

# Risk Management Approaches in Projects Management: Robust Reliability Model

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Assume, there are  $N$  activities and  $M$  paths in scheduling of the project, let  $t_n$  is the actual duration of the  $n$ th activity for  $n = 1, 2, \dots, N$ ,  $f_{mn}$  is the fractional participation of the activity  $n$  in the path  $m$ . This means that in the path  $m$  the activity following the starts when activity  $n$  is a fraction completed, between 0 and 1.

The duration of the activity path is the sum of durations of the activities in that path, weighted by their fractional participation times,

$$C_m = \sum_{n=1}^N f_{mn} t_n, \quad m = 1, 2, \dots, M \quad (1.0)$$

The dynamic model is the duration of the longest path,

$$T = \max |C_m| = \max_{1 \leq m \leq M} \left| \sum_{n=1}^N f_{mn} t_n \right| \quad (2.0)$$

The project is completed successfully if all of the activities are completed within the allowed duration i.e. CPM and known as  $T_{cr}$ . The failure criterion states that the project fails if the duration of the longest path exceed the critical value ,

$$T > T_{cr} \quad (3.0)$$

If  $\bar{t}_n$  denote the nominal duration of the  $n$  activity  $n = 1, 2, \dots, N$ .

The coefficients are  $w_1, w_2, \dots, w_n$  are the positive numbers expressing the relative variability of the activities. Higher value of this coefficient for any activity means that the duration of this activity tends to deviate more than the other activities. If there is no prior information about the relative variability of the activities, then all the  $w_n$  will equal unity.  $\alpha$  is known as

the uncertainty parameter. The value of  $\alpha$  indicates the information gap between what is known and what needs to be known for an ideal solution, , the greater the value of  $\alpha$ , the greater the variation.

A simple uncertainty model based on these information states that each activity duration may deviate by unknown fraction of its nominal value. The "uniform-bound" convex model as,

$$\tau(\alpha) = \left\{ t : \frac{t_n - \bar{t}_n}{\bar{t}_n} \leq w_n \alpha, n = 1, 2, \dots, N \right\} \quad (4.0)$$

$\tau(\alpha)$  is an infinite set of values of the vector  $t$  of activity durations. Each element  $t_n$  of the vector  $t$ , representing the duration of the  $n$ th activity, varies within the interval,

$$\bar{t}_n - w_n \bar{t}_n \alpha \leq t_n \leq \bar{t}_n + w_n \bar{t}_n \alpha \quad (5.0)$$

From equation (2.0) and (5.0), the maximum duration of the  $m$ th path can be written as,

$$\begin{aligned} \max_{\tau(\alpha)} C_m &= \max_{\tau(\alpha)} \sum_{n=1}^N f_{mn} t_n = \sum_{n=1}^N f_{mn} (\bar{t}_n + w_n \bar{t}_n \alpha) \\ &= \sum_{n=1}^N f_{mn} \bar{t}_n + \alpha \sum_{n=1}^N f_{mn} w_n \bar{t}_n \quad (6.0) \end{aligned}$$

Thus,  $\max C_m = \bar{C}_m + \alpha f_m$  (7.0)  
Where

$$\bar{C}_m = \sum_{n=1}^N f_{mn} \bar{t}_n \quad (8.0)$$

$$f_m = \sum_{n=1}^N f_{mn} w_n \bar{t}_n \quad (9.0)$$



The robustness is found by solving the following relation for  $\hat{\alpha}$ .  $\hat{\alpha}$  is the maximum of the set of  $\alpha$ -values for which the greatest path duration is acceptable, in other words, no failure,

$$\max_{1 \leq m \leq M} [\bar{C}_m + \hat{\alpha} f_m] = T_{\sigma} \quad (10.0)$$

To do this, the authors define the following quantities,

$$\alpha_m = \frac{T_{\sigma} - \bar{C}_m}{f_m} \quad (11.0)$$

where  $\alpha_m$  is the robustness of path  $m$ ,  $\alpha_m$  is the greatest acceptable uncertainty that the  $m$ th activity path can tolerate without violating the failure criteria, see equation (3.0). The robustness of the entire project is the robustness of the weakest path. That is, the robustness is the least of these  $\alpha_m$

$$\hat{\alpha} = \min_{1 \leq m \leq M} \frac{T_{\sigma} - \bar{C}_m}{f_m} \quad (12.0)$$

The value of  $\hat{\alpha}$  indicating vulnerability of the path to uncertainty, the least value of  $\hat{\alpha}$  indicate that the path is more vulnerable than all other paths.

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## PM QUICK TIPS

**Non-Verbal Communication.** The next time you meet someone new, notice the color of their eyes as you shake hands. You will gain strong eye contact, helping to make a good first impression. (Adapted from: *Secrets of Power Persuasion* by Roger Dawson, Prentice Hall [www.phdirect.com](http://www.phdirect.com))

**Project Team Operating Rules.** Consider establishing a "no surprise" team rule. Make withholding bad news the worst thing a team member can do. (Adapted from: *144 Ways to Walk the Talk* by Eric Harvey and Alexander Lucia, Walk the Talk Company, [www.walkthetalk.com](http://www.walkthetalk.com))

**Quiet Team Members.** Do you have a team member or two that tends not to speak-up at project meetings? After meetings, consider asking each team member to send you a follow-up email with further thoughts. You will likely receive valuable comments that you wouldn't otherwise receive, especially from your "shy ones." (Adapted from: *Stephanie Winston's The Organized Executive Briefings* Publishing Group (703) 518-2343)

**Double Check Those Numbers.** Underlying formula errors in spreadsheet programs are common. If you assemble your project budget using a spreadsheet program, don't accept final numbers before "running them" separately with a calculator. (Adapted from: *The complete Idiot's Guide to Project Management* by Sunny and Kim Baker Alpha Books [www.idiotsguides.com](http://www.idiotsguides.com))

**Performance Evaluations.** During project closeout, consider preparing your team member performance evaluations using a 350° feedback approach. Use a questionnaire to solicit information from people all around each team member: peers, subordinates, customers, managers. This provides a multi-perspective evaluation – more complete and accurate than the traditional top-down evaluation. (Adapted from: *Maximizing the Value of 360 Degree Feedback* by Walter W. Tornow and Manual London, [www.josseybass.com](http://www.josseybass.com))

## Project Manager Defined in Six Words

When someone asks you to describe your job as Project Manager, consider responding like Dan Fay. Instead of rolling out a long list of roles and responsibilities, Dan says simply, "I'm the lines in the organization."

Think about it. Envision a typical project org chart.... Lots of hierarchal boxes with names and titles, all connected by horizontal and vertical lines. A Project Manager's job can certainly likened to the lines:

- ♦ **Holding the project organization together** to function as an integrated whole.
  - ♦ **Keeping communications flowing** across the project organization.
  - ♦ **Providing essential tools**, resources and support across the project organization.
  - ♦ **Empowering elements** across the project organization.
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## Keep Your Project Vision Simple

Jack Welch advocates vision messages that are, "big but simple and understandable."

When you and your team mold a project vision message/statement, think about making it, "something you could get across easily at a cocktail party with strangers." (Adapted from: *Jack Welch and the GE Way* by Robert Slater, McGraw-Hill, [www.books.mcgraw-hill.com](http://www.books.mcgraw-hill.com)).