Chapter 1
Risk Management in Decision Making

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1 Risk Management and Decision Making

Organizational decision making often occurs in the face of uncertainty about whether a decision maker's choices will lead to benefit or disaster. Risk is the potential that a decision will lead to a loss or an undesirable outcome. In fact, almost any human decision carries some risk, but some decisions are much more risky than others. Risk and decision making are two inter-related factors in organizational management, and they are both related to various uncertainties.

There are several methods used to assess, evaluate, or measure risk in order to support better decision making. Some of them are quantitative and some are more subjective. They are all used in support human decision making.

Risk management is defined as "coordinated activities to direct and control an organization with regard to risk [1]" by the International Organization for Standardization (ISO), where a risk refers to "an uncertain event or set of events which, should it occur, will have an effect on the achievement of objectives [4]". Risk management is an important organisational activity used to identify and assess potential risks, and make appropriate decisions in response to, and to control, those risks.

A practical implementation of the risk management process follows a series of principles and guidelines. A well-established relationship diagram between the risk management process, the implementation principle, and the process framework is defined in [1] (see Figure 1).

Typical application fields of risk management include engineering, finance and banking. In recent years, risk management techniques and methodologies have been

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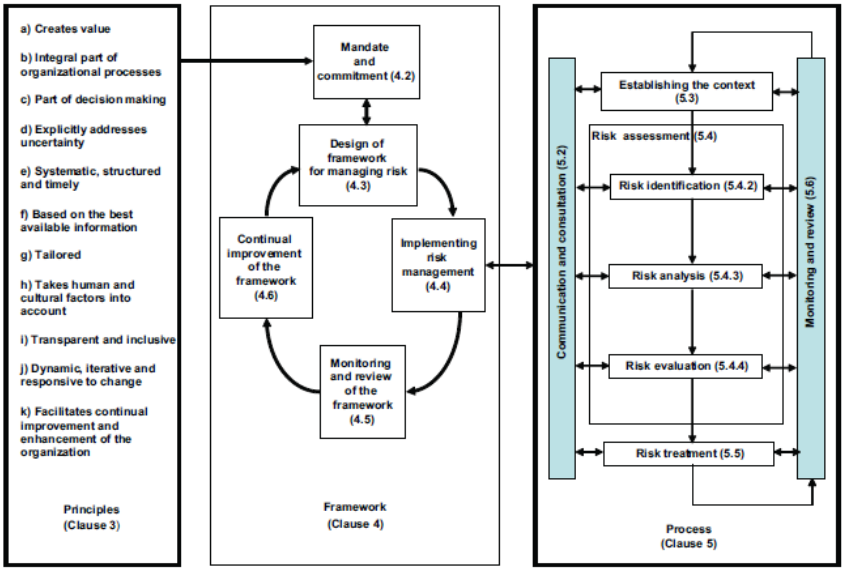

Fig. 1. Relationships between the risk management principles, framework and process [1]

extensively and successfully used in areas such as social management [5], energy management [3] and sustainable development [6], road and food safety [2], disaster forecasting and prediction, industrial and business competitions, and politics. Meanwhile, new challenges to the theories, the methodologies, and the techniques for risk management have emerged from the developments and deployments of risk management implementations.

Decision making is ubiquitous, and is closely related to risk management. On one hand, appropriate decision making is an important task in risk management implementation; on the other hand, a risk management process in decision making is an important step for better decision making. In practice, a decision environment for a real application becomes more and more complex and uncontrollable. Making an appropriate decision is not easy. Various uncertainties, which occur in natural environments and human societies increases the possibility of making inappropriate decisions. How to effectively make a decision, therefore, is a challenging issue for organisations needing to reach their targeted achievements.

Research into combining risk management with decision making has drawn considerable attention from researchers in a variety of disciplines. It includes decision making under risk, as well as risk decision making. In particular, research about how to respond to an emergency and reduce risk in a disaster has recently developed.

This book aims to present innovative theories, methodologies, and techniques in the risk management and decision making field. It introduces new research and technology development to readers interested in the area and provides a comprehensive image of their potential applications. The collected works cover: computational intelligence for risk management, multi-criteria decision making, healthcare modelling, risk forecasting and evaluation, public security and community safety, supply chain optimisation and resource allocation, and business and political risk management.

2 Chapter Outlines

Following Chapter 1, the book has 20 chapters in three parts that cover state-of-the art of research and development of various aspects of risk management in decision making, including both theories and applications.

Part one contains Chapters 2-9, which focus on decision making under risk.

Chapter 2 discusses Computational Intelligence (CI) techniques for risk management in decision making. A detailed classification of existing techniques is presented. Future directions of CI for risk management are presented.

Chapter 3 outlines the use of belief degree in distributed fuzzy cognitive maps for energy policy evaluation. The authors present a tool for dealing with casual reasoning.

Chapter 4 presents the comparative effectiveness analysis for decision making purposes. With reference to cancer drugs, comparative effectiveness analysis tends to compare quality threshold values. The author has used data mining to compare different aspects of comparative analysis for the treatment of osteoporosis with the overall cost of healthcare.

Chapter 5 outlines portfolio risk management modelling by bi-level optimization for investment. The authors present a formal model of optimization for the portfolio problem. They state that the risk of investment can be minimized twice by optimal content of portfolio securities and optimal assessment of the parameter of risk preference.

Chapter 6 presents a set of possibilitic decision making models for portfolio problems. The authors state that, since portfolio experts' knowledge is characterized by the upper and lower possibility distributions, the obtained portfolio will reflect portfolio experts' judgment.

Chapter 7 considers searching musical representation phrases using decision making based on fuzzy similarities. The authors present a method of locating representative phrases from a musical score and validating its superiority by use of examples.

Chapter 8 focuses on a risk-based multi-criteria decision support system for sustainable development in the textile supply chain. The authors have used a method of data aggregation with multiple fuzzy criteria for selecting the most appropriate textile material and the most suitable supplier.

Chapter 9 reports a fuzzy decision system for road safety. This is a significant contribution towards reducing road accidents by proposing corrective actions that should be taken by drivers.

Part two focuses on risk management in business decision making and includes Chapters 10 to15.

Chapter 10 describes a latex price forecasting model to reduce the risk of rubber over-production in Thailand. The model is validated using real rubber latex prices trend data, which in turn is compared with experimental forecasting results to determine forecasting accuracy.

Chapter 11 develops an agent-based model for pandemic influenza in Egypt. The results help us to understand the characteristics of a pandemic and the conditions under which an outbreak occurs.

Chapter 12 focuses on supply chain risk management. The authors present an overview of how better supply chain decision making with risk can be made so that it achieves supply chain resilience and business continuity.

Chapter 13 outlines the development of a fuzzy decision system for autonomous car parking. The authors validated this system using a simulation applet to park successfully in most of the initial conditions.

Chapter 14 presents a risk-based decision making framework for investment in the real estate industry. The proposed framework provides a comprehensive analysis of risk-based decision making for optimal decisions. The framework can be applied to problem solving involving different issues in the decision making process where risk is a factor.

Chapter 15 provides a compressive review of literature on risk management in logistics in order to provide valuable insights for enterprise by understanding the essential logistical risk management concepts.

Part 3 focuses on risk assessment and response systems in Chapters 16 to 21.

Chapter 16 studies natural disaster risk assessment using the information diffusion technique and a geographical information system. It takes grassland fire disasters in Northern China as the case study and tests the reliability of the proposed approach.

Chapter 17 applies a social systems modelling technique to political risk management. The authors present a social system modelling technique and its associated intelligent system tools; these are applied to assess and manage political risk. The agent models are subjected to real-world examples to establish the validity.

Chapter 18 outlines the development of an integrated intelligent cooperative model for water-related risk management and resource scheduling. Two of models are proposed by the authors. Simulation results demonstrate that the first model makes full use of the spatial and time data of a drought so that high accuracy of evaluation and classification of the drought severity can therefore be acquired. The second model distributes water storage between reservoirs timely and efficiently.

Chapter 19 discusses the significance of assessment criteria for risk analysis in business associations. The authors state that the proposed approach is applicable to any activity in any domain to determine the significance of the assessment criteria, while performing risk assessment and management.

Chapter 20 focuses on artificial immune systems for agent based modelling of crisis response operations. The proposed model is applied to the spread of pandemic influenza in Egypt.

Chapter 21 discusses a mobile-based emergency response system using an ontology supported information extraction technique. The proposed scheme can extract many kinds of semantic elements of emergency situation information such as disaster location, disaster event, and status of a disaster.

3 Summary

Organizational decision is usually made under a certain degree of risk. Risk management has been widely and successfully used in many decision problems. This book presents an overview of new developments of risk management and decision making theories and techniques and their applications. Research has shown that many

newly emerging problems are still facing managers, users, and organisations in the areas of risk management and decision making. This book aims to address some of those problems and provide innovative, yet practical solutions for organisational decision making.

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