

# The balancing act – Project Management's Triple Constraint

"You might say every one of us is a fiddler on the roof - trying to scratch out a pleasant, simple tune without breaking his neck"

"It isn't easy", says Tevye in the opening dialogue of "Prologue/Tradition" (the first song of the musical). You know what? He's right. Listen carefully to the opening of the music to this song. You'll hear a single violin assert and then repeat the *Fiddler* theme followed by other strains of the theme in *rondo* form. Think of this lone introductory violin as the project's statement of work, and the voices of the other violins coming in as attempting to tweak the statement of work – that is, applying new constraints or making new requests. Some of these "new voices" will be in concert with the project's objectives, and some will be in counterpoint, leading to music which is interspersed with emotion, conflict, and harmony. In a musical score, this is *by design*. In this particular piece from *The Fiddler*, the dialogue goes on to be a mix of cacophonous debate and a celebration of human accomplishment, capability, and joy. Such is a project, except that these voices are added not by design, but somewhat at random.

**Comment [ALG1]:** Terms to have defined before this chapter:

Risk  
Stakeholders  
Product of the project  
PMBOK Guide  
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**Comment [ALG2]:** Note to Rich and Ranjit – be sure to refer back to this and to discuss that we DO INDEED have some control over these voices, if we have put together a communications management plan.

As a project manager you are *already* in a precarious situation – on the peak of a roof, you might imagine. Why? Projects by definition are new territory. After all, in a project, we are not processing a tax return; we are

*introducing new tax software. We are not changing or even manufacturing a light bulb; we are introducing a new line of bulbs or opening a new bulb factory.*

Now take that precarious situation and add to it the effects of two of the most critical concepts in project management – **stakeholders** and **risks**. As you work – up there on the roof – stakeholders are pushing on you. Left, right, forward back. Some may be tugging and pulling on your feet and jeopardizing your very foothold.

What do these stakeholders want from you?

Some want the project to be finished sooner. Some want the project to cost much less. Some will want your project's product to include much more – or to be very different - than originally asked for and agreed to. Some will want combinations of these modifications. Some, usually your top executives, or most demanding customers, will want **all** of these. Even worse, they will want it without losing anything originally agreed to in the project's statement of work. As you're trying to fiddle, they're tugging at your legs, pulling and pushing you in multiple directions, some with the intent to knock you **down**, most with the best of intent but with the same possible outcome.

**Comment [REM3]:** Reference to Cape Wind project and the SOS group. Yes, SOS is a stakeholder in Cape Wind.

In addition to these immediate and local human forces, there are also the effects of good and bad fortune on a broader scale. The weather, the government, the stock market, the price of fleece in Nice – all of these could provide your

project with opportunity or threats. In project management parlance, this is Risk (see chapter \_\_\_\_). In our fiddler's analogy, you can think of Risk as the very roof itself shaking, shifting, tilting, sagging, rising... sometimes to the fiddler's advantage, and sometimes to his peril. Either way, the fiddler needs to make adjustments or face a painful fall (well, maybe the fall won't be painful, but the impact with the Earth surely will be).

Can we begin to see why Tevye says, "It isn't easy"? And, as Al Pacino, playing the fiery ex-Lieutenant Colonel Frank Slade said in "Scent of a Woman", in that famous scene where he is testifying on behalf of his young friend Charlie...we're "just getting **warmed up**".

### **PM's Triple Constraint**

Let's look in some detail at the fundamentals of the triple constraint. Before we do, let's bring in a definition of a project from the IPMA which will become an important backdrop for the triple constraint:

*A **time and cost** restrained operation to realize a set of defined deliverables (the **scope** to fulfill the project's objectives) up to **quality** standards and requirements.<sup>1</sup>*

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<sup>1</sup> International Project Management Association

Looks like time, cost, scope, and quality are the key words, doesn't it?

We'll review those below, and later, each will be treated more thoroughly in their own chapters.

### **Cost:**

Unless you are fortunate enough to be working on a project funded by an infinitely wealthy sponsor, you can instinctively understand the cost/resource constraint. Funds are limited. You cannot put an unlimited number of staff members on the project. "Money is no object" only means that *the cost constraint may be the most flexible*, not that there are infinite Dollars or Euros to spend. Here are some elements of cost constraints<sup>2</sup> along with examples:

Budgeted expenditures: *Spending in June is limited to \$110,000*

Personnel limits: *3 Scientists and 1 Technician, 14 staff-years of effort*

Equipment: *12 Spectrometers, 5 forklift trucks*

Consumables: *3,000 drums of paint, 160 tons of concrete mix, 500GB of storage space*

Overhead/Administration: *Project Management software must be Brand X, version Y*

Intangibles: *Use of political power, favors, negotiation, concessions*

### **Time:**

Even if a "wonder of wonder, miracle of miracles" takes place and you suddenly receive an infinite amount of

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<sup>2</sup> Dobson

resources for your project, the very definition of a project prevents you from having an infinite amount of time. A project, you'll recall, is defined by the PMBOK Guide as having a definite beginning and end. So, your project will have a date by which it simply must be completed. And while that date is fixed, variations in the timing and duration of contributing tasks and subtasks will inevitably put pressure on that end date. Scheduling and sequencing techniques such as CPM and network diagrams (see section \_\_\_), and sometimes the simple disciplined use of a shared project calendar, help project managers deal with the time constraint.

Here are some elements of **time constraints**:

Calendar Deadline: *Completed by June 24, 2010*

Event-related: *Before concrete sets, by 2Q state tax filing deadline, immediately after release 1.5.1 passes QA Testing*

ASAP: *Top management deems this activity hot, get it done right away*

## **Scope:**

Unlike the constraints set on a project by time and resources, which are "used up" by the project as you (hopefully) make progress towards the project's product, scope is a constraint which is set and limited by the vendor/supplier/seller in agreement with the customer/client/buyer in the form of a contract (see section \_\_\_).

## Scope Creep

Violation of this constraint must be carefully watched, even when (maybe especially when) changes are being made in deceptively small increments. These small, seemingly innocuous changes to the project – or the product of the project – are collectively called *scope creep*. We cannot stress enough how important it is to fully understand the project's scope up front and in crystal-clear, commonly-understood terms between all stakeholders. The authors' experience shows that if scope is given only lip-service, it will become an insidious issue that really won't rear its ugly head until near the end of the project, when a "misunderstanding" between parties over requirements or scope is absolutely devastating. One of the most dreaded phrases you will ever hear as a PM is, "*I thought they meant ...*", especially when that is uttered late in the project. Spend extra time – even to the point of obsession – defining scope at the beginning of the project and keep your project energy focused on defining, communicating, defending and managing scope throughout the project. It will make a tremendous difference in your chance for a successful – and less stressful – project completion. The other phrase that should send shivers down your spine is this one: "*it's just a little change...*". This reference to an incremental change – for those of us in the engineering fields, just one little epsilon – is the way that scope creep got its name. It may only be incremental but it must be controlled or it will kill your project.

Here are some elements of scope constraints:

Performance Criteria:

- *600 GB of storage*
- *vehicle must have 25-person capacity*
- *< 10<sup>-9</sup> errors per second*
- *needs to be understood by people with 6<sup>th</sup> grade English language skills*

Result-oriented objectives:

- *Enable division to reach \$1B sales per year with 35% margin by EOY 2009*
- *Product certified by International Certification Agency*

Now, if one of your stakeholders asks you to increase storage to 610 GB, a vehicle that has a 26-person capacity, consider this scope creep. Even these “tiny” changes must be approved by a project authority, usually a Change Control Board.

**Quality:**

Here is the current American Society for Quality (ASQ) definition of quality:

**Quality:** A subjective term for which each person has his or her own definition. In technical usage, quality can have two meanings: 1. the characteristics of a product or service that bear on its ability to satisfy stated or implied needs. 2. a product or service free of deficiencies.<sup>3</sup>

This means that even between the two authors of this book, there is a potentially different definition of this basic term.

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<sup>3</sup> ASQ Web page [www.asq.org](http://www.asq.org)

We'll agree to define project Quality (for now) as a **producing a result for the customer of the project which best balances the use of resources and time and meeting all of the requirements of the scope.** Quality has been defined by some <sup>[footnote]</sup> as "what the customer wants". Some experts<sup>[footnote]</sup> believe that the "triple constraint" should be a "quadruple constraint", with "client acceptance" or quality as the fourth constraint. Some have said that there are five constraints – with Risk being the fifth. So, there is conflict in the world of constraints, yet there seem to be no constraints in the world of conflict when it comes to deciding on constraints in project management!

The Constramid®

At this point we would like to introduce you to the Constramid. See Figure \_\_\_\_\_. If you want to build one, see the pull-out card in Appendix \_\_\_\_\_. The Constramid is a conceptual device you can use to help you understand how these constraints affect you as the Fiddler on your project. The Constramid is a simple 3D pyramid, with three triangular *facets* named simply **Time**, **Cost**, and **Scope**, and a triangular *floor* named Risk/Uncertainty. To make this **very** personal, imagine that you're standing- just as Tevye's fiddler – on the peak of this structure.

Why is Risk and Uncertainty considered the Constramid's floor? We assert that **the main work of project managers in the real world is managing uncertainty and risk.** Managing of schedules and timelines in the face of 100% certainty does not require a professional project manager's touch. It is

precisely the effects of uncertainty and risk that make the job of project management challenging, interesting, and even fun. No guts, no glory. You should picture the floor as being “in motion”. Risks and uncertainties – such as a fire in your development lab, a new competitor arriving on (or leaving) the scene, a change in government regulations – imply **movement**. This is where our structure becomes interesting because in addition to being promoted from two dimensions to three (from a triangle to a pyramid), it is not limited to being a **static** form. Indeed, it is extremely dynamic. Risks and uncertainty exert force on the facets of your project’s schedule, budget, and requirements – the now familiar facets of Time, Cost, and Scope. You can imagine that if the base is changing shape, the facets of the Constramid are being forced to change also.

So where’s Quality? We further assert that *quality must be inherent in each of the facets of the Constramid*. Each facet should be imagined as having “What The Customer Wants” woven into its very fabric. To quote the PMBOK® Guide, “High quality projects deliver the required product, service or result within scope, on time, and within budget”.

### **The Constramid: a closer look**

Let’s look at the Constramid in more detail. Figure 1 is a flattened Constramid, unfolded from 3 dimensions to 2 so that (1) we could print it on a two-dimensional page, and (2) so that you can more clearly see the boundaries and intersections.

Figure 1-1 shows the boundaries – the lines formed at the intersection of the triangles – Risk/Uncertainty with Cost, Scope, and Time respectively. Note that the core of this discussion is one of **Risk Identification**, which we cover on its own in section \_\_\_\_\_. But for now, back to the facets of the Constramid - let's examine them one at a time.

#### Boundary A: Cost/Risk

At this boundary we deal with uncertainties related to our project's costs and resources. If we don't know or don't care enough about this boundary, variations in costs will control the project rather than the other way around. One of the authors was involved in a venture to import candies from The Netherlands. The group (optimistically) ignored the exchange rate between the US Dollar and the Euro, which at the time favored the Dollar at about a 0.85 Euros to the Dollar ratio. What we were implicitly doing, of course, was making an assumption that the exchange rate would be stable. Unfortunately for the venture, this flipped around so that the US Dollar was worth only 0.85 Euro, and the business case fundamentals fell apart. Note that if the exchange rate had gone the other way – so that the Dollar was even more strikingly in a favorable position, this still represents movement of Boundary A, however this would have been an "Opportunity" instead of a "Threat". Either way, we need to have taken this into account consciously and to have been aware that there was a Cost/Risk boundary here and we needed to understand the dynamics of that boundary with respect to our project.

### Boundary B: Time/Risk

At this boundary we face variability in schedules, durations, milestones, and deadlines. Note that from the author's experiences, deadlines tend to be stubbornly fixed or accelerated inwards, never pushed out!

To get a better grip on the Time/Risk boundary, PMs should use industry standard data, prior experience, expert judgment, and other schedule management techniques (see section \_\_\_) to verify norms and truly understand the overall project impact of these variations.

### Boundary C –Scope/Risk

As previously mentioned, this can take on the form of scope creep, in which the boundary moves imperceptibly slowly but before you know it, the project is almost unrecognizable. Take the 2008 Beijing Olympics as an example.

**BEIJING May 8, 2006 (AP)**— Work on a shooting range for the 2008 Beijing Olympics has been suspended after the discovery of imperial-era tombs on the site, newspapers and an antiquities official said Monday.

The tombs, found in mid-April, are believed to date back five to six centuries to the Ming dynasty, and may be those of eunuchs serving at the imperial court, the Beijing Morning Post said.

Beijing has been the site of imperial and other capitals for more than 1,000 years, and many major building projects unearth gravesites or relics. Most are removed or destroyed before experts can examine them.

A spokeswoman for the Beijing Olympic organizers, Zhu Jing, said the find accounted for only a small part of the construction site and "shouldn't affect the work too seriously."

"We'll let everyone know if there is a major discovery," Zhu said.

An official of the Beijing Cultural Relics Department, Liu Baoshan, declined to give an age for the tombs and said no details would be released until a final report is drawn up.

Archaeologists have found coins, ceramics and jade in the tombs at the shooting range on the Chinese capital's western outskirts, the Post and other papers said.

An Associated Press photographer who visited the site Monday saw antiquities officials at work on several pits dug into an area on the edge of the construction site, where work otherwise appeared to have halted. Workers refused to answer questions and demanded the photographer leave the area.

Olympics organizers broke ground in July 2004 for the shooting range.

The main Olympic facilities are on Beijing's north side, while other facilities are scattered around the city.

Beijing has been racing ahead with construction of venues for the games. Most have proceeded smoothly, although there have been some protests by people whose homes have been destroyed to make way for new stadiums and gymnasiums.

When the project managers for the Olympics began their work, they were not intending to get involved with archaeologists and tombs. But risk has a strange way of

changing the whole focus of your project in unpredictable ways.

OK, so you can hopefully picture our Fiddler atop the Constramid, faced with keeping his balance while the facets of the structure are tilting and moving and perhaps the whole structure itself is being raised and lowered. What other things affect his balance?

We can think of the project's *complexity* in terms of the *slipperiness* of the roof. A complicated project will make for a slippery roof – making it that much harder to gain a foothold.

What measurements of project complexity exist? One we prefer to use is CIFTER<sup>4</sup>, which defines seven complexity factors:

- Stability of the overall project context
- Number of distinct disciplines, methods, or approaches involved
- Magnitude of legal, social, or environmental implications from performing the project
- Overall expected financial impact (positive or negative) on the project's stakeholders
- Strategic importance of the project to the organization or organizations involved
- Stakeholder cohesion regarding the characteristics of the product of the project

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<sup>4</sup> Crawford-Ishikura Factor Table for Evaluating Roles, from GAPPS framework

- Number and variety of interfaces between project and other organizational entities

If each of the above factors are at the high end of the spectrum, you can imagine how much more complex the project would be and in turn the additional 'difficulty factor' for our Fiddler.

### Thinking with distributions in mind

Another important principle for PMs to follow is this: although project stakeholders (team members, functional managers, customers, and especially contributors) will tend to **speak** project cost, scope and time numbers in terms of specific fixed numbers or dates, you need to **hear** those numbers in terms of a distribution (see figure \_\_\_). Visualize a distribution and push back on the information. Ask the contributor for their confidence level in the estimate and how much "plus/minus" variance they would expect. Allow for the fact that the variance may not be symmetrical. For example, it may be that the development of a module or the lab test for a chemical will take 6 weeks, plus 2 weeks, minus 1 week – meaning that the expected distribution is skewed towards the pessimistic side. See section \_\_\_ on estimating.

### Tradeoffs between constraints

Think again about the Fiddler – or for that matter a tightrope walker or any other athlete trying to keep their balance. In addition to their facial expression of stolid concentration you can also see muscles straining as they shift their weight. What you are seeing in action is the athlete changing the

stress they are placing on one leg, the angle of their backbone, the position of their arms, even subtle movements of their toes and fingers. These are tradeoffs. Here are the tradeoffs we have within the Constramid:

### Adapted From Dobson

#### Exploiting the Weak Constraint

There is the possibility that in your project, the sides of the Constramid are ranked in priority. One is probably a Driver, one a Middle, and one a Weak constraint.

Weak constraint	Exploitation Strategy
Time	Allow the schedule to slip to mitigate cost (for example, use a slower but cheaper vendor)
Cost	Apply dollars and resources at problems as the best way to solve them.
Scope	Identify essential, desirable, and optional elements of project scope. Prioritize the schedule so that the essential elements are done first.

#### Summary

In this chapter, we've introduced a new tool you can use to visualize the effects of **cost**, **scope**, **time**, **quality**, **risk**, and even **complexity** on your project. Much of the remainder of the book is devoted to analyzing these in more detail and fleshing out and giving meaningful examples of 'knowledge area' treatment which is outlined in the PMBOK Guide. If you're a 'visual person', keep this imagery in mind. If not, use your other senses and sensibilities to recall the fact that managing a project is quite like the act of balancing on a slippery, sloping, shaking, shifting, shingled structure.

