

Table of Contents

Introduction	1
Chapter I	
The Nature of Uncertainty in Projects	3
1 What is uncertainty?	7
2 Uncertainty or Risk categories.....	10
3 Do Uncertainties or Risks only have a negative impact?.....	13
4 Uncertainty and the rolling wave concept.....	14
5 Risks and company culture	15
5.1 Risk taker or risk avoider.....	15
5.2 Attitude towards risks.....	16
Chapter II	
Uncertainty and Probability	19
6 Introducing statistics.....	23
7 Numbers.....	23
7.1 Discrete and Continuous data.....	23
7.2 Rounding numbers.....	24
7.3 Significant numbers	24
7.4 Representing data in graphs	26
7.5 Possible problems with graphics.....	27
8 Populations and Distributions	30
8.1 Normal Distribution (Gauss)	30
8.2 Beta-distribution	34
8.3 Bar charts.....	36
9 Statistical measures for a distribution	36
9.1 Notations	36
9.2 Mean.....	37
9.3 Median.....	37
9.4 Variance and Standard deviation.....	38
10 Probability.....	39
10.1 Game of "Craps"	40
10.2 Calculating chances for Lotto.....	40
10.3 Law of "large numbers"	41

10.4 Expected Value	43
11 Cautions to take when using statistical data.....	44

Chapter III

Identifying Uncertainties in Projects..... 47

12 Identifying uncertainties or risks in projects.....	49
12.1 Documents at our disposal	49
12.2 ABC – Process	49
12.3 Risks and Assumptions	50
12.4 Risks and the constraints	51
12.5 Barriers to Good Risk Identification and Remedies	57
13 Risk Management Planning	59
13.1 Planning meeting and analysis.....	59
13.2 Risk Breakdown Structure (RBS)	60
13.3 Probability and Impact of Risks.....	61
14 Techniques for identifying Risks	64
14.1 Brainstorming and Affinity diagram.....	64
14.2 Delphi and Wide Band Delphi Technique	65
14.3 Interviewing.....	66
14.4 Root cause identification	67
14.5 Strength Weakness Opportunity Threat.....	69
14.6 Checklists	70
14.7 Cause-and-effect diagram	71
14.8 System or process flow charts	72
14.9 Fault Tree Analysis.....	73
14.10 Pareto Analysis	75
14.11 Failure Mode and Effect Analysis.....	76
14.12 Five Why's.....	77
15 Ranking or Qualification of Risks	78
15.1 Risk classifying	78
15.2 Qualitative Risk Analysis	78

Chapter IV

Introducing Risk Quantification Techniques 81

16 Evaluating Impact of Risks on the Project	83
17 Expected Monetary Value of Risks	83
17.1 Expected Value of Risk.....	83
17.2 Expected Monetary value of Risk	84
17.3 Calculation example	85

17.4	Total Cost of Risk	85
18	<i>The Decision Tree</i>	86
18.1	Structure of the decision tree	86
18.2	Example of a Decision Tree	87
19	<i>Reliability of Systems – Redundancy – Fail Safeing.....</i>	93
19.1	Reliability of a system	93
19.2	Failure rate.....	94
19.3	Failures over the life span or “Bath Tub” curve	96
19.4	Reliability	97
19.5	Mean Time between Failure (MTBF)	98
19.6	Mean Time to Repair (MTTR).....	99
19.7	Mean Time between Removal (MTBR)	99
19.8	Availability	99
19.9	Introducing redundancy to systems.....	100
19.10	Adding Fail-Safe to a system	101
20	<i>Introducing PERT and Beta-distribution</i>	102
20.1	PERT	102
20.2	Beta- Distribution.....	105
20.3	Example	106
21	<i>Monte-Carlo Simulations.....</i>	111
22	<i>Comparing PERT with Monte-Carlo</i>	118

Chapter V

Risk Management Process and Cycle	121
23 Introduction	123
24 Risk Management Planning	124
25 Risk Identification	125
26 Qualitative Risk Analysis	125
27 Quantitative Risk Analysis.....	126
28 Risk Response Planning	127
29 Risk Monitoring and Control	128
Annex 1 – Abbreviations.....	133
Annex 2 – Definitions	135
Annex 3 – Formula’s and Symbols	147
Annex 4 – Examples of Standard Normal Distribution.....	149

Annex 5 – Standard Normal Table	155
Annex 6 – Beta function.....	157
Annex 7 – Triangular Distribution	161
Index.....	165
Bibliography	167