Estimating the Implications of Project Uncertainties

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INTERNATIONAL CEMENT CONFERENCE
Cemtech
PRODUCTION EXPERTISE - MANAGEMENT SKILLS

Dubai 2010

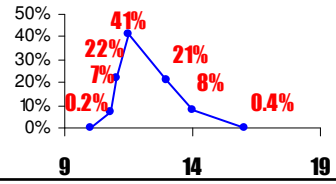
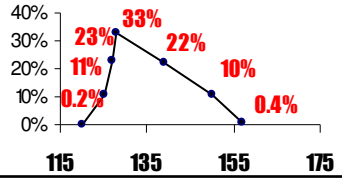
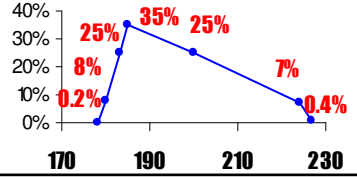
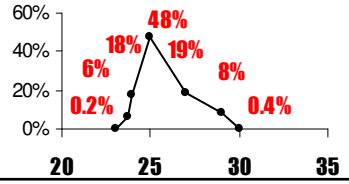
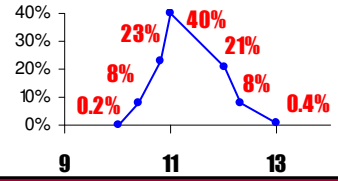
Initial Project Description

- Capacity : 2 mio tpa Cement
- Location : Timbuktu
- Expected Projected Duration : October 2005 – March 2008
- Raw Materials : Limestone & Clay (Captive Mines), Others (Purchased)
- Fuel : Coal + HFO
- Key Equipment :
  - Raw Mill : 525 tph, VRM
  - Kiln : 6,000 tpd, 5 Stage PH+PC, 75 m X 5.2 m, no bypass
  - Cement Mills : 2 X 170 tph, CCBM, 18 m X 5.4 m
  - Cement Silos : 3 X 8,000 t, 50 m X 16 m
- Expected Financials :
  - Investment : US $ 360 mio, D/ E = 1.5
  - Sales Revenue in Year I : US $ 216 mio
  - Operating Costs in Year I : US $ 130 mio
  - EBIDTA in Year I : 40%
  - IRR on Investment : 15 %

Implications of Uncertainties ?

- Increased Investment : Need for costlier Bridge Funds
- Delayed Commissioning : Opportunity loss in sales, reduced Market Access, higher Pre-Operative Expenses, etc.
- Over-estimated Limestone Reserves : Reduced Plant Life, compromised Quality
- Inadequate attention to Raw Material Variability : Reduced Output, poorer Quality, higher Operating Costs, crucial omissions in Technical Concept
- Constrained Short-Term, Equipment Capacities : Insufficient Output during Market Highs
- Insufficient Cement Storage Capacities : Recurring Stockouts, Higher Equipment Loads.
- Overestimate of Sales Volumes/ Price : Poorer Cash Flow
- Lower EBIDTA Margins : Defaults in Debt Servicing

Variability in Investment Components

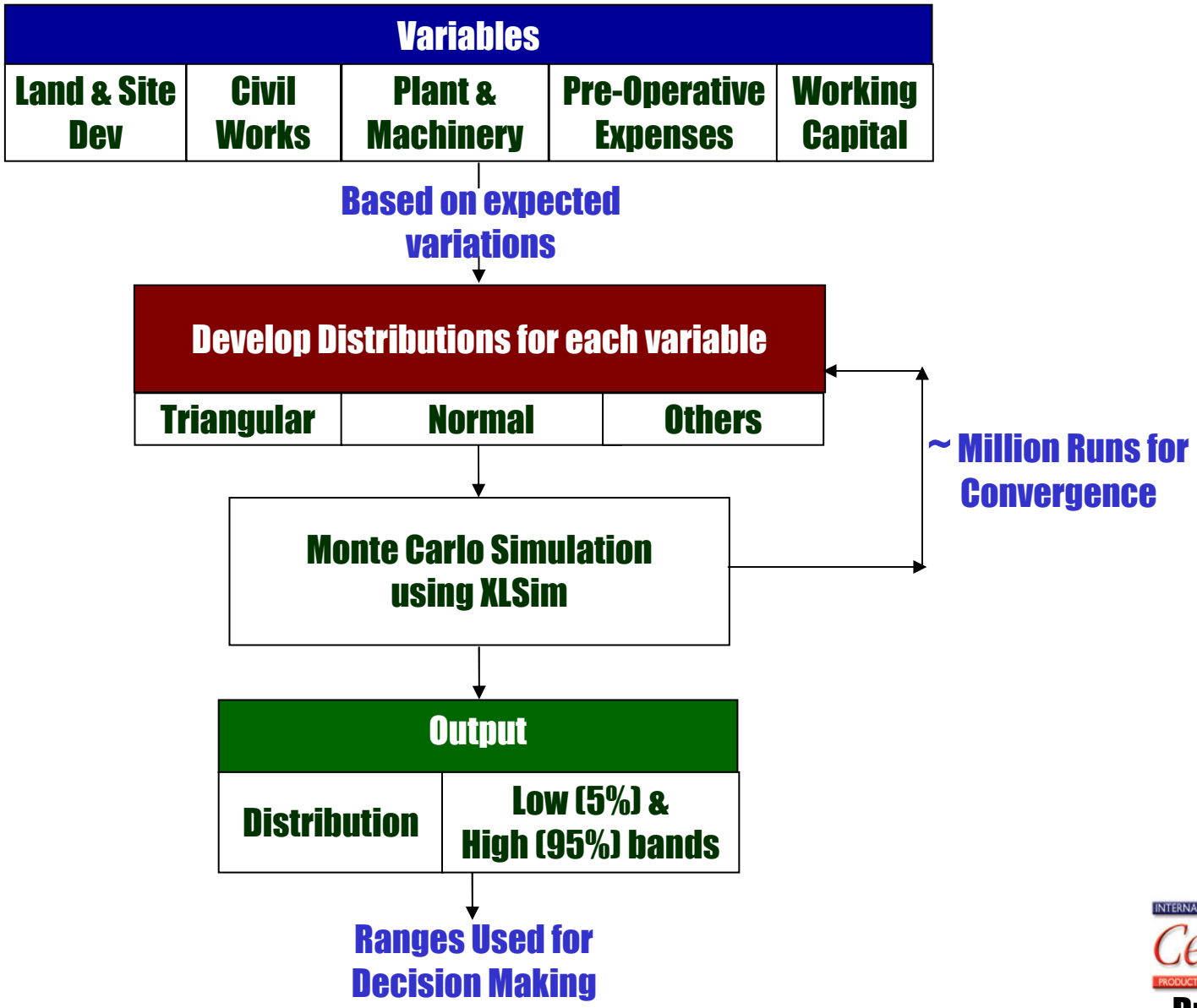
Components	Mean	Range	Variability
Land & Site Development	11	10 - 16	
Civil Works & Structures	128	120 – 156	
Plant & Machinery	185	178 – 227	
Pre-Operative Expenses	25	23 - 30	
Working Capital	11	10 - 13	
Total	360	341 - 442	

(All figures in USD mio)

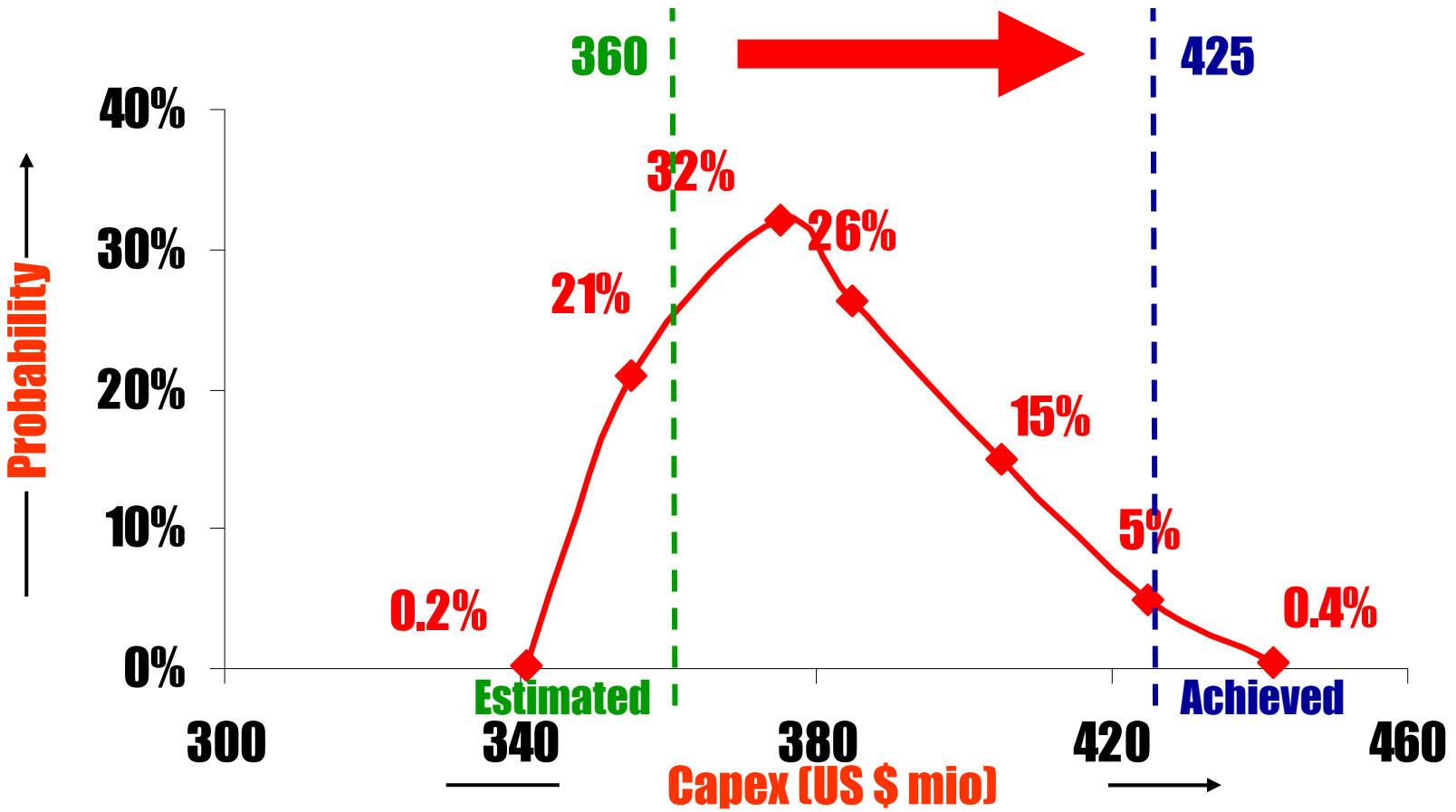
Reasons for Enhanced Investment

- Land Cost : Delayed Acquisition, Higher Realty rates, Increased requirement due to non-recognition of site constraints.
- Site Development Costs : Ignorance of topography/ hydrology, omission of several infrastructure development requirements.
- Cost of Civil Works : Inadequate soil investigation, insufficient information for accurate quantity estimates, higher material rates, contractual omissions.
- Cost of Equipment : Increase in equipment tonnage/ cable lengths, contractual follies, omissions in auxiliaries.
- Pre-operative Expenses : Increase in capitalized interest on account of longer gestation period, increase in resource requirements due to need for crashing activities.
- Working Capital : Increase in interest rates, higher stock volumes, increase in projected operating costs.

Steps in Simulation

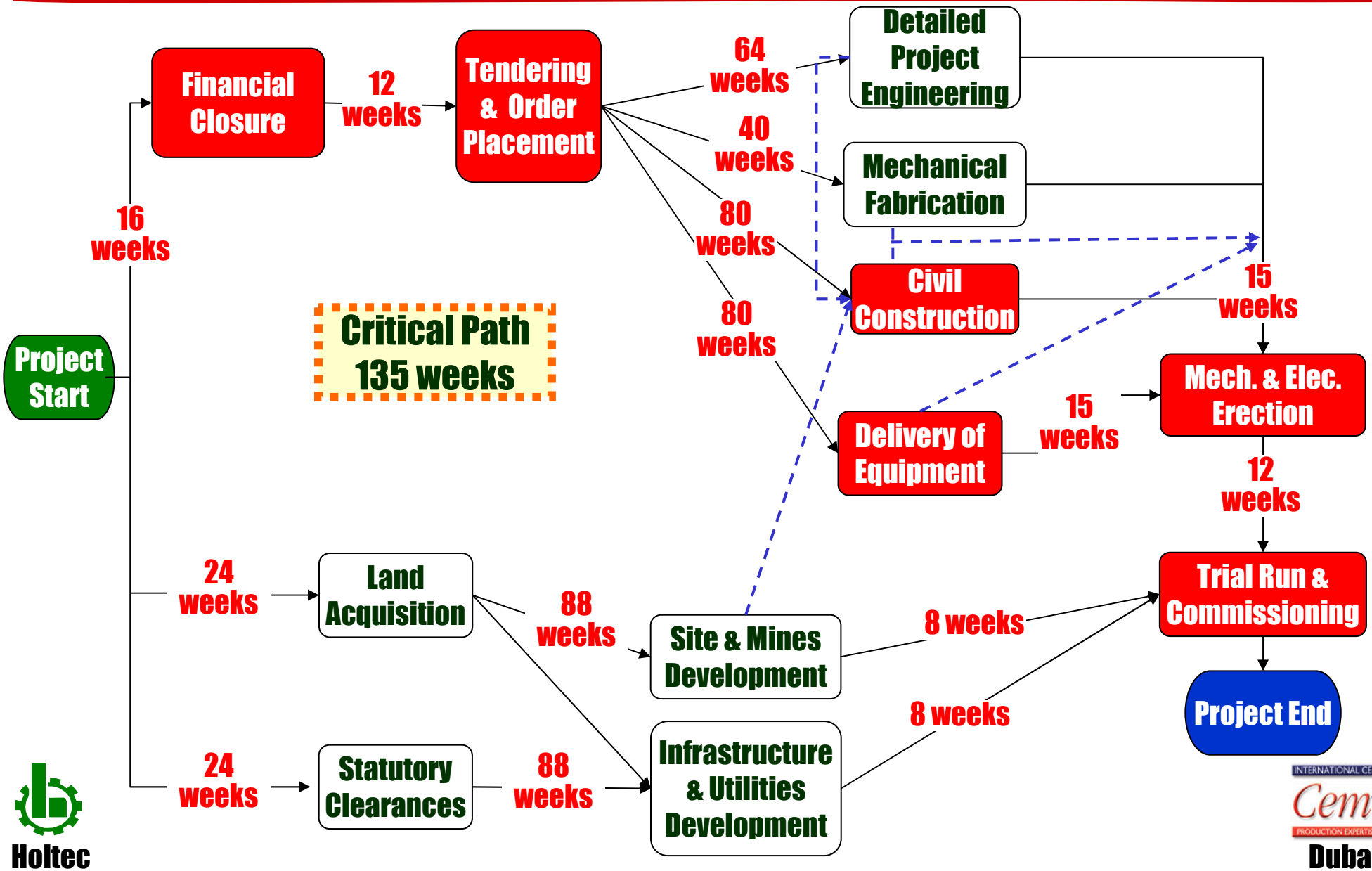


Simulated Investment



Had Simulation been initially used, it would have been known that the chances of overrun were ~ 79% !!

Implementation Period



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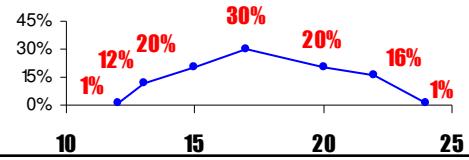
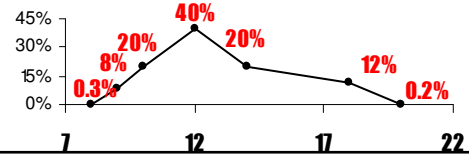
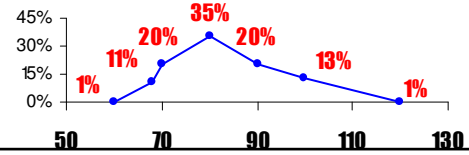
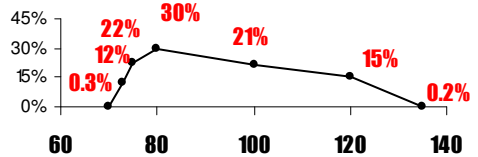
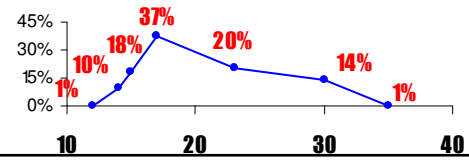
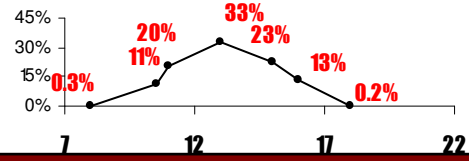
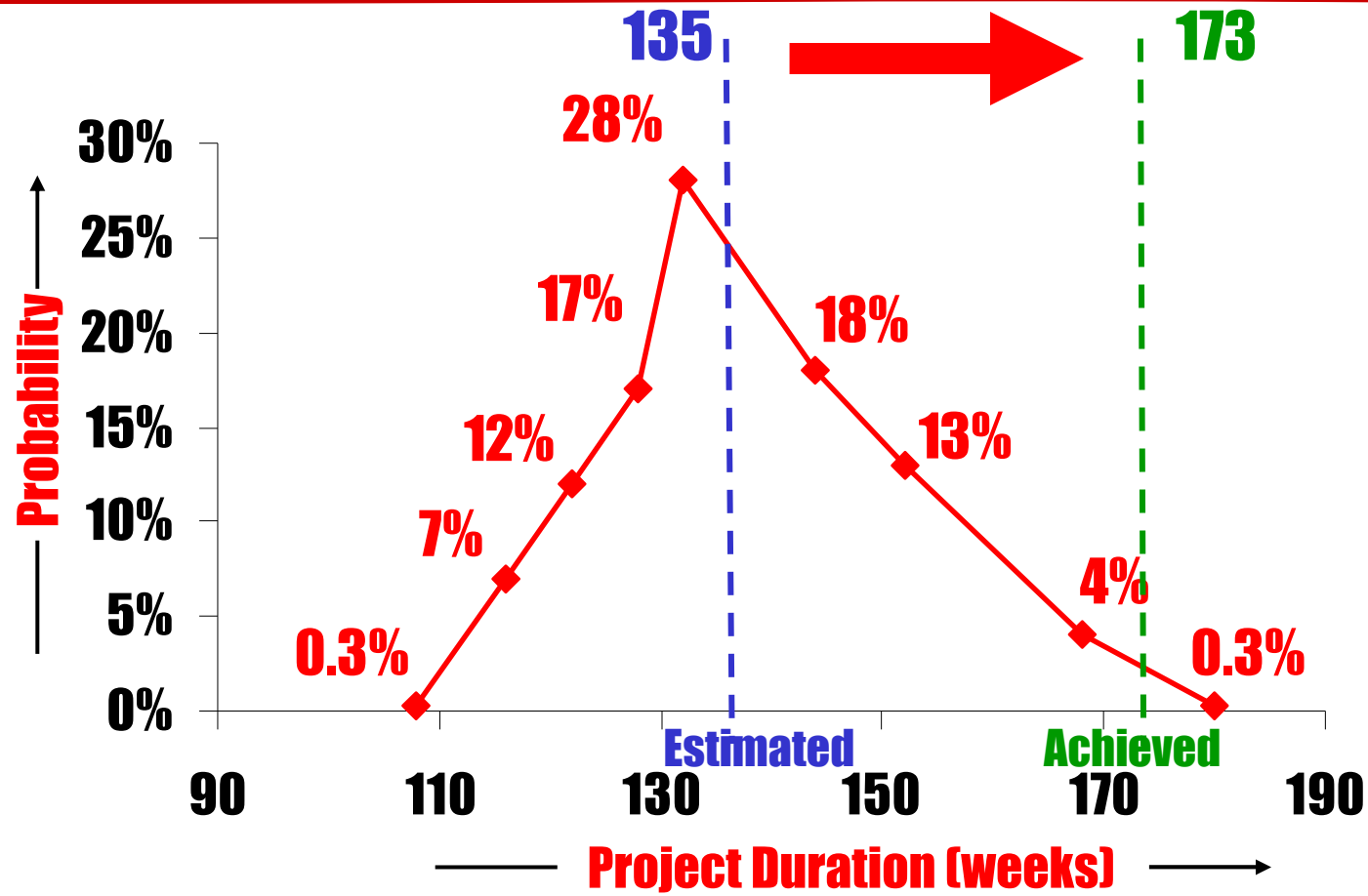
Variabilities Influencing Gestation

Variables	Mean	Range	Variability
Financial Closure	16	12 – 24	
Tendering & Order Placement	12	8 – 20	
Delivery of Equipment	80	60 – 120	
Civil Construction	80	70 – 135	
Mechanical & Electrical Erection	15	12 – 35	
Trial Runs & Commissioning	12	8 - 18	
Implementation Period	135	110 - 180	

(All figures in weeks)

Simulated Implementation Period



Had Simulation been initially used, it would have been known that the chances of time overrun were over 35% !!

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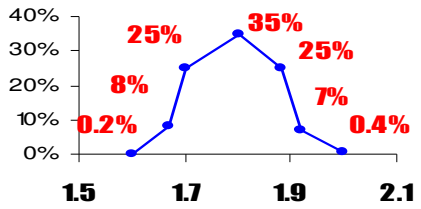
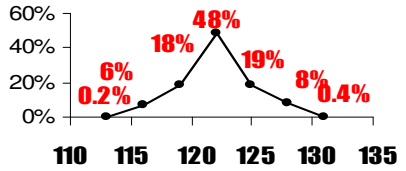
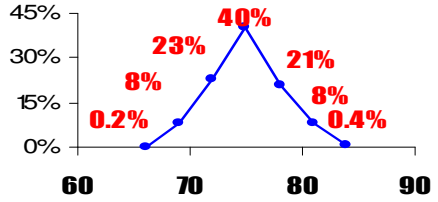
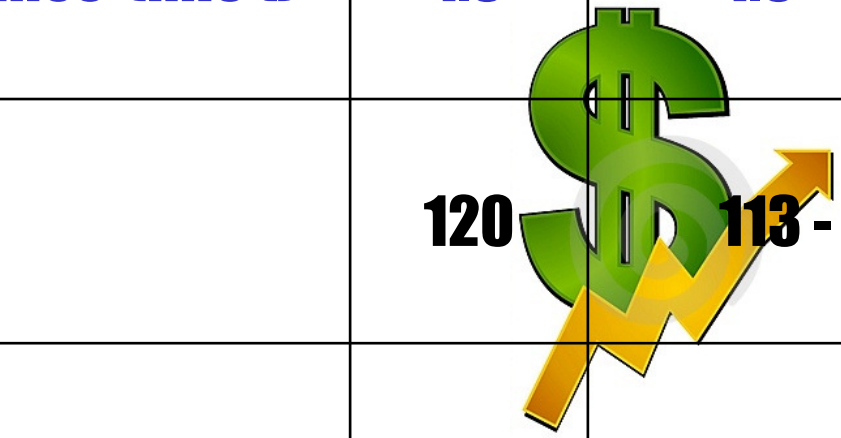
Variabilities in EBIDTA Components

Variables	Mean	Range	Variability
Sales Volumes (mio t)	1.8	1.6 – 2.0	
Price (USD/ t)	120	113 - 132	
Operating Cost (USD/ t)	72	69 - 81	
EBIDTA Margin	40%	29 – 48%	



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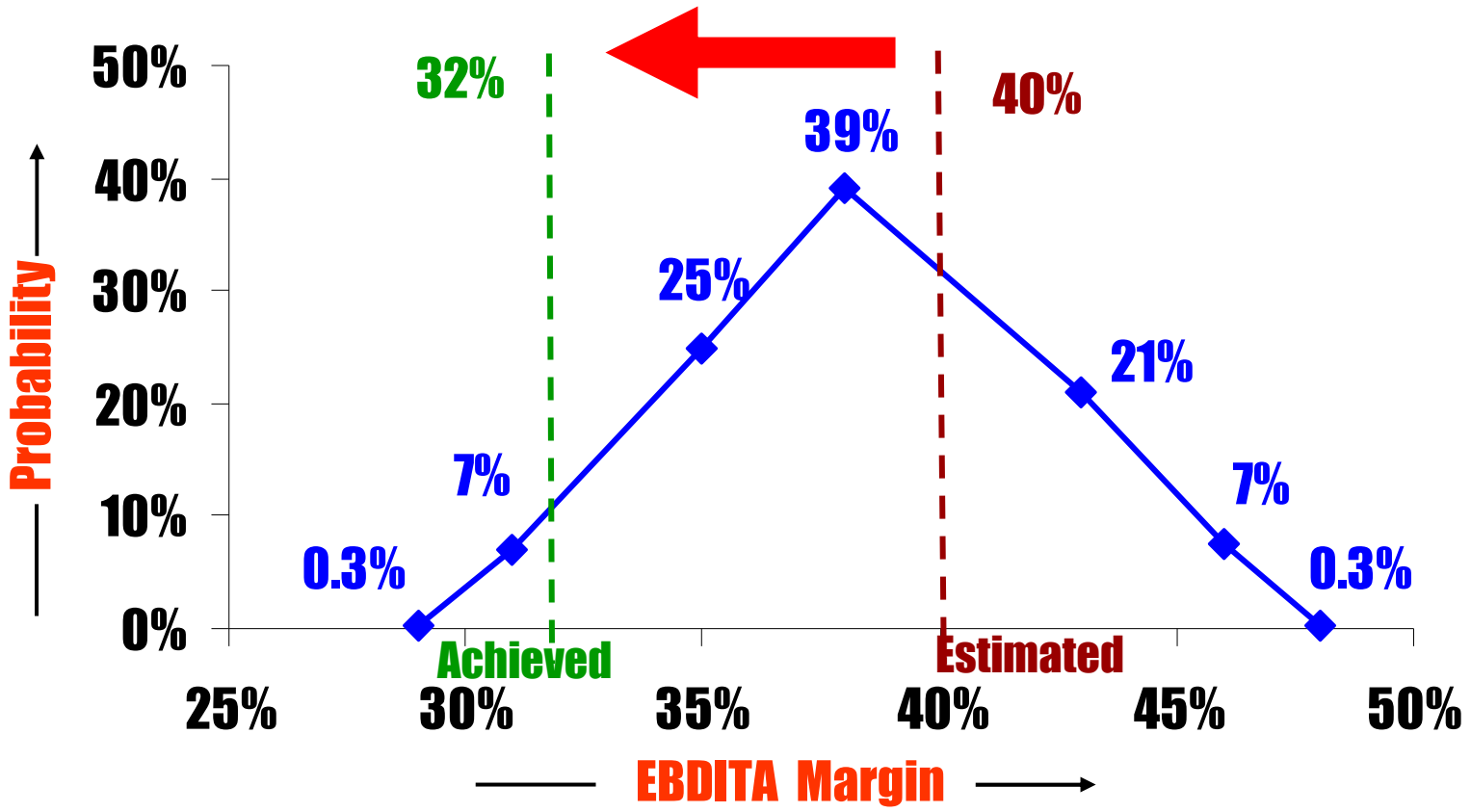
Simulated EBDITA Margin



Had Simulation been initially used, it would have been known that the chances of falling below the targeted EBIDTA was over 71% !!

Cyclone Blocking in the PH Tower

Cyclone Blocking is often caused by:

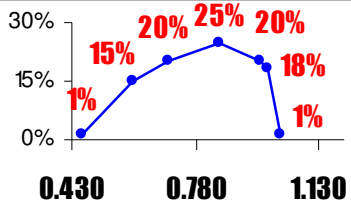
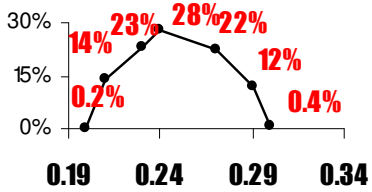
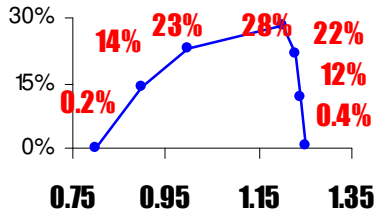
An imbalance of alkalies, sulphides and chlorides in the raw mix and fuel.

This may be determined by the Q Factor,

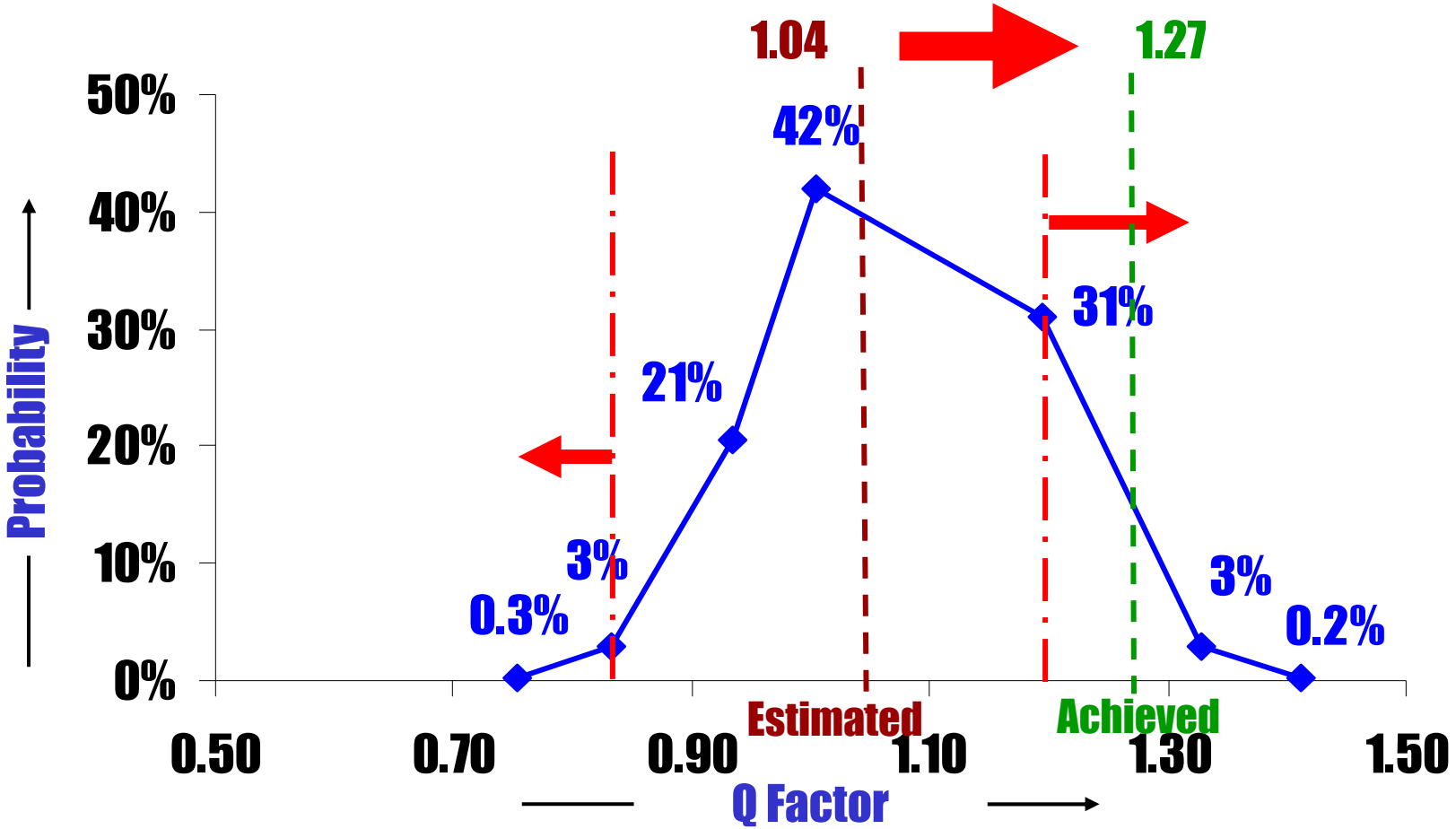
$$\frac{[SO_3/\ 80]}{[Na_2O/\ 62 + K_2O/\ 94 - Cl_2/71]}$$

Q Factors, not falling in the range, 0.8 - 1.2, generally result in cyclone blocking.

Variabilities in Q Factor Components

Variables	Mean	Range	Variability
Equivalent Alkalies	0.987	0.457 – 1.020	
Chloride	0.025	0.020 - 0.030	
Sulphides	1.250	0.800 – 1.250	
Q-Factor	1.04	0.75 - 1.41	
Cyclone Blocking	No	Not sure	

Simulated Cyclone Blocking

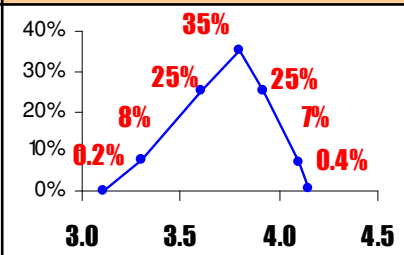
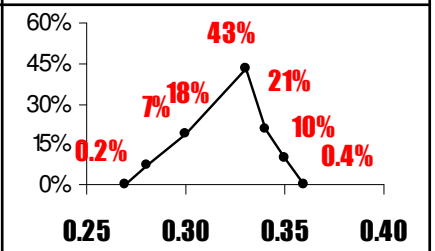
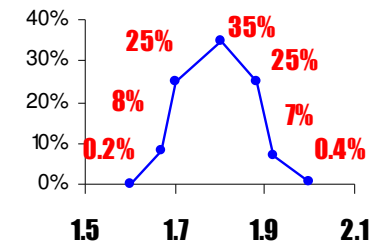


Had Simulation been initially used, it would have been known that the chances of cyclone blocking were over 34% !!

Silo Capacity

Variables	Mean Values
Capital Cost of Silo	: USD 3.8 mio
Mill Capacity	: 2 X 170 tph
Interest Rate for WC	: 12% pa
Sales Volumes	: 1.8 mio t
Silo Capacity	: 24,000 t

Variabilities Influencing Silo Capacity

Variables	Mean	Range	Variability
Capital Cost of Silo (USD mio)	3.8	3.1 – 4.2	
Working Capital (USD mio)	0.33	0.27 – 0.36	
Sales Volumes (mio t)	1.8	1.6 – 2.0	
Silo Capacity (t)	24,000	21,500 – 27,500	

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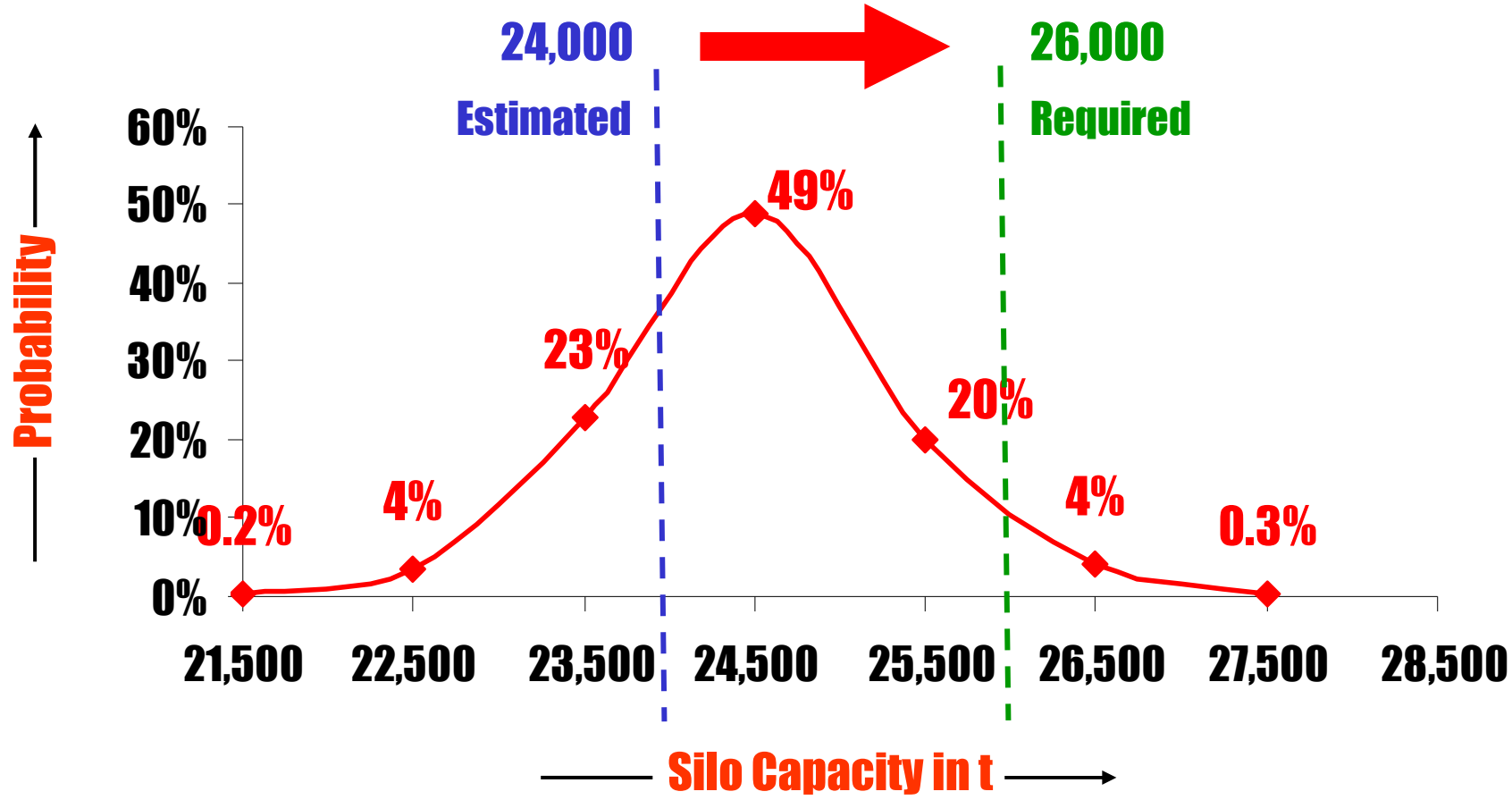
Simulated Cement Silo Capacity



Had Simulation been initially used, it would have been known that the chances of cement stockout were over 73% !!

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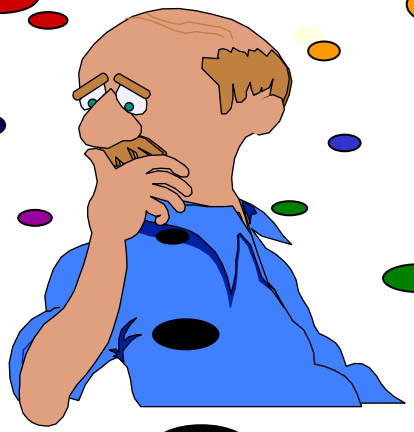
Are We Surprised ?

Commissioning delayed by ~ 9 months!

Debt Default! Promoters negotiating Project Sale!

Investment Estimates exceeded by US $ 65 mio!



EBIDTA down by 8 %

Preheater cyclones getting blocked!

Operating Costs up by 9%

Recurring cement stock outs?

Sales Revenue down by 11%

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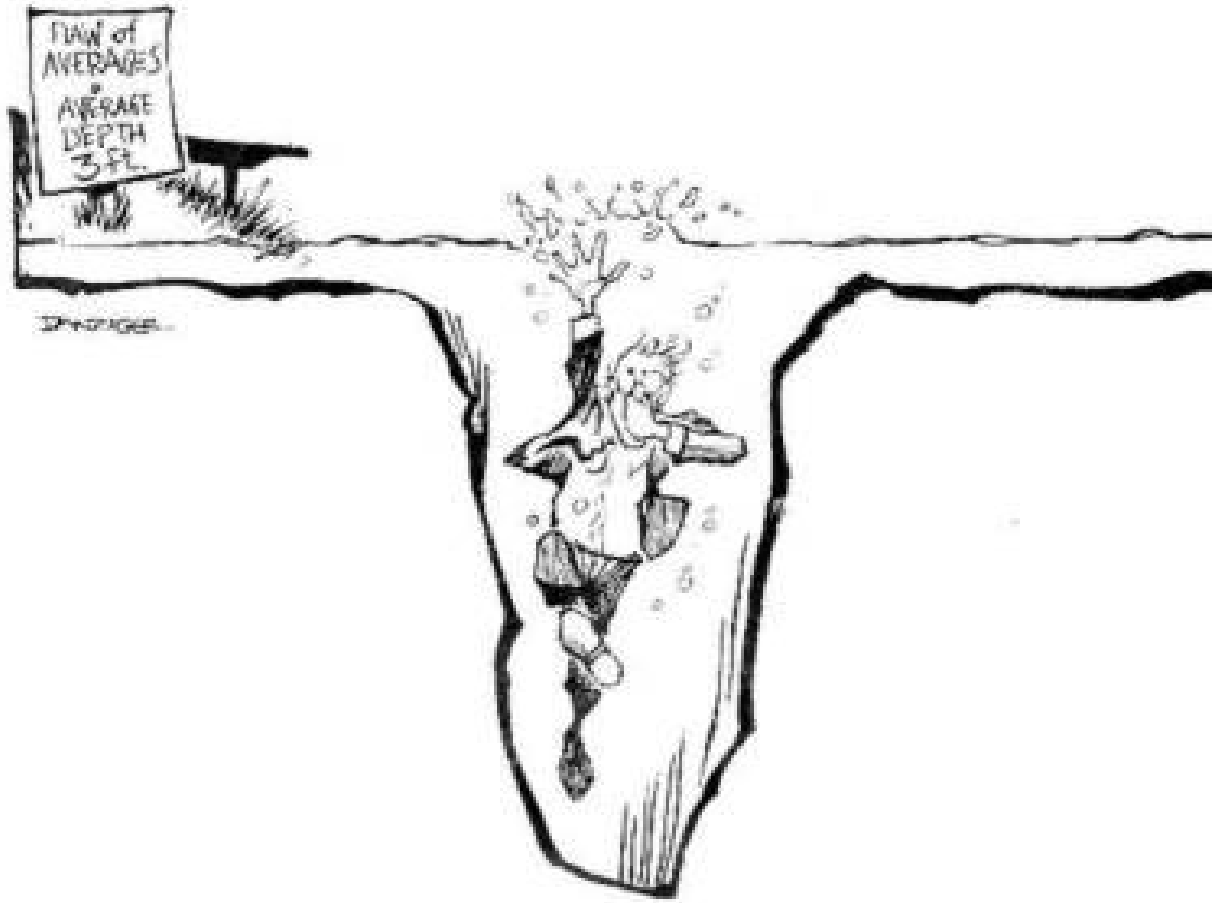
Credibility of Means/ Averages?

Predictions based on averages can indeed, be disastrous!



Well Then ?

- We may not have control over many uncertainties.
- However, to preclude unpleasant surprises, it becomes vital to estimate their implications better
- Simulation is a technique that helps us in estimating these implications.
  - It provides us a bandwidth within which the expected outcomes could lie.
  - It also permits us to estimate the degree of certainty with which an outcome can fall below/ above a certain cut-off.
  - Can explicitly predict the extent of risk.
- Calculated decisions can thus be taken, based on the risk taking ability of the decision maker

Contact Information

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Thank you for your attention !

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