3Quence

CLEVER ESTIMATING EBOOK

Peter Clancy – Projectrics bvba / 3Quence | CLEVER Estimation | 19 May, 2017

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INTRODUCTION

CLEVER is an Estimation Framework developed by 3Quence – Please like us on Facebook and followus on LinkedIn

Estimation is a necessary task that tends to have a very negative connotation in business. Those of us who make estimates are used to hearing common complaints such as “the estimates are never right”, “what’s the point in estimating?” or “how can we believe you?”.

Projects are becoming more and more complex. New technologies are being implemented every day and each new implementation impacts the way business operates. This can bring uncertainty into businesses which needs to be managed formally.

Good estimation can help to alleviate some of the risks involved when implementing a new project.

These complaints can be a distraction from the fact that regardless of what people may think, doing good estimations based on objective facts are necessary in order to ensure that businesses don’t lose money and from the customers perspective that they have a ballpark figure for a scheduled expense.

Estimates themselves are inherently incorrect, there are many factors that make them so. Some of these factors are:

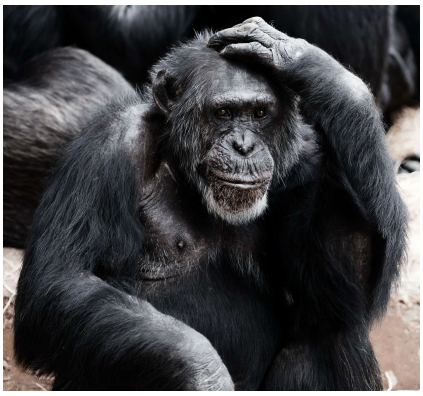
- Lack of detailed information
- Inconsistency of workhour quality
- Incorrect assumptions or
- Poorly defined requirements.

In order to get around these problems it’s necessary to gather as much information as possible into one location, formalize the information and follow a consistent process that provides consistent results.

3Quence has developed an estimation framework that will assist in making your estimations more objective, relevant and accurate over time. The estimation framework is called CLEVER.

The main goals of CLEVER are to provide:

- an objective view of the work that is required,
- feedback on a common understanding of the solution required,
- insight into the risks involved in the project,
- assumptions that, if shown to be false, will impact the project,
- an overview of the total cost, and
- assist with resource planning



CLEVER© estimating is an estimation framework developed by Peter Clancy of www.3Quence.com to provide a standardized and consistent approach to estimating any project.

Estimation in general is not well understood.

CLEVER© stands for:

- "**C**"onsider the particular project or problem at hand
- "**L**"everage information that exisits currently in the company
- "**E**"valuate the information for usability
- "**V**"alidate the information for accuracy & applicability
- "**E**"stimate the project using the information collected
- "**R**"eview the estimates with the project team as a "sanity check"

When considering this, it's also important to note that the steps from Evaluate through to Review should be repeated if there is any ciritcal feedback that deems the estimates inaccurate.

In order to understand each of the steps we will consider them separately.

CONSIDER

The first step in the estimation process is to **consider** the problem at hand:

- What are you trying to do?
- What is the current specific problem?
- Are your price offers always “wrong”?
- Do you not know how many hours a particular task will take?

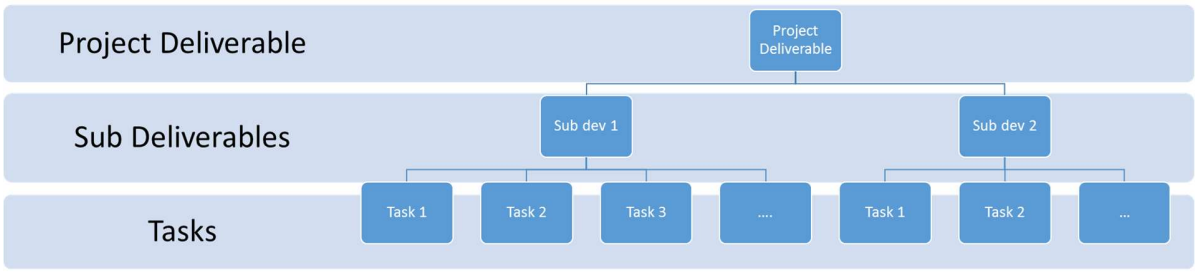
Naturally at this step, each organization will have a clear idea of what their particular problem is. The important thing is to avoid defining the problem as too big – don’t try to solve too much at once. Solving a smaller problem successfully is better than failing to solve a large problem. These small successes will add up to a large success later.

Break down the issue into its component parts and see what can be done for each individual part. Can the problem be defined in a smaller way?

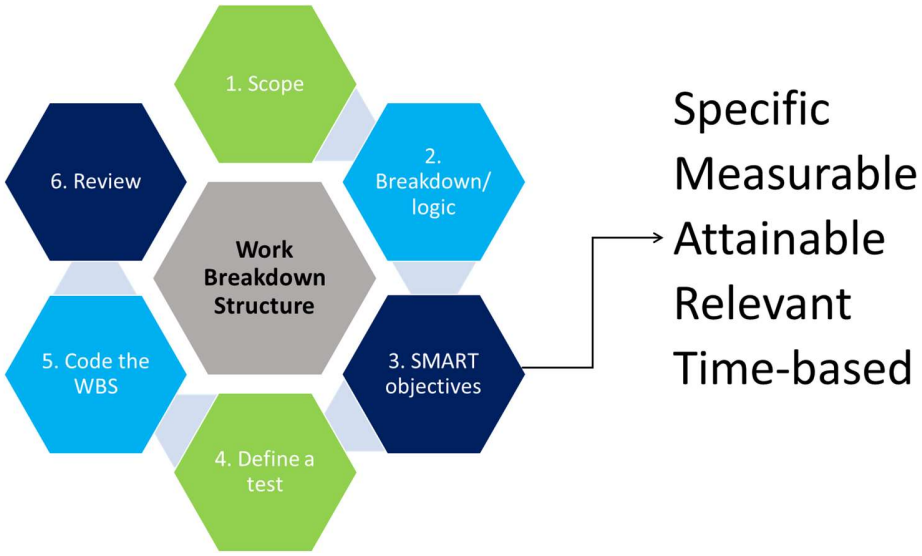
As a tool to understanding the various components of the problem, consider using a Work Breakdown Structure (WBS) to break the problem into smaller deliverables which combine to produce larger deliverables. This will allow the problem to be visualized in a different (more manageable way) and can also be used throughout the project as a way to visually followup on the project.

When decomposing deliverables down to the sub-deliverable and task level, keep in mind that the definitions of each of the sub-deliverables and tasks is vitally important to ensure that no intrinsic parts of the project are missed. A WBS dictionary can be included to ensure that each of the sub-deliverables & tasks are explained in detail, and also including some of the various suggested delegation opportunities can be addressed at this point.

The project manager will also be able to use this as input to the project plan and because of the direct links between the WBS and the project plan it will be relatively straight forward to keep both up to date.



Below is an overview of steps that can be taken to develop a work breakdown structure:



In addition to a WBS, it is also important to understand the dependencies and constraints that impact your project and the various deliverables and tasks included in the WBS.

Dependencies:

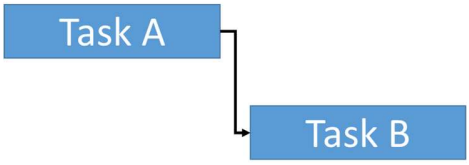
There are 4 categories of dependencies:

- Mandatory : dependencies that must be respected for project continuation;
- Discretionary : optional dependencies it is not necessary to respect;
- External : dependencies over which the project has no control;
- Internal : dependencies that are included in the projectLeverage;

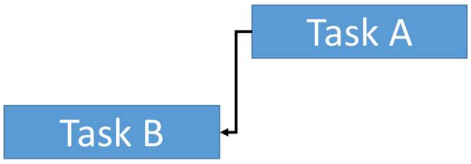
Types:

There are 4 main types of dependencies:

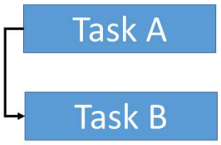
- Start to Finish (SF) – For task B to start, task A must finish.



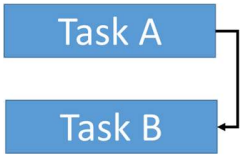
- Finish to Start (FS) – for Task B to Finish, task A must start



- Start to Start (SS) – for task B to start, task A must start



- Finish to Finish (FF) – for task B to finish, task A must finish



Constraints:

Constraints are more difficult to define than dependencies, and there is generally discussion on what are constraints and what are dependencies. In general constraints can be considered to be limitations on what can be done for either practical or logical reasons. They will impact the sequencing of tasks (for example Resource availability) but they may also be dependencies (task A must be done before task B can begin).

Assumptions:

In order to ensure that ambiguity is eliminated from the understanding of the estimates and the supporting documentation, make assumptions.

Assumptions will ensure that where there are unknowns, the resulting estimates are made with specific circumstances in mind which have an impact on the project.

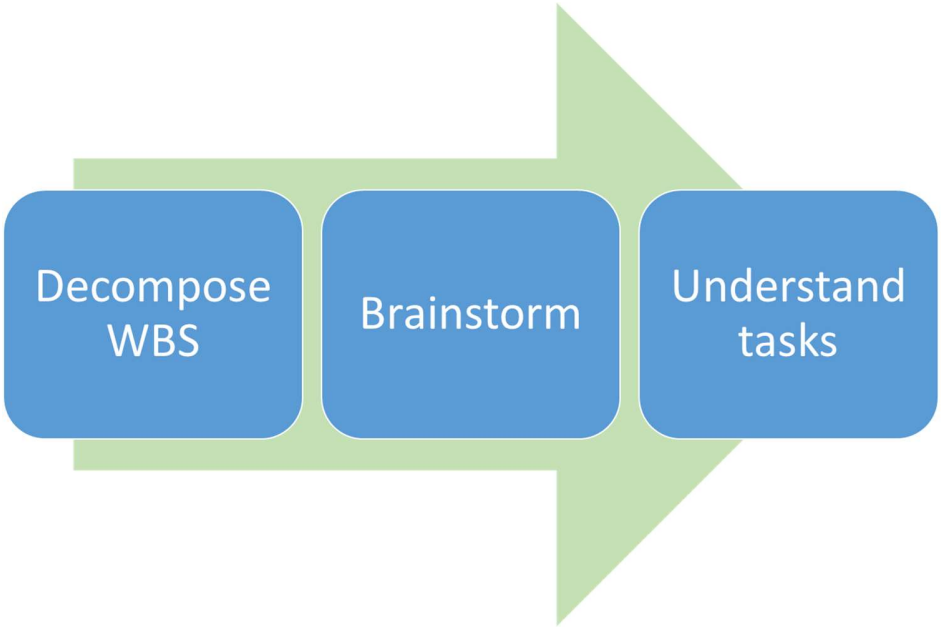
Verify that assumptions are relevant – they should have a clear impact on the project and should be reviewed on a regular basis for currency.

Store assumptions centrally to ensure that they can be referred to during the project.

All assumptions should be reviewed with team members to ensure that they are valid and relevant. Assumptions may only be relevant for 1 or 2 team members, but that does not make them irrelevant for a whole project – they can have major impacts on project results depending on their impacts.

Project management tools can be very useful for managing and following up on project task dependencies and constraints. One of the most commonly used tools to manage these is MS Project (© Microsoft) and OpenProj (open source project management tool).

Conideration Overview:



In order to fully understand a particular problem or effort, a good and reliable approach is to:

- Decompose the problem using a Work Breakdown Structure approach
- Brainstorm with project team members to ensure that you have a clear understanding of the problem
- Understand each of the tasks to ensure that they are put in the right order with constraints and dependencies.

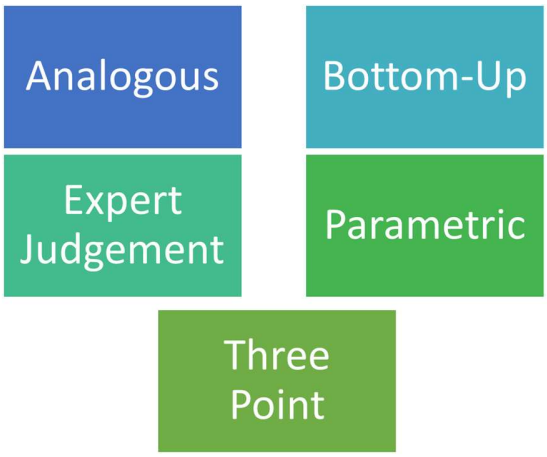
LEVERAGE

The second step is to **leverage** the information that is currently available in the organization that might be usable to solve the problem at hand.

All companies, large and small, store significant amounts of data in different formats and locations. In order to solve any problem using historical information it is important to identify what data is available and how it might be used for a particular problem.

Collecting this data is not always easy and data that is available may be incomplete, but consider looking at current and past project directories, downloads from accounting applications, stored data libraries etc. Try to focus on what data might be usable, but don't be too picky at first – inventorise any data you can to understand what data you have available.

When considering data keep in mind the estimation techniques that may be used to analyse this data to develop estimates. There are a number of different methods available as indicated:



Analogous: Projects are compared against other projects

Bottom-up: Using the WBS, calculate the details of each of the tasks

Expert Judgement: Ask the person most knowledgeable/expert in the project material

Parametric: use a model based on historical project information

Three-point: using a method such as PERT (Program Evaluation Review Technique)

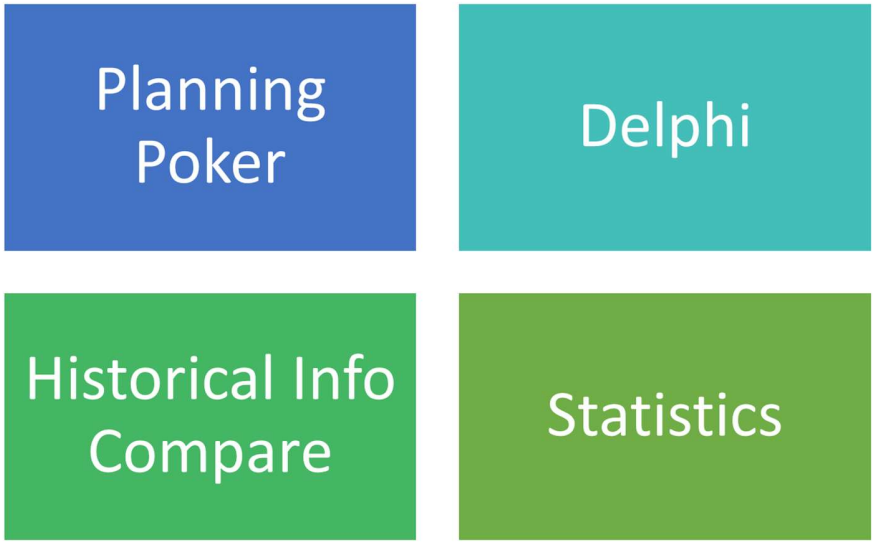
While each of these will give an estimate, it is advisable to use at least two of these methods to come up with an estimate to increase the reliability of the estimate.

Project History

One of the most important sources of project data for a company is their project historical database which should contain information on initial project estimations and the actual project results so that they can be analysed and used for future estimations.

There are arguments to indicate that historical information is in the past and is therefore irrelevant, however, historical information can be of vital importance to better project estimation so long as it is well maintained, and the data that is used is relatively recent. "Recent" in this case depends on the technology used etc.

Some of the different techniques that are used are:

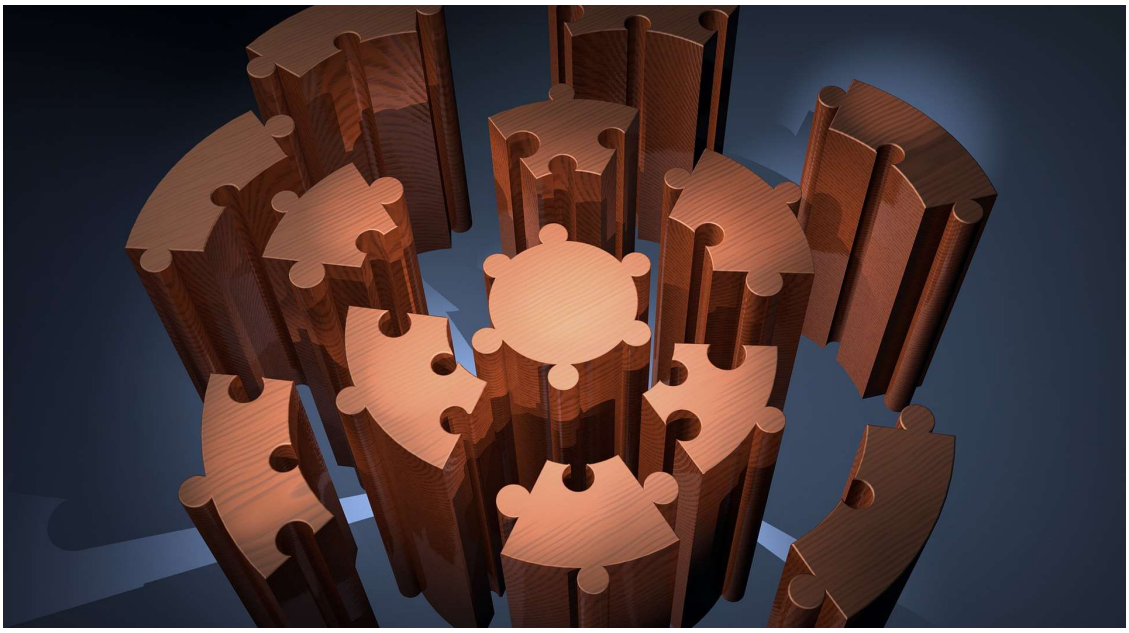


Planning poker: is an estimation "game" that is based on the mathematical Fibonacci series and is a form of analogous or comparative estimation.

Delphi: there are a few Delphi methods, but in general they refer to "blind" collaborative models where experts provide estimates for parts of the work without knowing who else specifically is involved in the estimations to avoid bias.

Historical Info: This refers to simply using historical information contained in the Project History Database which refers to previous projects and may indicate current project estimates. This can prove inaccurate as per definition no two projects are the same.

Statistics: This is making predictions based on certain criteria based on a statistical analysis of historical project information.



There is no silver bullet, estimation can be puzzling and, regardless of the estimation methodology used, the estimates will need to be interpreted in relation to the project at hand. This is where project estimation experts can be of most value.

EVALUATE

The third step is to **evaluate** the data you have collected, this will take time, but it is a vital step that will ensure the success of the project. All the data collected, if inventorised and categorized properly will help to provide answers. It is possible that not all data that is collected is relevant for the particular problem, but a careful analysis will answer that question.

- What is the data I have collected?
- Is it relevant to the problem at hand?
- Is it standardized in some way to ensure a good analysis?
- Does it match what my experts think?

Once these questions can be answered satisfactorily, the data can then be moved to the next step where it will be checked again for use.

Isolated evaluation will not provide extra information, however, the best method to do this would be to use a Delphi method of estimation. This will allow comparions of any parametric or analogous estimates made.

VERIFY

The fourth step is to **verify** the data that will be used for the estimation. In order to do this, there should be multiple checks done on the data to ensure consistency and completion and again a further check for standaridsation. The data needs to be checked for statistical distributions and correlations as well as for outliers. Risk assessment is also important in this phase.

Data that is rejected at this stage should be discarded from use for estimations as it could skew the results providing inaccurate estimates.

Once the validation has been done and the data appears to be stable and usable, then the next step can be performed.

Risk Management

What is Risk?

- According to the 5th edition of the PMBOK® guide, project risk is “an uncertain event or that, if it occurs, has a positive or negative effect on one of more project objectives such as scope, schedule, cost or quality”.

What is Risk Management?

- Risk management is the identification, assessment & prioritisation of risks followed by coordinated and economical application of resources to minimise, monitor and control the probability and/or impact of unfortunate events or to maximise the realisation of opportunities.

Thera are 4 main causes of risks:

Judicial: legal changes that occur

Assumptions: assumptions that are made and found to be incorrect

Constraints: some constraints that may prove difficult to manage

Organisational: organisational changes or events that occur

To complicate things even further, there are also problems regarding Known versus Unknown risks.

Known risks: it is possible to reduce the likelihood that they occur; plan responses and do contingency planning.

Unknown risks: these cannot be evaluated and generally project managers will work around these problems with their management and take budget from management reserves (which are not part of the contingency budgets).

In order to deal with risk there are a few things that need to be considered:

Assess: First assess the risk

- Consider the risk in relation to the assumptions made
- Interview people about the risk to establish impacts
- Document any results attained
- Followup and Reassess any risks and assumptions over time (risks can become irrelevant to a project over time, or can increase in importance and impact).

Respond: Risk responses fall into 4 main categories

	Low Impact	High Impact
High probability	Mitigate	Avoid
Low Probability	Accept	Transfer

When there is a high probability of the risk occurring but a low impact if it does occur, take actions that mitigate the risk so that the impact is lower.

When there is a high probability of the risk occurring and a high impact if it does occur, take actions to avoid that risk altogether.

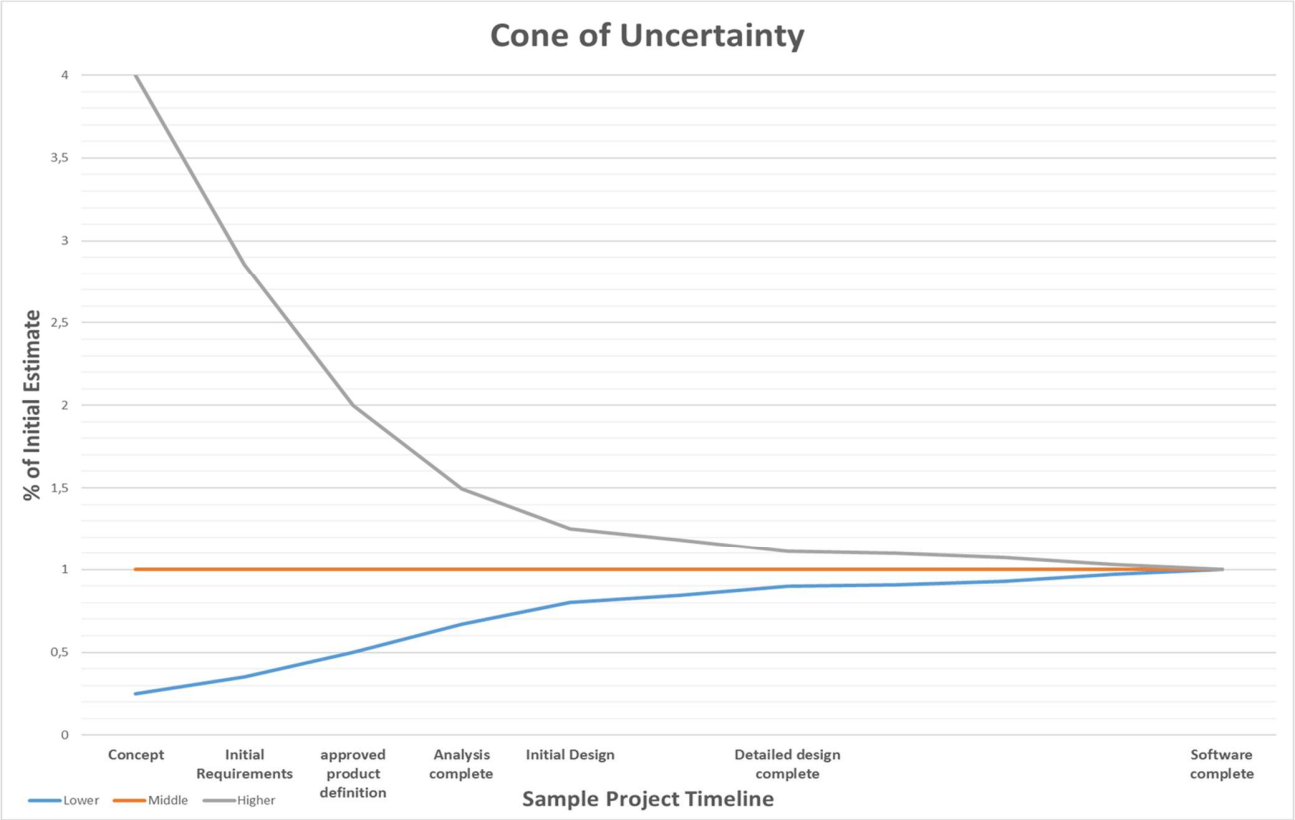
When there is a low probability of the risk occurring and a low impact if it does occur, this is probably not worth spending time on.

When there is a low probability of the risk occurring and a high impact if it does occur, transfer that risk by (for example) agreeing with management that if it occurs extra budget will come from outside the project, and given the low probably of occurrence it shouldn't be included in the project budget.

Quantify: for each risk quantify what the risk will cost in money terms over a year or per event. This information is important to ensure that management can take relevant actions and can understand the impact of the risk.

Cone of Uncertainty

In addition there is also the concept of the "Cone of Uncertainty". The earlier a project is in the project life cycle, the higher the chance that the estimates will be wrong. As a result of various studies the error can be as much as -75% and +400% of the initial estimates but do tend to converge as more information is available during the project. This is a representation of the Cone of Uncertainty:



In order to reduce the ranges of uncertainty, gather as much information as possible about similar projects in the past, and interview people who have managed similar projects. Accept also that it is not possible to have a “perfect” estimate – estimates are by definition inaccurate, however, if done properly, and with skill, they should be within a range of +/- 10% of the final results – assuming that the scope, resources etc. remain constant through the project.

ESTIMATE

The fifth step in the process is to actually **estimate** the work. This involves taking the data and actually performing the estimate. There are many methods that can be used for this step, but what is useful to ensure unbiased and more reliable results is that more than one method of estimation is used.

Using some of the estimating methodologies that have been explained before, this should be the more straightforward task:

- Single-Band Delphi
- Wide-Band Delphi
- Planning Poker
- Analogous estimations
- Monte Carlo Simulations
- Computerised estimation tools (based on project historical information)

The estimates that result from the above methodologies need to be interpreted and put into context by the project manager or facilitator to ensure that they are meaningful. If managed correctly they will be within a reasonable range of the actual results of the project at the end.

Bear in mind that as a project progresses risks change, scope may change, team members may change etc. which will all have an impact on the overall results of the project and the projected end dates, effort and costs. In this case it is necessary to consider reviewing the

estimates on a regular basis through the project when these events occur or are likely to occur so that the impact is fully understood.

Delphi Overview

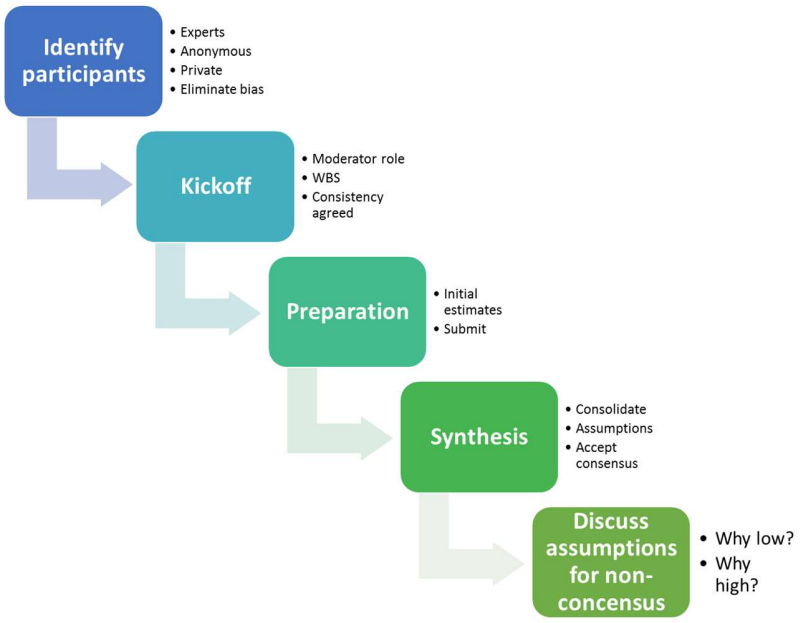
Delphi, if properly carried out has a number of advantages:

- Bias is eliminated
- Experts in different areas avoid the negative “wiseman” effect
- Control can be maintained over the source and quality of the estimates
- The safe environment gives better assurances of reliability
- Consensus can be reached without introducing bias but while identifying potential problems.

On the other hand, there are some disadvantages that should be taken into account:

- You need to have the right experts included in the virtual team
- While the results of this method can be very reliable, it does cost time (and therefore money)
- This is time consuming.

A graphical representation of how Delphi can work is shown here:



During the estimation process estimates for various components of work will be resolved by the various participants reaching a consensus after being provided with more accurate information while reconciling variances in the estimations made. Where results are within defined limits and to avoid futher time being lost, methods such as PERT (Programme Evaluation Review Technique) can be used. This helps make statistical inferences with the estimates made using pessimistic, optimistic & most likely estimates.

PERT Formula for the **PERT Weighted Average**

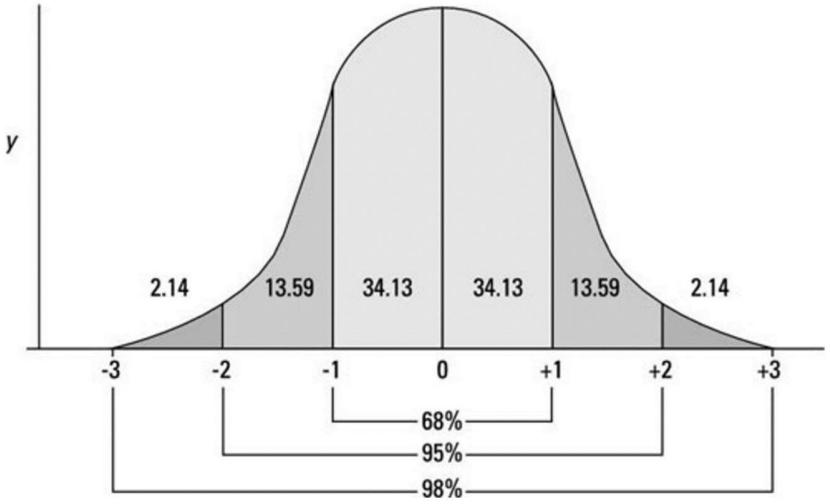
$$\frac{O + (4 * ML) + P}{6}$$

PERT Formula for the **Standard Deviation**

$$\frac{P - O}{6}$$

P = Pessimistic
O = Optimistic
ML = Most Likely

From a statistical perspective, PERT can give a good approximation to 98% accuracy when used correctly:



REVIEW

Finally, the sixth step in the process is to **review** the estimates that are produced. The review should be done with the people that were involved in the estimation during the various preceding steps, but also people who are familiar with the type of work and maybe not necessarily directly related to the project.

The estimates should normally be provided in the form of a report that has both an estimation and the basis on which that estimation is made. The basis will include things like the requirements, any assumptions made, risks that have been identified and issues that may already be apparent.

Reviewing the report (ideally with the team to perform the work) will provide a clear indication of the achievability of the work in the estimate time. This review will provide good insight to any further issues/problems that may be identified.

This will be the first time that those involved in the estimation exercise will see a consolidated overview of the estimates and this may impact their assessment of their achievability. Any issues should be taken note of and the project manager or moderator/facilitator should consider whether a new iteration of estimation is required. If this is the case, then the steps above should be repeated from the “Evaluate” step through to the review.

CASES

Below are some sample projects undertaken using the principles of 3Quence:

IT project estimation & planning: Based on the customer requirements, estimate the duration, effort and costs of various IT projects.

Furniture building: Using the information available from the client, analyse that information to provide insight into the clients estimating problems and correct estimation mistakes by creating an estimation verification model.

Painting: Based on the various choices that a customer can make, and conditions of surfaces, produce an estimation verification model to ensure more accurate estimation of time & effort.

Food waste: Conference centres must ensure that all attendees have sufficient food, but of course for hygene and safety reasons uneaten food must be disposed of. This is a cost that can be at least reduced significantly (if not avoided altogether).

Market size estimation: It is not easy to estimate the size fo a market for a new product or service. However, this is something that can be done using estimation techniques.

BIOGRAPHY

Peter Clancy is an estimation specialist with over 25 years experience in estimation across different industry industries such as insurance, automotive, banking, aviation, cosmetics and IT projects. Estimation has been a consistent part of his career which working on projects across Europe, the US, South Africa, the Middle East and India.

“Estimation is vital to the businesses of tomorrow – without knowing what projects are likely to cost, a company’s budget process has little meaning”.

Estimation provides a way for companies to plan a way forward and to develop strategies to combat company challenges that are both seen and unseen. Resources can be more reliably planned with high confidence that they will be fully utilized to keep the company powering forward.

3Quence is the brand under which Peter Clancy operates, the main services are:

- An online estimation tool for IT project estimation based on function point sizing
    - This tool will be extended in the future to incorporate other industries
- Estimation consultancy to share experience and guide companies to benefiting from better estimation techniques.
- Coaching, which includes training, to help companies help themselves perform better and more reliable estimates.

For more information visit www.3quence.com.

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