

TABLE OF CONTENTS

List of Figures	IX
List of Tables	XI

CHAPTER ONE: GENERAL INTRODUCTION

1.1 Introduction.....	1
1.2 Software Disasters	2
1.3 Basic Concept	3
1.4 Risk Monitoring.....	4
1.5 Software Risk Management History	5
1.6 Motivation.....	6
1.7 Benefits of Risk Management.....	7
1.8 Project Aims.....	8
1.9 Metodology	9
1.10 Thesis Overview	9

CHAPTER TWO: SOFTWARE RISK MANAGEMENT

2.1 Introduction.....	11
2.2 Theoretical Background.....	12
2.2.1 Risk Sources	12
2.2.2 Likelihood / Potential / Probability.....	14
2.2.3 Loss/ /Impact / Consequence / Magnitude.....	15
2.2.4 Software and Risk.....	15
2.2.5 Software Risks Categories and Types.....	16
2.2.6 Software Risk Management Concept.....	17
2.2.6.1 Software Risk Management Motivation	18
2.2.6.2 Narrative, Qualitative or Quantitative.....	19
2.2.6.3 Risk Exposure (RE)	20
2.2.6.4 Risk Reduction Leverage (RRL)	21
2.2.6.5 Risk Reduction Options	21
2.2.7 Software Risk Management Steps	22
2.2.7.1 Boehm's Steps	22
2.2.7.2 Charette's Steps	24
2.2.7.3 Rakos's Steps.....	25
2.2.7.4 Jacobson's Steps.....	26
2.2.7.5 Fairley's Steps	27
2.2.7.6 Software Engineering Institute (SEI) Steps	28
2.2.7.7 Risk Assessment and Mitigation Procedure (RAMP) Steps.....	29
2.2.7.8 Riskit Method Steps.....	30

- 2.3 Software Risk Management Approaches31
 - 2.3.1 Software Risk Abatement31
 - 2.3.2 Top Ten Risk Items Technique34
 - 2.3.3 Spiral Model.....35
 - 2.3.4 Software Risk Evaluation Method (SRE)37
 - 2.3.4.1 SRE Functional Components37
 - 2.3.4.2 SRE Implementation Phases40
 - 2.3.5 Software Risk Taxonomy40
 - 2.3.6 Taxonomy Based Questionnaire (TBQ)41
 - 2.3.7 Risk Factor Table.....42
 - 2.3.8 A Quantitative Methodology for Software Risk Control.....43
 - 2.3.9 Risk Assessment and Mitigation Procedure (RAMP)43
 - 2.3.10 Metrics for Software Risk Management44
- 2.4 Techniques Used for Risk Assessment44
 - 2.4.1 Checkbox44
 - 2.4.2 Applying Weighting Factors.....45
 - 2.4.3 Risk Severity Contours.....46
- 2.5 Risk Monitoring Techniques.....48
 - 2.5.1 Traffic Light Monitoring.....48
 - 2.5.2 Monitoring Schedule by Timeline49
 - 2.5.3 Monthly Risk Reporting for Senior Management50
 - 2.5.4 Risk Charting50
- 2.6 Related Tools51
 - 2.6.1 METRIX: A Tool for Software Risk Analysis and Management.....51
 - 2.6.2 ARMOR: Analyzer for Reducing Module Operational Risk52
 - 2.6.3 Software Technical Risk Advisor (STRA)52
 - 2.6.4 Software Risk Management Database Tool.....53
 - 2.6.5 Tools Comparison.....53
- 2.7 Conclusion54

CHAPTER THREE: SOFTWARE RISK MANAGEMENT SURVEY

- 3.1 Introduction.....56
- 3.2 Prior Studies.....57
- 3.3 Research Approach58
- 3.4 Survey Results58
 - 3.4.1 Top Risk Items Evaluation.....60
 - 3.4.1.1 Top Ten Risk Items.....60
 - 3.4.1.2 Additional Top Seven Risks63
- 3.5 Discussion.....69
- 3.6 Conclusion70

CHAPTER FOUR: *SOFTRISK* ANALYSIS AND REQUIREMENTS DEFINITION

4.1 Introduction.....	71
4.2 Information Description.....	71
4.2.1 Problems and Motives.....	71
4.2.2 General Requirements.....	73
4.3 Functional and Behavioural Description	75
4.3.1 Identification, Estimation, and Documentation	75
4.3.1.1 Risks' Database (RskDB) Manager	75
4.3.1.2 Projects' Risks File (PRSF) Manager	77
4.3.1.3 Probability and Magnitude Estimator	79
4.3.2 Assessment and Prioritisation	80
4.3.3 Monitoring and Controlling	81
4.3.3.1 Monitoring	81
4.3.3.2 Controlling and Re-assessment	81
4.3.4 Statistics Preparation.....	85
4.3.4.1 Risks Threatens.....	85
4.3.4.2 Risks Frequency	85
4.3.4.3 Risks Sorting	85
4.3.4.4 Risks Infection Impact	86
4.3.4.5 Risks Similarity.....	86
4.4 Overview on <i>SoftRisk</i> Steps	86
4.4.1 Step 1: Risk Identification	87
4.4.2 Step 2: Risk Probability and Magnitude Estimation.....	89
4.4.3 Step 3: Risk Documentation	89
4.4.4 Step 4: Risk Assessment	89
4.4.5 Step 5: Prioritisation and Highlighting Highest Ten Risks.....	90
4.4.6 Step 6: Monitoring (Graphical Representation).....	90
4.4.7 Step 7: Controlling and Reassessment.....	90
4.4.8 Step 8: Performing Statistical Operations and going back to step 1	91
4.5 <i>SoftRisk</i> Implementation Requirements and Environment	91
4.5.1 The Hardware.....	91
4.5.2 The Software.....	91
4.6 Conclusion	92

CHAPTER FIVE: *SOFTRISK* DESIGN

5.1 Introduction.....	93
5.2 Description of <i>SoftRisk</i> Design	93
5.2.1 Risk Matrix	93
5.2.2 <i>SoftRisk</i> Main Classes	94
5.2.2.1 <i>SoftRiskStarter</i> Class	95
5.2.2.2 <i>OperationsSelector</i> Class	95

5.2.2.3 Risk_Documentation Class.....	96
5.2.2.4 Projects_Risks Class.....	97
5.2.2.5 Risk_Assessment_and_Prioritization Class	97
5.2.2.6 Monitoring_and_Controlling Class.....	98
5.2.2.7 Graphic_Builder Class	99
5.2.2.8 Controlling Class.....	99
5.2.2.9 Prob_Mag_Estimation_Assistance Class.....	100
5.2.2.10 Prob_Mag_Preparation Class.....	100
5.2.2.11 Prob_Mag_Utilization Class.....	101
5.2.2.12 Statistical_Data_Preparation Class	101
5.2.3 SoftRisk Interaction Diagrams	102
5.2.4 Uder Interface Design	107
5.2.4.1 The Design of RskDB Data Entry/Retrieve Frame.....	107
5.2.4.2 The Design of PRSF Data Entry/Retrieve Frame	109
5.2.4.3 Estimation Assistance Utilization Frame Design (probability side)	110
5.3 Conclusion	111

CHAPTER SIX: *SOFRISK* IMPLEMENTATION

6.1 Introduction.....	112
6.2 Development Environment	112
6.2.1 Software Used	112
6.2.2 Hardware Used	113
6.3 <i>SoftRisk</i> Components Description	114
6.3.1 Projects' Risks Handling	116
6.3.1.1 Specifying A Group of Risks.....	117
6.3.1.2 Selecting One of Project's Records.....	117
6.3.1.3 Adding Data.....	119
6.3.2 Risks Documentation	124
6.3.2.1 Adding Data to RskDB.....	125
6.3.2.2 Working on Previous Registered Records.....	127
6.3.3 Risk Assessment and Prioritization	128
6.3.4 Monitoring and Controlling.....	130
6.3.4.1 Selecting A Project.....	130
6.3.4.2 Monitoring Preparation	131
6.3.4.3 Graphic Builder.....	131
6.3.4.4 Risk Controlling.....	132
6.3.5 Statistical Data Preparation	137
6.3.5.1 Risks Threatens.....	138
6.3.5.2 Risks Frequency.....	138
6.3.5.3 Risks Sorting.....	139
6.3.5.4 Risk Infection.....	139
6.3.5.5 Risks Similarity.....	140

6.3.6 Implementation Problems and Difficulties	142
6.4 Conclusion	143

CHAPTER SEVEN: *SOFT*RISK TESTING AND VALIDATION

7.1 Introduction.....	144
7.2 Testing.....	144
7.2.1 Testing Case.....	144
7.2.1.1 Initialization Data.....	145
7.2.1.2 Inspection Data	147
7.2.2 Testing Implementation	150
7.2.2.1 Risks' Database Testing.....	150
7.2.2.2 Projects' Risks Testing	152
7.2.2.3 Monitoring and Controlling Testing	156
7.2.2.4 Statistics Preparation Testing.....	159
7.3 Validation.....	163
7.4 Conclusion	167

CHAPTER EIGHT: CONCLUSION

8.1 Summary	168
8.2 Contributions	169
8.2.1 Research Contributions.....	169
8.2.2 The Features of <i>SoftRisk</i>	170
8.3 Limitation and Future Perspective	172
8.3.1 Risk Statistics.....	172
8.3.2 Specialization	173
8.3.3 Integration	173
8.3.4 Risk Cost Estimation	173

REFERENCES

APPENDICES

Appendix A: A Sample of Software Risk Management Questionnaire	A-1
Appendix B: Checklists of Probabilities and Magnitudes Estimation of Top Risks	B-1
Appendix C: A Sample of Validation Questionnaire	C-1

LIST OF FIGURES

Figure 2.1: Word-To-Probability Relationships.....	14
Figure 2.2: Cost/Benefits of Risk Mitigation.....	18
Figure 2.3: Software Risk Management Steps (Boehm)	23
Figure 2.4: Impact Assessment	33
Figure 2.5: Spiral Model	36
Figure 2.6: Air Force's Risk Assessment (AFSC/AFLC 800-45) Matrix	38
Figure 2.7: SEI-Taxonomy Structure	40
Figure 2.8: Part of the Taxonomy-Based Questionnaire.....	41
Figure 2.9: Risk Severity Contours.....	47
Figure 2.10: Monitoring on a Weekly Basis	49
Figure 3.1: Software Risks Types	59
Figure 3.2: Reasons for Non Implementation of Risk Management Techniques	60
Figure 3.3: Top Ten Risks Items (Sorted Based on Respondents Prioritization)	63
Figure 3.4: Additional Seven Top Risks (Sorted Based on Respondents Prioritization).....	69
Figure 4.1: <i>SoftRisk</i> Steps Diagram (Continuous inspection and monitoring)	88
Figure 5.1: Class and Relationships Notation	95
Figure 5.2: <i>SoftRisk</i> : Main Classes Diagram.....	96
Figure 5.3: Risk Assessment and Prioritization	98
Figure 5.4: Interaction Diagram Scenario-1 (Risk Documentation)	103
Figure 5.5: Interaction Diagram Scenario-2 (Projects' Risks Identification).....	104
Figure 5.6: Interaction Diagram Scenario-3 (Monitoring and Controlling).....	105
Figure 5.7: Interaction Diagram Scenario-4 (Statistical Operations).....	106
Figure 5.8: RskDB Data Entry/Retrieve Frame Design	108
Figure 5.9: PRSF Data Entry/Retrieve Frame Design	109
Figure 5.10: A Probability Estimator Frame	110
Figure 6.1: <i>SoftRisk</i> Main Components.....	114
Figure 6.2: Projects' Risks Handling Components.....	116
Figure 6.3: Specifying Risks for Entering Purpose.....	117
Figure 6.4: Selecting One of Projects Records for Display, Update, or Delete	118
Figure 6.5: Projects' Risk Record Selection	119
Figure 6.6: Risk Magnitude Estimator	123
Figure 6.7: Risk Documentation Components Hierarchy	125
Figure 6.8: Specifying A Risk Record	128
Figure 6.9: Reduction Action Documentation	137
Figure 6.10: Diagram of Infected Projects Processing.....	139
Figure 7.1: Testing of RskDB Data Entry/Retrieve Frame	150
Figure 7.2: Risk-Code Checker.....	151
Figure 7.3: Probability and Magnitude Preparation Testing.....	152
Figure 7.4: Testing the Projects Code Detector	153
Figure 7.5: Testing the Risk Code Detector	154

Figure 7.6-a,b: Probability Estimator Testing..... 155

Figure7.7: Inspection Number Detector..... 156

Figure 7.8-a,b: Monitoring Graph..... 157

Figure 7.9: Controlling Frame Components 158

Figure 7.10-a: Frequency List..... 159

Figure 7.10-b: Frequency List..... 160

Figure 7.11-a,b: Risks Infection..... 161

Figure 7.12-a: Similarity 162

Figure 7.12-b: Similarity 163

LIST OF TABLES

Table 2.1: Quantification of Performance Probability	32
Table 2.2: The Existing Top Ten Risk Items	34
Table 2.3: Levels of Magnitudes and Guidelines.....	39
Table 2.4: Risk Factors in Software Development	42
Table 2.5: Measures for Risk Factors.....	43
Table 2.6: RAMP Capability Levels.....	44
Table 2.7: Checkbox for Risk Analysis	45
Table 2.8: Risk Model Using Weighting Factors.....	46
Table 2.9: Computed Reference Points.....	46
Table 2.10: Risk Severity Table	47
Table 2.11: Risk Chart	51
Table 2.12: Comparison between Related Tools	54
Table 3.1: Reasons for Non Implementation of Risk Management Techniques	59
Table 3.2: Existing Top Ten Risk Items	61
Table 3.3: Top Ten Risk Items Evaluation	62
Table 3.4: Additional Top Seven Risk Items	64
Table 3.5: Additional Top Seven Risk Items Evaluation.....	68
Table 4.1: A Sample of Probability and Magnitude Estimation Checklists.....	80
Table 5.1: Risk Matrix Example	94
Table 6.1: Bufferdata Example	129
Table 6.2: BufferReady Example.....	130
Table 7.1: A Sample of Risks' Database Initialization Data.....	145
Table 7.2: Data sample of probability and magnitude estimator checklist	146
Table 7.3: Codes and Risks Names	147
Table 7.4: Sample of Fixed Data.....	148
Table 7.5: Changeable Inspection Data.....	149
Table 7.6: Validation Questionnaire	164
Table 7.7: Summary of the questionnaire results	165
Table 8.1: Comparison with Previous Tools.....	172