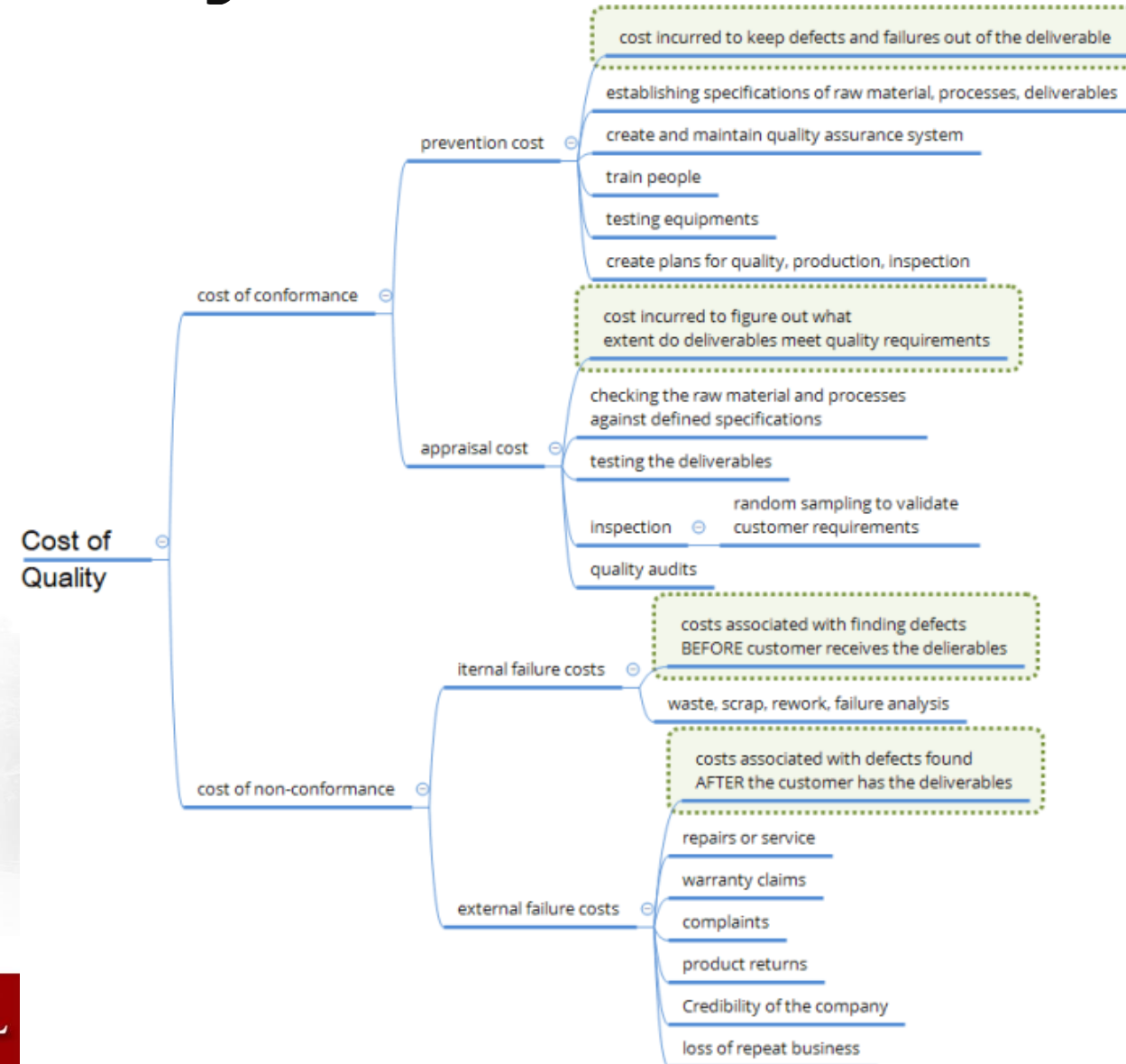
- This is an important technique to analyze the cost of quality activities – both of doing and not doing right set of activities.
- Cost of Quality consists of Cost of Conformance and Cost of Non-conformance.





# 4. Cost of Quality (CoQ)

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# 4. Cost of Quality (CoQ)

## Cost of Conformance

### • Prevention costs

- This is the cost of activities required to **prevent defects** and failures getting into the product as it is developed.
- establishing specifications of raw material, processes, deliverables
- create and maintain quality assurance system
- training people to work effectively to produce quality product
- equipment needed for conducting tests
- creating plans for quality, production, inspection

### • Appraisal costs

- This is the cost of activities conducted **to test** whether the product adheres to the agreed upon quality standards and requirements.
- checking the raw material and processes against defined specifications
- testing the deliverables
- inspection
- quality audits



# 4. Cost of Quality (CoQ)

## Cost of Non-conformance

- **Internal failure costs**

- Costs associated with fixing the deliverables after defects are found internally by the **testing team**.
- failure analysis
- rework required to fix issues found
- scraping the deliverables if defects/issues cannot be fixed
- waste generated during rework

- **External failure costs**

- Costs associated with repercussions after defects are found by the **customer**. This is the most expensive type of cost – both tangible and intangible.
- repairs or service
- warranty claims
- complaints
- product returns
- *credibility of the company*
- *loss of repeat business*





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## 4. Cost of Quality (CoQ)

Cost of Quality technique is used in the following processes:

- Estimate Costs
- Plan Quality Management



# 5. Cost-benefit analysis (CBA)

- Cost-benefit analysis is a way of evaluating alternative options to identify one that has the least amount of cost while providing the best way to achieve the benefits.
- This is also called Benefit Cost analysis.



COST-BENEFIT ANALYSIS



# 5. Cost-benefit analysis (CBA)

- This technique can be used to solve different problems such as choosing the best way to test a product, choosing the best risk mitigation strategy, choosing the best project among different opportunities and so on.
- The cost will have long term repercussions, right? What about impact of inflation on budget, for instance?
- That's the reason when the CBA is calculated from a long term perspective, you look at time value of money. By converting future expenses into present value.



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COST-BENEFIT ANALYSIS





# 5. Cost-benefit analysis (CBA)

- In its simplest form,

**Benefits – Costs = Net Present Value (NPV)**

- If NPV is positive then the undertaking is a profitable one, and if it is negative then it is unprofitable one.
- In the context of quality management, CBA is used to find which quality activity gives the best results.
- When used during project initiation stage, CBA is used to see if the project is a profitable venture. The present value of all the costs and present value of all the benefits are calculated in monetary figure and then the above formula is applied to see if the project would be profitable.
- CBA can also be used for making make-or-buy decision.
- When used in the change control process, CBA helps decide whether the proposed change request is worth implementing.



COST-BENEFIT ANALYSIS



# 5. Cost-benefit analysis (CBA)

Other processes that involved in CBA:

- Monitor and Control Project Work
- Perform Integrated Change Control
- Plan Quality Management
- Control Resources
- Plan Risk Responses



COST-BENEFIT ANALYSIS



## 6. Decision tree analysis

- Again, this is a data analysis technique that is used to find the best among several alternative scenarios. Best in terms of meeting project objectives.
- Typically used in the context of risk analysis this technique helps show various available decision paths passing through one or more decision points.
- As you can see each decision point may create more than one path (or branch, in the parlance of tree), and with multiple decision points the overall number of decision paths can grow exponentially.



## 6. Decision tree analysis

Most effective decision path is calculated based on expected monetary value of each of the paths and the one with most Net Path Value will be chosen.

- Decision tree has three types of nodes:
  - **Decision node** – represents a decision. Shown with a rectangle. Decision is written inside this rectangle.
  - **Chance node** – represents uncertainty associated with this decision. Could lead to a payoff or cost. Shown with a circle.
  - **End node** – end of path. Shown with a triangle.

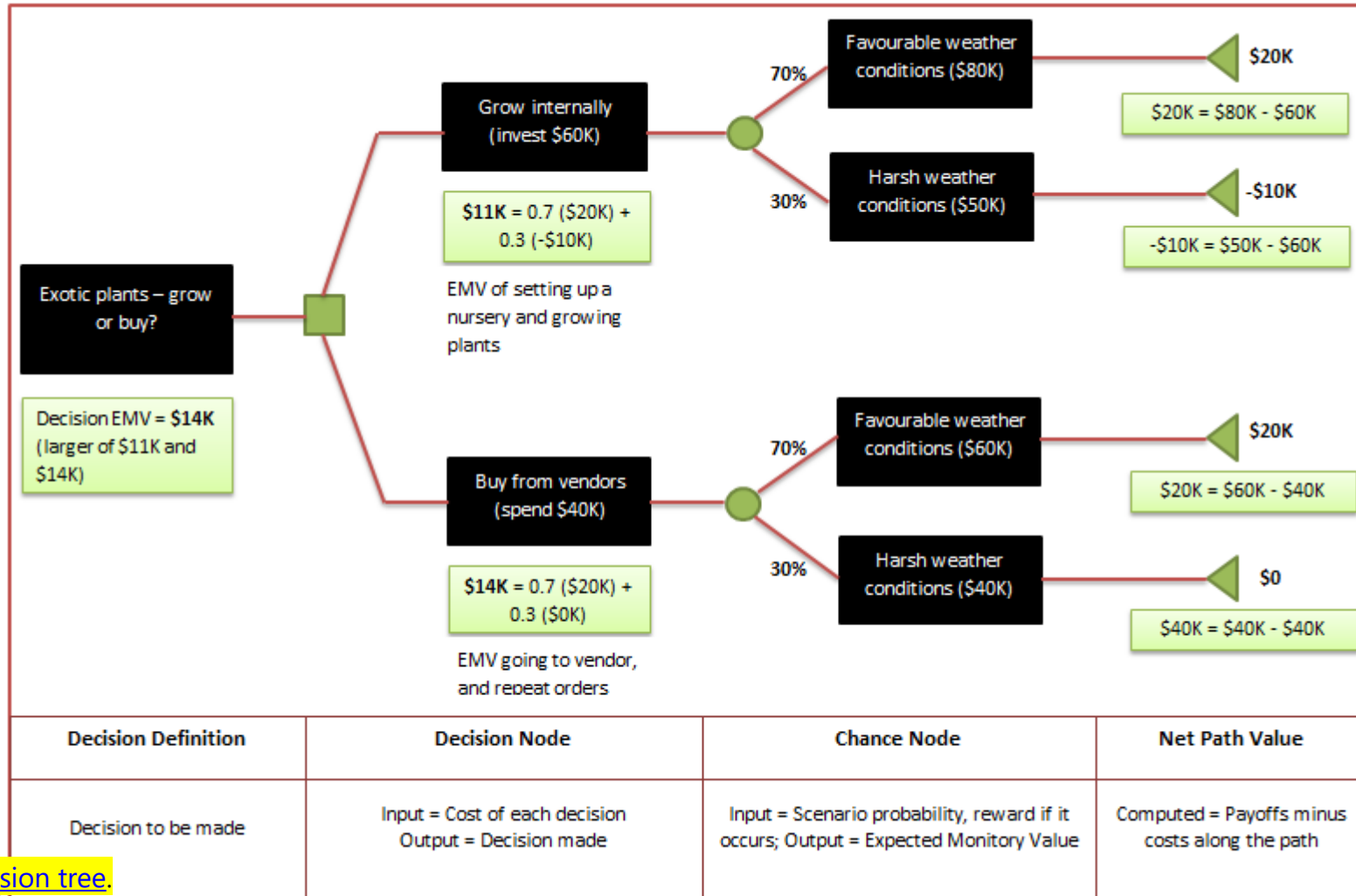




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Here's an example of Decision Tree, [click here for the complete example that is used to draw this decision tree.](#)



# 7. Document analysis

- Document analysis is what the name says – analyze the documents in order to get relevant information needed for decision making.
- As an example, in [Collect Requirements](#) process some of the documents that are used for analysis are – *Agreements, Business plans, Process flows, Issue logs, Organizational policies, Regulatory documents, Request for proposal*



DOCUMENT ANALYSIS



# 7. Document analysis

## The processes that use this technique are:

- [Close Project or Phase](#) – predominantly used for updating lessons learned register with all that has been learned in the project or phase.
- [Collect Requirements](#) – various documents as given in above list to understand requirements
- [Manage Quality](#) – here the reports coming from control processes – such as test reports, performance reports, and variance analysis reports – are going to be analyzed to ensure the deliverables meet quality requirements
- [Identify Risks](#) – as the process name suggests the idea here is to identify as many project risks as possible, and the documents that can help are various plans, agreements, project charter, business documents, technical documentation, requirements documentation and so on.
- [Identify Stakeholders](#) – as you know this is one of the initial processes executed on the project. At this time there are just a few documents available – business case document, project charter, benefits management plan, and of course lessons learned register. Analyzing these will help identify key stakeholders.



DOCUMENT ANALYSIS



## 8. Earned value analysis (EVA)

- Earned Value analysis is a technique using 3 main project constraints – Scope, Schedule, and Cost – to have a single measure of project performance.
- In the context of Earned Value management, the combination of approved Scope, Schedule, and Cost to give a measure of project progress is called as Performance Measurement Baseline (PMB).

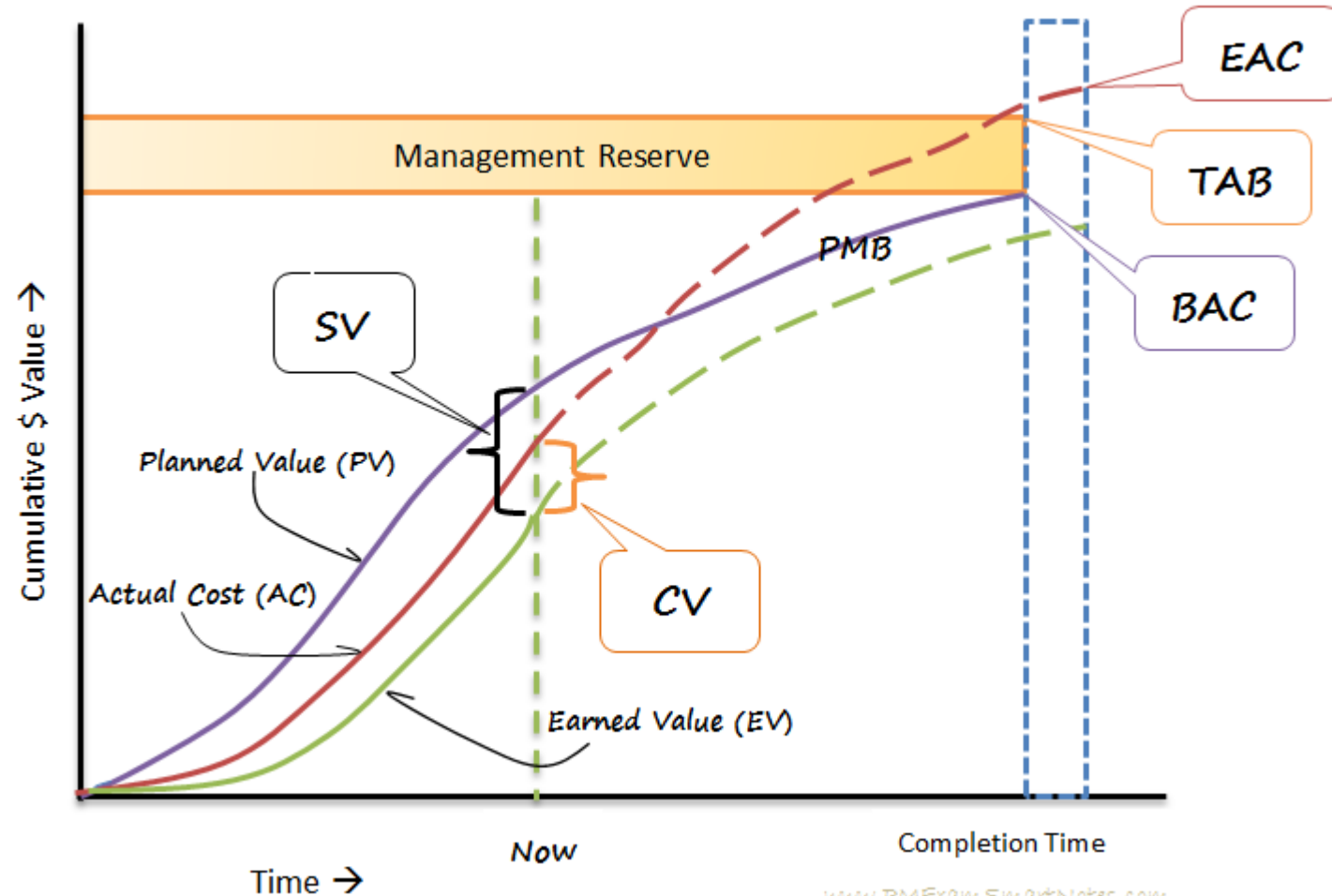




# 8. Earned value analysis (EVA)

**here's how we go about measuring project performance:**

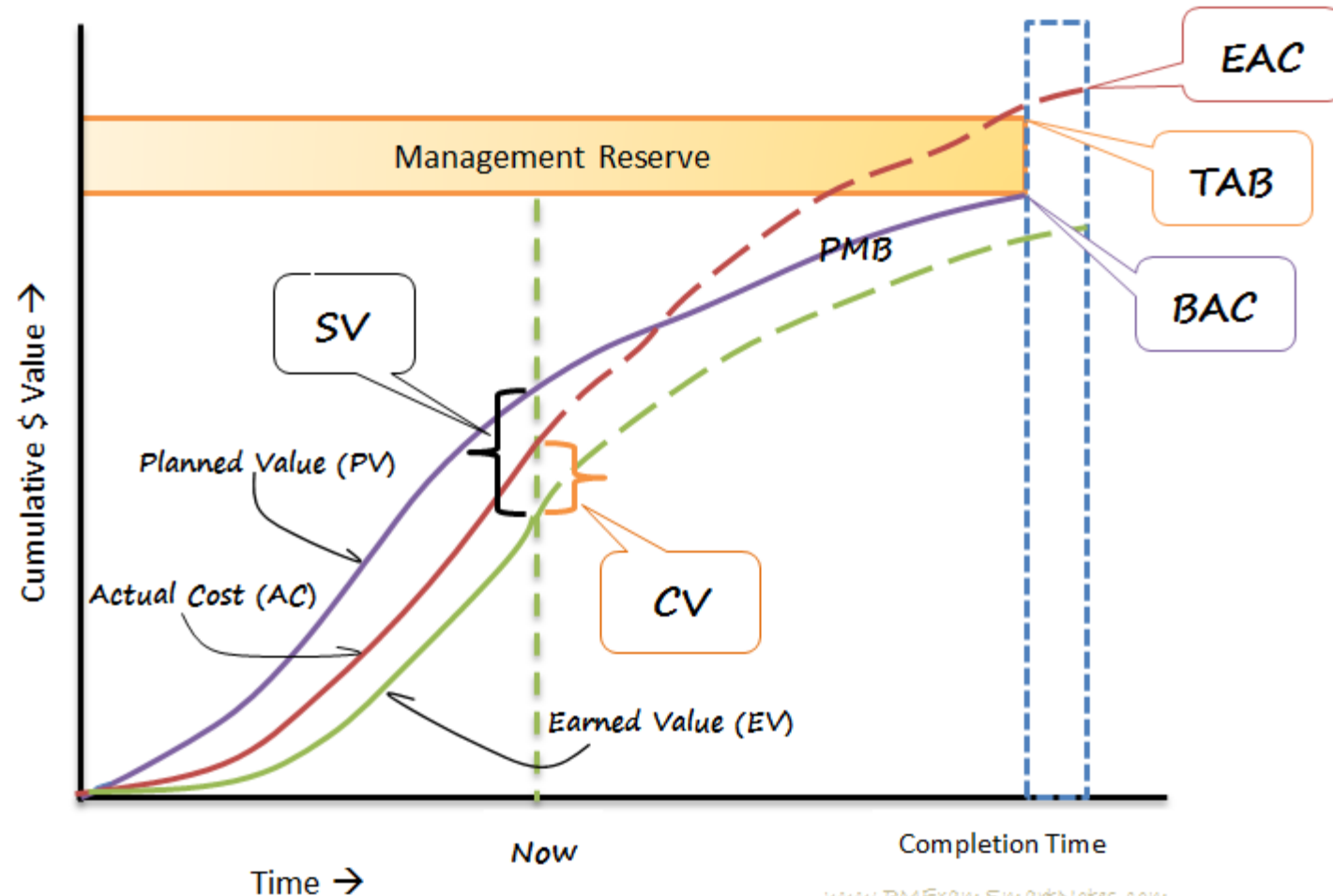
1. In the S-curve that you draw, PMB shows you the Planned Value of the project (cumulative) on any given day. The project progress is measured against PMB for that day, which tells us if there is a variance and whether it is positive.
2. That is, for a given day, PMB gives you the Planned Value. From the actual spending you know the Earned Value (that is the work completed and it's value earned).  $EV - PV$  gives you Schedule Variance. If you have earned more than planned then you are ahead of schedule, else behind.
3. Similarly, looking at the money spent to complete that much work (for which you calculated EV), you will get Actual Cost figure. And the formula  $EV - AC$  will tell you Cost Variance. Again, if it is positive your project is within budget, else it is not.



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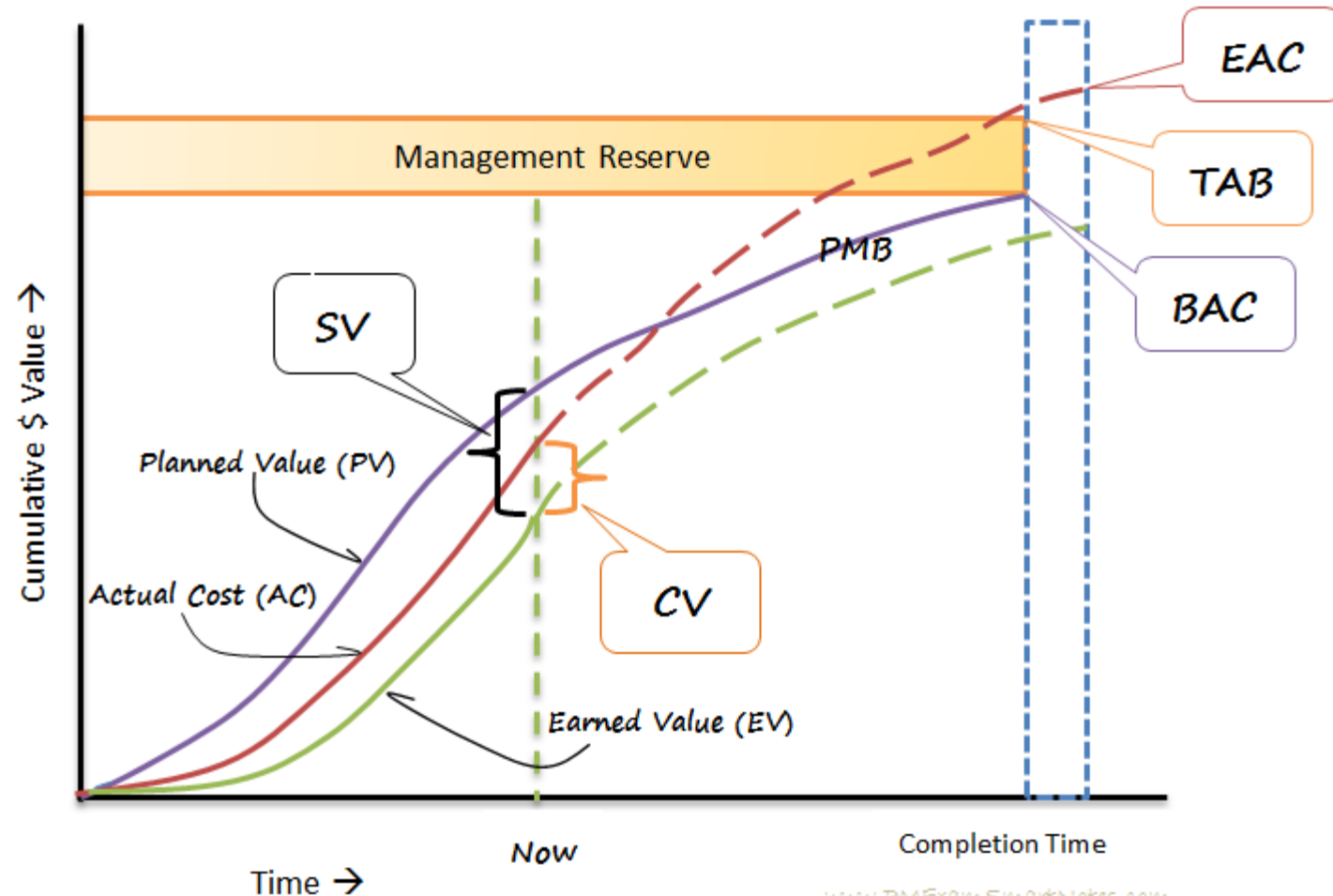
you can [study Earned Value Analysis in detail in this post](#)



# 8. Earned value analysis (EVA)

Control Costs is not the only process where Earned Value Analysis is done. Here's the entire list:

- Monitor and Control Project Work
- Control Schedule
- Control Costs
- Control Procurements

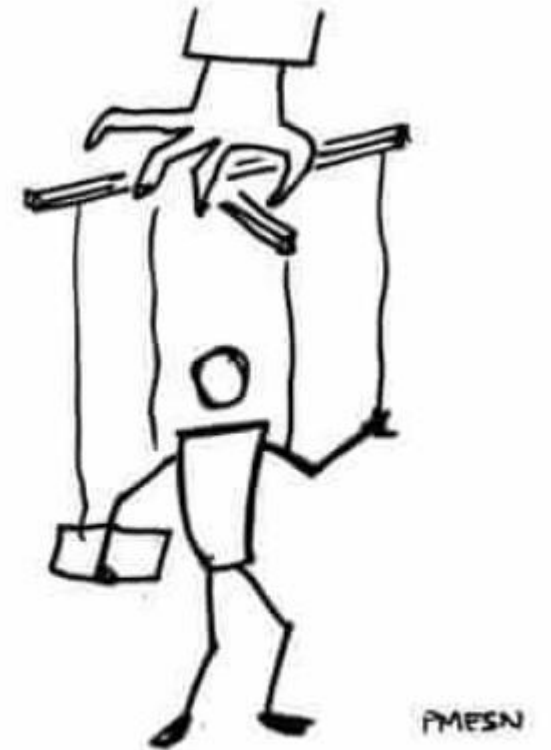


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# 9. Influence diagrams

- Influence diagrams are plotted to show relationship between variables involved in decision making process – in the context of uncertainty that is inherent.
- Influence diagram uses shapes to show area of uncertainty (oval), decisions or choices (rectangle), desired outcome (octagonal), and influences between them.
- This technique is used in [Perform Quantitative Risk Analysis](#) process.
- Risks develop from uncertainties in the project and Influence Diagram help you take better decisions in the face of uncertainty.
- Understanding this will give you insights into decision making process because you now understand which variables impact more the overall outcome of decision.



INFLUENCE DIAGRAM

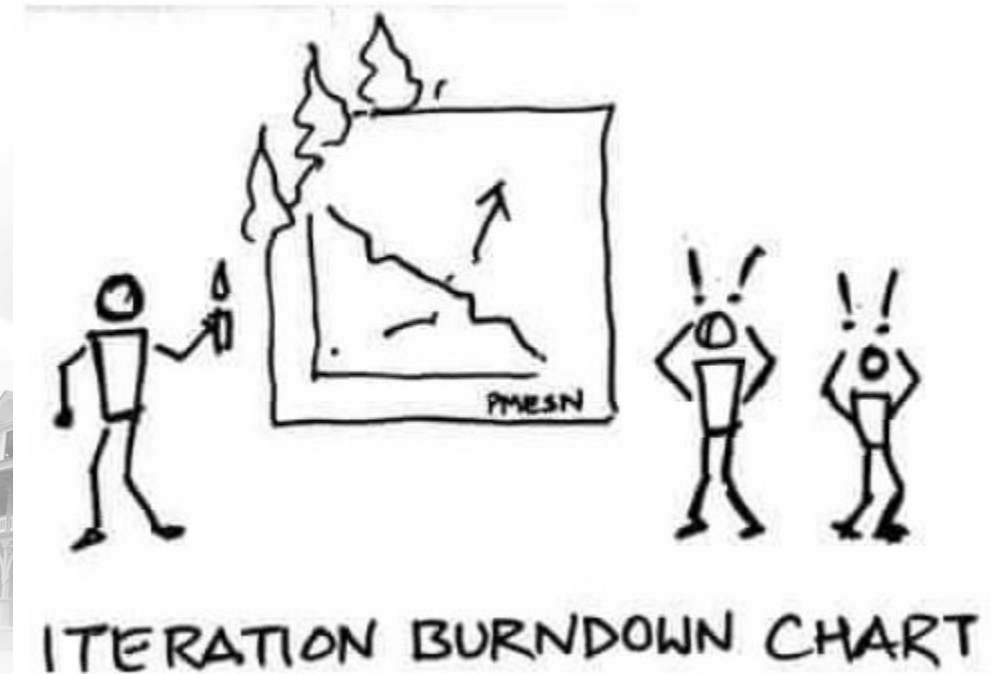






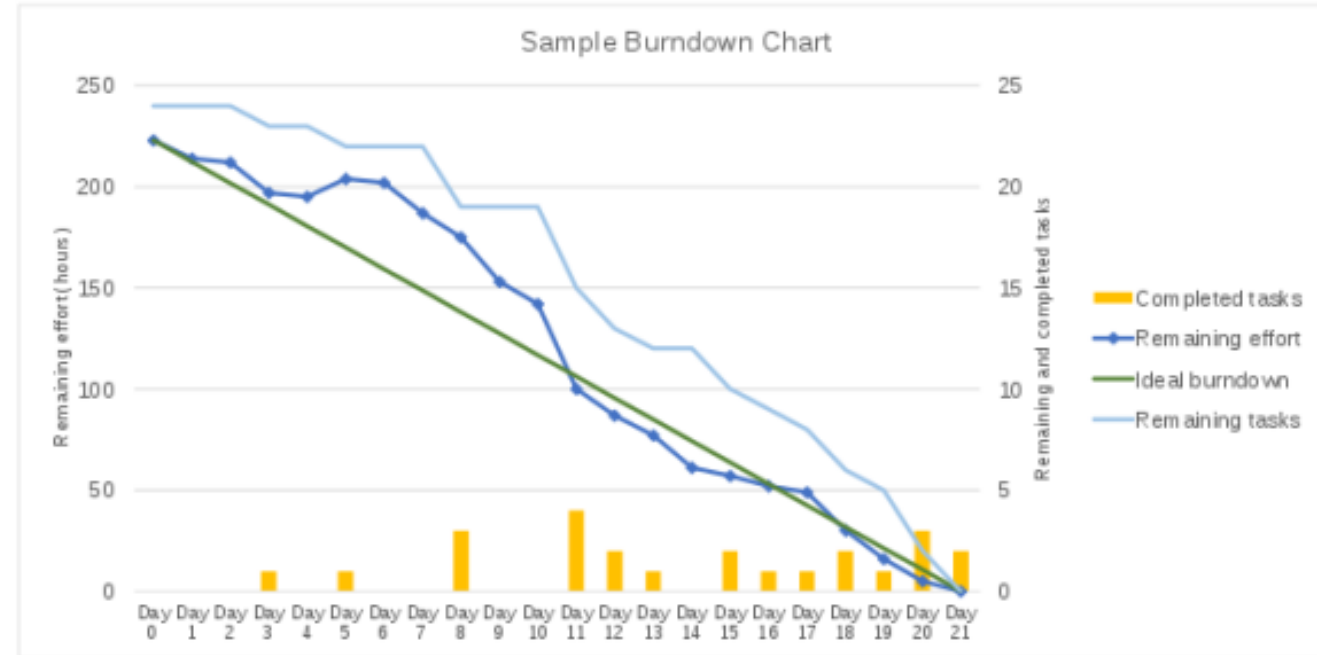
# 10. Iteration burndown chart

- This is primarily used in Agile projects as a means of visually measuring project progress, by looking at how much work still remains to be completed in the iteration.
- Burndown indicates 'remaining' work effort. By the way, this could be remaining 'story points' as well, but that's for another 'agile discussion'.



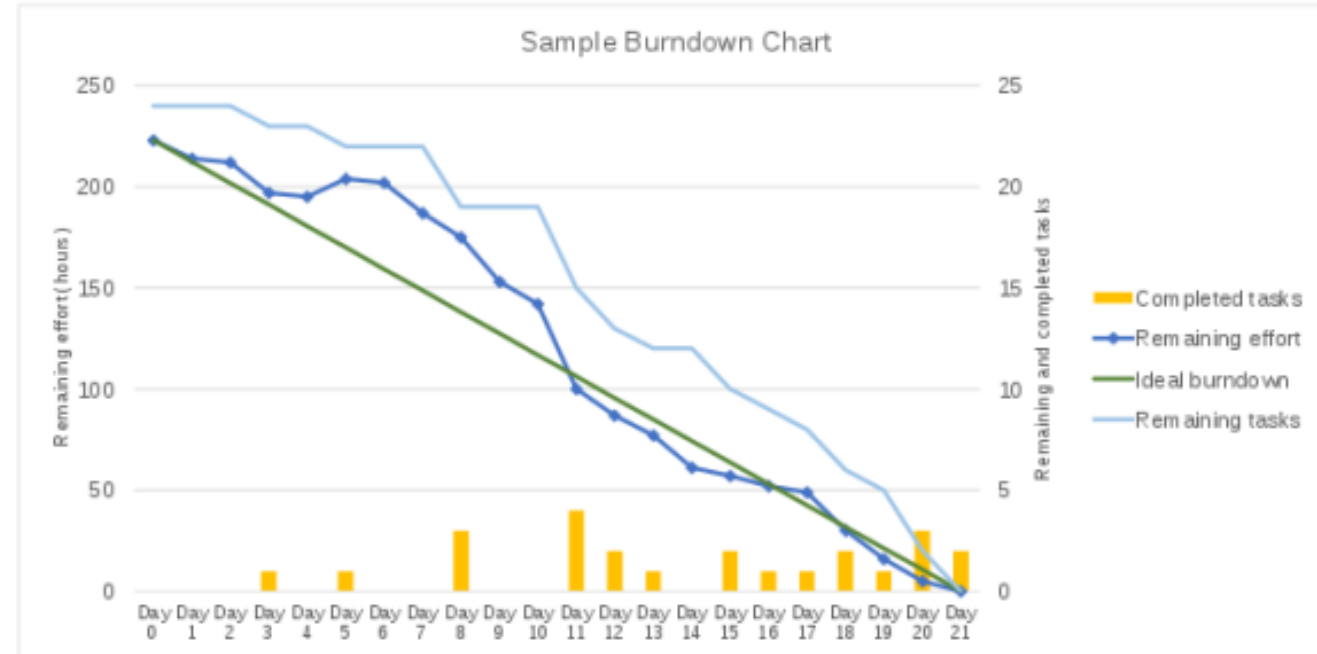
# 10. Iteration burndown chart

- Thus at the beginning of the iteration the total planned work effort is plotted on the y-axis (x-axis being the timeline). A straight line joining this point to x-axis on last day of iteration shows the **ideal burndown line**.
- This straight line ideal burndown line assumes that the amount of work planned for each day is completed on the day. In other words it assumes same 'daily velocity'.
- This of course we know this isn't how it works on the project.
- Life happens on the project.



# 10. Iteration burndown chart

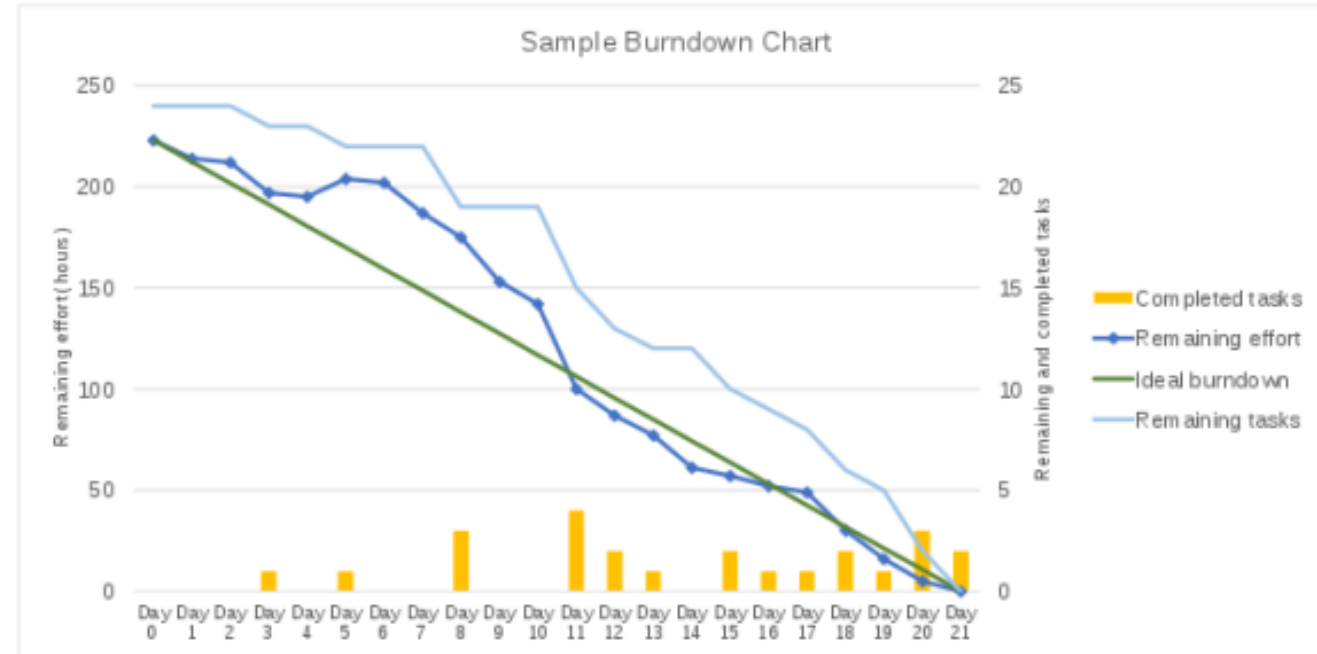
- So, we plot actual burndown 'curve' by plotting remaining work at the beginning of each day and joining that point with previous day's remaining-work point. This is the **actual burndown line**.





# 10. Iteration burndown chart

- The difference in work hours between ideal burndown line and actual remaining work on any given day gives us the variance as on that day. This would tell us whether we are ahead of schedule or behind.
- By taking average daily burndown velocity of previous days we could plot a link and extend it to hit x-axis – that would be our **forecast burndown**.
- The only process where is tool is used is [Control Schedule](#).



# 11. Make-or-buy analysis

- This is a technique used in [Plan Procurement Management](#) process to decide which aspects of the project should be outsourced and which should be made in-house.
- This is typically used in conjunction with Cost Benefit analysis for making objective decisions.



MAKE-OR-BUY ANALYSIS



# 11. Make-or-buy analysis

Some of the reasons to buy rather than make are:

- no in-house knowledge
- no in-house infrastructure support
- economical to purchase from outside
- more risky to get it done in-house
- lack of time

In some cases the decision is easy to make. In some cases some analysis and objective reasoning is necessary to arrive at a decision. Cost-benefit analysis of alternatives considering pros and cons of each approach would help.

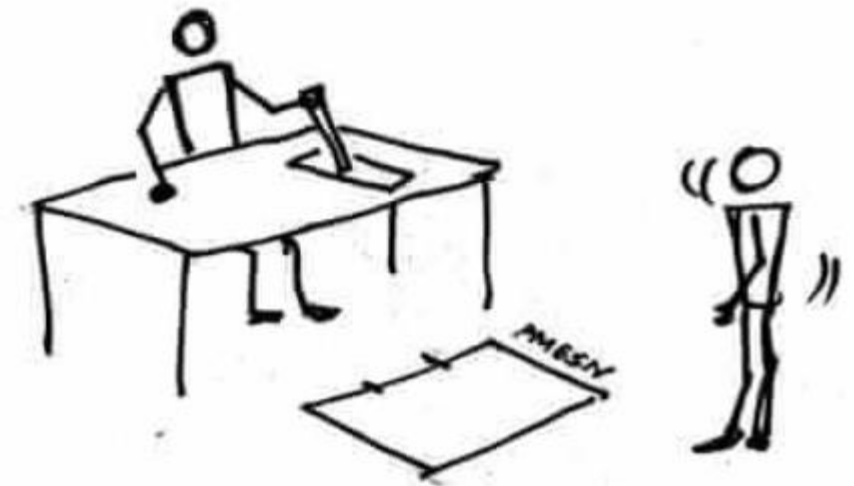


MAKE-OR-BUY ANALYSIS



# 12. Performance reviews

- You look at performance figures and compare it against expectations as in the case of schedule performance compared against schedule baseline in [Control Schedule](#) process.
- In this case some of the parameters you look at are start and end date of activities, percent complete, and remaining duration for activities in progress.



PERFORMANCE REVIEW





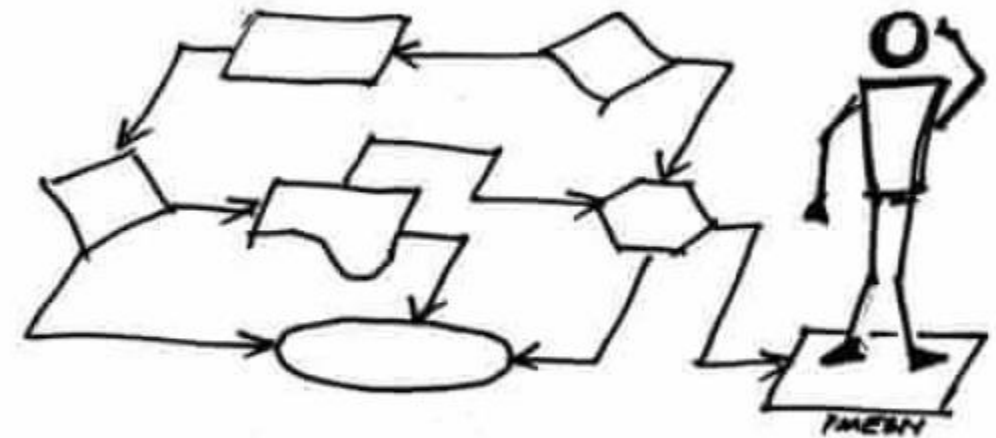
# 12. Performance reviews

- The processes that use this technique are –
  - [Control Schedule](#)
  - [Control Quality](#)
  - [Control Resources](#)
  - [Control Procurements](#)
- These are all control processes that make use of performance reviews technique.



# 13. Process analysis

- Similar to document analysis, process analysis is all about analyzing a quality process to –
  - ❖ identify scope for improvements
  - ❖ examine existing problems and/or constraints for smooth running of the process
  - ❖ identify non-value-adding activities that are draining resources without any benefits
- The only process, as you might have guessed now, that uses this technique is [Manage Quality](#).



PROCESS ANALYSIS



Reference:

<https://www.pmexamsmartnotes.com/data-analysis-tools-techniques-pmp-exam-part2a/#alter>

*Post at the Forum section if you have questions.*



# Activity

Applying Visualizations and Descriptive Analysis  
using MS Excel or SPSS

