

“Estimation for the Savvy Project Manager”

The most critical estimate in the life of a project is the first estimate. Occurring typically at project planning or initiation phase. Not a great deal of attention appears to have been paid to this first estimate and the issues around it. In part this could be due to the gulf that exists between the promise of software project estimation and its application in practice. A great deal of what passes today for project estimation is in fact little more than wishful thinking on the part of the participants. Its’ neither scientific or particularly substantial. In this paper we will explore the significance of the initial project estimate to the project and suggests ways to approach developing this critical estimate.

Before proceeding further we should look a bit closer at the title of this paper. The choice is deliberate; the savvy project manager. The descriptor savvy is not something that is applied with any frequency to software project managers. Savvy implies someone who is streetwise, experienced and knowledgeable on all the pertinent issues, generally smart and knows how to be creative in meeting their goals. Most project managers are typically not thought of this way. This is even the more the case with current software industry trends to label first-level supervisors as project managers. To deliver value to their organization, projects managers need to become a lot savvier.

To become savvy project managers as far as software project estimation is concerned, project managers need to develop more ‘streetwise’ smarts in several key areas;

1. Being cognizant to the importance of the initial estimate;
2. The source of conflict around estimates and the legitimacy of both sides;
3. How to develop constructive collaboration among participants towards solving problems rather than entrenched positions; and
4. Recognise the need to develop sound defendable estimates as a cornerstone of the solution.

The initial estimate

Project planning is the process whereby an organization decides if a project will be undertaken and to what benefit. Depending on the nature of the organization certain attributes of the project may have higher importance, primarily because they are the drivers of the

business. The initial estimate at the beginning of a project plays a key role in the project planning process. The estimate is the first indication to the organization about the feasibility of realising the anticipated benefits. If the project-planning phase indicates that benefits are realisable, then the initial estimate also plays a significant role in determining the amount of resources (\$, people, time, ...) that will be committed to the endeavour by the organization.

Throughout the project planning process, we need to move our thinking to recognize the first estimate is a communication vehicle that allows the whole organization to have a meaningful dialogue about the project and its significance to the organization.

The key players in the acceptance of an estimate

Project estimates and software estimation are viewed as predominantly technical activities. Unfortunately this labelling obscures some key aspects of the process. What is not recognised is that the process of approving an estimate involves two very distinct sides of an organization. The business side and the technical side. Both sides are driven by different issues, concerns and goals. However, problems occur when neither side really takes time to understand the other's perspective. To understand this better, we'll explore some of the issues around the first estimate.

- The role of the different participants need to be considered;

A business management function, one of whose roles is to set targets for the different business functions as a step towards meeting the business objectives as expressed in the annual business plan. We should recognize that these are often 'stretch' goals.

A business development function, one of whose roles is to secure business (i.e. projects) that will deliver a component of the annual business plan. This can often be the principal motivator for this group.

A development function whose role is to deliver the projects in order to secure the business objective. The principal motivator for this group is to perform sound technical work and to focus on what is feasible.

- There are many complex organizational dynamics at play. One of them is a certain level of political posturing by the various functions, each seeking to ensure their perspective forms the plan going forward. We also need to recognize that it is one of the very critical times when these three key areas of the organization are seeking to work together, collaborate towards a common goal.
- We also need to consider the role that leadership plays. The traditional view of leadership in this situation was someone who was willing to 'step up to the mark' and accept a challenge. In project planning, leadership

should not mean to beat down estimates, nor should it mean to accept challenges where the estimate has been arbitrarily cut, since this frequently tends to backfire.

- The role of corporate strategy needs to be considered. Increasingly organizations are dealing with multiple projects, or project portfolios. Each offering a different combination of rewards, risks and benefits. The relationship with the project at hand and the ensuing balance in the project portfolio needs to be considered.

Why the process is often difficult

Estimation is typically considered to be a hard task. It can be often be a source of personal risk for the project manager preparing the estimate.

"It is very difficult to make a vigorous, plausible, and job-risking defense of an estimate that is derived by no quantitative method, supported by little data, and certified chiefly by the hunches of the managers."

— Fred Brooks, "The Mythical Man-month"

The friction point that arises in the ensuing debate occurs over the gap between the business' target for the project and the technical staff's estimate. The gap between the two represents organizational risk. Frequently the organization solves the risk to the organization by adopting the target as the plan. The risk becomes transferred to the project team and in the process becomes additional personal risk for the project manager.

For many organizations, the debate over the gap between the target and the estimate can degenerate into strife, or a "negotiation" instead of a "discussion". With each side seeking to have their view of the project prevail to the exclusion and expense of the other. This strife that occurs at project planning or initiation over whether the business' target or project team's estimate should prevail can poison a project. Senior & business managers' interest in software estimation focuses on getting better estimates that are closer to the desired business targets. For project managers the estimation process can be a source of personal risk. Estimation often concludes with the project manager accepting additional responsibility and project risks to solve business problems in the process of meeting the target.

Throughout this activity the organization loses sight of the process & focuses on the end result of the process. The approach shortchanges the organization. Throughout the lifetime of a project there are two maybe three places where an organization as a whole has the opportunity to develop an in-depth understanding of the project in terms of risks, rewards and benefits. We recognise that we can learn a lot through undertaking post project reviews or post-mortems. If we have a good change management process, we can also learn when change happens. The

other point where we can learn is at the outset, as we start to plan the project and make initial decisions.

Observations on the estimation process, highlight that we often lose sight that it is an 'estimate' we are creating. Instead we start to focus on the certainty of outcome, downplaying and de-emphasizing the risks and uncertainty that could prevent success. We frequently overly focus on the deliverables of the projects we are estimating. We omit to address our expectations or take the time to agree on project CSFs (Critical Success Factors). We allow our over-confidence in our abilities to deliver the project to mask the uncertainty. We allow our groundless optimism to mask the risks. Invariably the hard questions about the project such as risks and likelihood of success are not asked.

Another key shortcoming is that we routinely only prepare a single estimate once in the project lifecycle. According to Tom Demarco 85% of project managers never prepare a second estimate. However Barry Boehm in his research into the Cocomo cost estimation model, observed the significant degree of uncertainty in project estimates dependant on when in the project lifecycle the estimates were made. At the initial project inception stage of a project, estimates have the potential to be out by as much as 16 times.

Backdrop to project initiation

To gain a better understanding of why the degree of friction can be so high, we also need to take account of some of the external pressures that have an indirect effect on the Stakeholders in the project initiation process.

At the micro-level, the corporate organization has a significant impact. The benefits to be gained from performing the project are likely to have a significant impact on the performance of the organization. It will also impact how the stakeholders are seen in an organizational context.

At the macro-level, organizations are discovering they face increasing pressures posed by the new digital economy and the fierce competition from the marketplace. The project being initiated will be intended to address these factors in some way or another.

It is also important to recognise subtle impact of the three marketplaces (commercial, financial and labour) that an organization competes in.

- In the financial market, investors and the capital markets are punishing with increasing frequency those organizations that fail to live up to their expectations. It becomes key that every project contributes to the organization in the maximum possible manner.
- In the commercial market, the end users of projects, buyers of product wield strong influence. If they perceive the project will not be available in the timeframes they want they are likely to go to another organization to satisfy their needs.

- In the labour market, and in an increasingly tight labour market, employees are less interested in working for organizations that seeks to resolve tough project planning problems by requiring employees to work punishing long hours of overtime.

Exploring the friction points

Frequently the project planning process does not run smoothly, leading to internal organizational conflict and ultimately difficulties in delivering to a planned schedule. This situation occurs because of the difference between the “target” set by management and the “estimate” created by the project planning team. The target (quantified as monetary costs, labour effort, or calendar duration) is generally lower than the estimate. Conflict occurs (the degree and intensity varies between organizations) because organizations usually deal with the difference by choosing one or the other as the plan. The overall process pits the project planning team against the business management team. Frequently management seeks to resolve the situation by imposing the target on the project planners

This situation looks unlikely to be resolved in the immediate future by current practices. If anything, current developments are likely to exacerbate the situation. The pressures of rapid development, the ‘Internet’ age are forcing cycle-times to be smaller, reactions need to be faster. This is pressuring the project-planning phase to reach its conclusion quicker. Without a change in process the development organizations are increasingly seen as being unable to deliver. The business climate is also pressuring the process. In the portfolio of opportunities; only the projects with the lowest risk/highest reward ratio should be pursued. The current approaches to estimation are not supporting this change in direction.

Understanding the significance of the first estimate

The role the initial estimate plays in laying the foundation for an effective project management environment is largely unaddressed in the industry. Gerry Weinberg has been credited as saying that project management provides the optimum problem-solving environment. Organizational agreement on a sound estimate will give the project manager the resources (people, time, \$) to establish an efficient and effective project. In the process establishing a project management environment that can provide the capabilities suggested by Weinberg.

Unfortunately in most situations the message (risks, assumptions, and so on) behind the first estimate is frequently lost in the debate between the estimate and the organization’s target for the project about which one should form the basis for the project plan. In most organizations the current estimation practice is ineffectual. The credibility of the project manager's estimate is invariably questioned and the process reverts to a technical discussion of the project and the estimate's merits, giving the impetus to the business target forming the basis of the project plan. The implications for the organization of the gap between the estimate and the target are rarely discussed. It is for the project manager alone to solve.

Improving the accuracy of the first estimate

Given the initial estimate is so critical, there are a number of steps that can be taken to improve the accuracy and soundness of the estimate. The first step is to ensure your organization has an approved estimation process, and follow that process. The key to a good estimation process is that it lays down a standard agreed upon way of preparing an estimate. It also identifies who is qualified to prepare an estimate,

The next step is to prepare a thoroughly sound estimate. We discuss later several techniques you can use to create an estimate. Key is to present it in a way that will move your organization beyond sterile debate/discussion. The techniques behind 'principled negotiation' [Fisher] are an excellent approach to follow to encourage creative collaboration among project stakeholders.

As noted by McConnell, there are several "don'ts" that the savvy project manager needs to be aware of:

- Avoid rushed estimates. Rushed estimates tend to be low estimates. One of the principal failures that occur is that tasks get omitted or overlooked in the rush.
- Avoid off-the-cuff estimates. In a similar vein these tend to be low estimates. Research by van Genuchten, indicates that most developers typical under-estimate by a margin of about 30%.
- Understand the difference between precision and accuracy. Given the work by Barry Boehm into the inherent uncertainty of early stage estimates, an accurate estimate is most likely to be sufficient. In fact a precise number probably conveys the wrong message, implying that a great deal of thought and effort (or certainty) went into the creation of the number.
- Avoid single-point numbers for early estimates. Precise numbers imply a degree of precision that is not warranted at the initial stages of a the project. The imprecision can be best covered to the recipient by expressing the estimate as a range.

The siren call for better estimates

In discussing these techniques with project managers, a frequent comment is that their organizations are looking for better estimates. On discussion this usually means a single-point number that can be used in business planning by management. It is my opinion that this is a siren call, similar to others that we often hear from management, including "we should pay programmers for the number of bugs they find in code" and "we need to measure the productivity of programmers to determine who produces the most code". Superficially, they are attractive statements, however they don't bear scrutiny. We'll focus on the estimation example.

The statement belies the truth of what management really wants. Ultimately management doesn't want better numbers, what they want are numbers that are a

more accurate indication of the likely outcome of the project. To that end we need to understand the probability of the likely outcome of the project matching the estimate. If we know the probability of likely outcome, management is in a better position to determine the 'right' number to use in business planning. If the probability is too low, management has to determine whether they can accept that estimate and base plans on a low probability of outcome, or seek a higher estimate with a more acceptable probability. Business management is now fully informed as to the decisions they are required to make about future plans.

The current position whereby probability is not addressed forces us to deal with the symptoms of the problem. We fail to see a root cause, namely a lack of appreciation of the depth of the business/technical divide with the organization. We need to develop ways to address the divide. Helping the organization develop an appreciation for the probability associated with an estimate is a step in the right direction. It is a key element for the savvy project manager in developing a creative solution that will help sidestep a significant proportion of this unproductive strife.

Dealing effectively with the gap between estimates & targets

The savvy project manager will use a thorough estimate to promote business discussion of the estimate. This will focus discussion on the gap with the organization's target, rather a technical discussion of the estimate's merits. At the conclusion of the improved estimation process, the organization is aware of the level of risk in the project, and the whole organization, not just the project manager accepts the estimate and the need to develop a plan to bridge the gap with the organization's target.

The setting of financial targets for a project is part of business. The difference between a savvy and not so savvy project manager is in how effectively they deal with business targets. The first step is to recognize that the target & estimate are both legitimate positions. However in most organizations there is little serious discussion about either. The result is often a polarization of positions. To break the stalemate, the project manager needs to take the initiative and understand what the target represents. It's important not to take it at face value.

The goal is to move the organization beyond sterile debate about the merits of different positions. The point is to generate creative collaboration among all stakeholders, leading to a solution that is acceptable to all. It is recognized that this is not an easy task. There are four techniques that you can use to get Management's attention on your estimate so that you can get the creative collaboration process started;

- Quantify the 'gap' that exists between the target and the estimate. Understand what the gap represents for the organization. Discuss the gap in these terms.

- Undertake risk identification; identify the risks that could impact the estimate and target. Highlight the additional risks that exist in the target. The risks and assumptions need to be documented and presented with the estimate. Any discussion on the estimate should address the impact of the highlighted risks.
- Assess the probability or the likelihood of the outcome of the estimate. Use a software estimation tool that can give you a probability value for your estimate. See how the target compares, if it has a lower probability, highlight it.
- Assess the level of confidence in the estimate. Do this taking into consideration the likely probability of the estimate and considering how the data for the estimate was generated. Give a higher level of confidence to estimates that have used data derived from previous project experiences.

The degree of adversity that can be generated in these situations can be daunting, especially for inexperienced project managers. The temptation is strong to give in and accept the target just to move on from the current unpleasant situation. That would be a mistake. It's important to keep in mind that reasonable people always want reasonable solutions to their problems. The techniques of 'principled negotiation' can be used very effectively at this stage to bridge the difference between the two sides and find some common ground. A key benefit of the collaboration process is that it encourages all of the participants to feel some sense of ownership in the solution. This is a significant benefit for the savvy project manager, because it keeps ownership of the problem at the organization level, rather than forcing it onto the project for resolution.

It is important to note that the difference between the two positions may not be 'bridgeable' at this point. It may not be possible to agree on "degrees of freedom" for functionality, resources, and/or time. Rather than reverting to choosing one option over the other, the smart solution is to focus on identifying a point in the future when additional data will be available. At that point the situation can be revisited and agreement or compromise might be more easily reached on the basis of more complete information.

To create a good estimate

In several places we have identified the need for sound estimates. The first thing to consider is what constitutes a good estimate. Project Management Institute's Guide to the PMBOK suggests;

"An assessment of the likely quantitative result. Usually applied to project costs and durations and should always include some indication of accuracy (+- x percent)."

— *A Guide to the Project Management Body of Knowledge (PMBOK), Project Management Institute*

A good definition of an estimate consists of a description of the *scope*, the *technique* used, and the *accuracy*. In addition we need to include a statement about the uncertainty in the estimate. The amount of contingency or margin of safety needed to address the uncertainties can be determined by conducting a Monte Carlo simulation based on the estimate to determine the range of possible outcomes, or the likely probability of the estimate.

Estimation is most successful when multiple methods and different people are used to develop an estimate. Convergence in the results is an indication of the increased likelihood that the estimate is accurate. It also allows having a higher level of confidence in the outcome.

Greater confidence in the estimate is justified if we also base our estimate on our actual experience on similar previous projects.

Seven techniques to use to create an estimate

In this section several techniques are identified that can be used successfully to generate an estimate;

- Analogy. This technique involves comparing the project at to previous projects. We need detailed size, effort, cost estimates for the similar previous projects. We then compare the new project module-by-module to the old project at the finest level of detail possible, and build up the estimate for the new project as a percentage of the *actual results* of the old project.
- Historical data. This technique is similar to analogy in that we need similar previous projects. The difference is we are drawing on work performed by researchers like Larry Putnam, who have developed mathematical models to model the relationships between schedule, effort and cost. Properly calibrated and supported by software tools this technique can provide us with powerful insight into our estimate.

A variation on the use of historical data is requirements driven estimation. Instead of using function points, or lines of code as a scope measure, this technique assigns high, medium, and low values for the likely development effort of each requirement. These values are derived from past experience.

- Inspection. Using techniques such as Function Points we can develop a very accurate estimate of the size of a new project. The mathematical models can be used to provide an estimate of the effort required and the cost of the development. Estimates derived in this way are considered by many to be worthy of greater confidence due to the implicit accuracy of the function point method.
- Effort driven approach. This is an alternate approach that is supported by some software tools. For example SPC's Estimate Professional tool permits the direct import of a schedule developed in a project management tool such as Microsoft project. The tool can provide an estimate of the size, effort and cost based on the populated task detail in the schedule. Some people find it

easier to develop a schedule in this manner rather than estimating size directly which some find intellectually challenging.

- Base it on your team's capacity. This a derivative of the Analogy approach earlier. Instead of using size of previous projects, you can use an assessment of what your team can produce in a given period of time as the basis for your estimation.
- The component approach is a more complex method. Essentially this is based on an architectural decomposition of your project. The principal advantage is that it permits different techniques to be used on different components. It is most suited to larger projects and works best when supported by an estimation tool.
- Timebox-ing to handle severe constraints. This is another advanced method that works with an architectural decomposition of your project. It is of most use in the later stages of a project. Essentially the method allows you to determine how much functionality can be delivered against a particular constraint, usually time although it could be cost too. It is most frequently used in response to project slips and other hiccups. With the support of an estimation tool it should be possible to trade-off different combinations of functionality and different grades (deluxe, basic etc.) of solution.

Conclusion

This paper examined how the savvy project manager can side-step the strife, by recognizing the target and the project team's estimate as legitimate positions. A thoroughly prepared estimate is key to success, allowing the project manager to deflect the discussion on the technical merits of the estimate. In this paper we have emphasized focusing the organization's attention on the gap between the estimate and the target, and the level of risk the gap represents for the organization. At the conclusion of the project planning or initiation process the project manager will have set up the project for maximum success, in the process uniting the organization behind the project and the risks that have to be managed for success. The gulf between the promise of software estimation and its application will have been narrowed to the organization's benefit.

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