COMPUTER SUPPORTED RISK MANAGEMENT

TOPICS IN SAFETY, RISK, RELIABILITY AND QUALITY

VOLUME 4

Aims and Scope. Fundamental questions which are being asked these days of all products, processes and services with ever increasing frequency are:

How safe?
How reliable?
How good is the quality?

In practice none of the three topics can be considered in isolation as they often interact in subtle and complex fashions. The major objective of the series is to cover the spectrum of disciplines required to deal with safety, reliability and quality. The texts will be of a level generally suitable for final year, M.Sc and Ph.D students, researchers in the above fields, practitioners, engineers, consultants and others concerned with safety, reliability and quality.

In addition to fundamental texts, authoritative 'state of the art' texts on topics of current interest will be specifically commissioned for inclusion in the series.

The special emphasis which will be placed on all texts will be, readability, clarity, relevance

The titles published in this series are listed at the end of this volume.

Computer Supported Risk Management

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Preface

The management of human-made and natural risks is facing new challenges from two perspectives. On the one hand are the increasing complexity of human activities and their interactions with technological systems which result in the potential for large catastrophes. On the other hand are the latest advances in communications and information technologies which are opening new frontiers for the development of support tools for risk managers.

Human activities, including energy production, transportation, manufacturing, and recreation, are becoming more intensive and, simultaneously, more widespread as the population grows and its expectations rise. The unavoidable risks associated with those activities must be addressed in regional, national, and even global perspectives. Risks to which a society is exposed cannot be seen just as the "sum" of the risks from individual hazards. Rather, hazards interact, thereby "multiplying" the risks of individual hazards. Moreover, the conflicting objectives in planning do not permit one to set a minimum level for all risks. The focus of safety planning has to change from a goal of a safe environment to a sustainable development perspective. Due to the integrative nature of this focus, risk managers must be prepared to address issues of even higher complexity than in the past.

Advances in information technology will provide opportunities for the development of decision aids that could help risk managers deal with this increased complexity. Such aids are, in fact, being developed and used. Safety planners are employing powerful geographic information systems to process and visualize vast amounts of data; emergency managers are relying on satellite-based communications systems to coordinate remote and mobile operations; emergency planners are investigating the use of hypermedia information systems to generate response plans; controllers in energy generation plants are using computer-based expert systems to monitor the technological processes; and policy planners are taking advantage of computerized group decision support rooms to devise new policies, plans, and procedures.

But advanced information and communications technologies have the potential for developing even more audacious support tools. Virtual reality technology, satellite location and tracking systems, satellite-based communications systems, fiber optics wide-area networks, and voice and motion controlled computer systems provide the basis for new risk management approaches that are very different from common practice. Moreover, the steadily increasing user-friendliness of computer technology provides the basis for managers to develop their own software, tailoring the tool to their need.

There are many challenges that result from the appearance of new tasks in risk management and the commercialization of powerful information and communications technologies. However, the crucial challenge lies in finding the optimal sharing of tasks between the technology and its human user, e.g., the risk manager. This anticipated

synergy can open new horizons but it can also create uncertainties and hazards for the risk managers, for the people exposed to the risks, and also for the society. To get the most effective use of an integrated human-computer system, the interface must be designed to capitalize upon the strengths of the resources, human, or computer, and allow for their deficiencies. Humans have intuition, they can make analogies, and they can quickly recognize patterns. Computers are perfectly suited for logic and deductive reasoning; they can perform complex computations, rapidly and error-free.

Knowing the strengths and the weaknesses of both humans and computers is not enough; the quality of the synergy also depends upon the efficiency and effectiveness of the interactions between the two. These interactions are based upon ***models***, abstractions of real-world relationships. Models help us to understand phenomena, develop alternative means for dealing with them, and set goals and objectives used to decide among alternative courses of action.

The Polyproject *Risk and Safety of Technological Systems* of the Swiss Federal Institute of Technology recognized the emerging challenges in risk management by establishing an interdisciplinary four-year international project. The goal of the Polyproject is to address emerging issues in risk management. It consists of over twenty sub-projects in risk analysis, risk assessment, and risk management. As part of the sub-project *Methodology and Computer Supported Risk Management*, we were asked to address the role of emerging technologies in risk management at the international level.

In doing so, we contacted leading experts in risk management world-wide. The result is this book, consisting of 16 chapters, prepared by researchers and practitioners from ten countries: Australia, Austria, Italy, Finland, France, Netherlands, Russia, Switzerland, United Kingdom, and United States. The book is divided into four sections: conceptual aspects, planning and policy analysis, operational decision making, and commercial applications.

The first section addresses conceptual aspects of computer supported risk management. *Sage* introduces the vast field of risk management and defines basic concepts. *Hollnagel* compares computerized risk management with manual risk management to identify relative strengths and weaknesses. *Haastrup* addresses design issues for risk and environmental management support systems. *Wahlström* discusses different modeling approaches for designing human-machine systems.

The second section deals with planning and policy analysis. *Harrald* presents group decision support systems in contingency planning. *Glickman et al.* present a GIS-based environmental equity analysis in the Pittsburgh area. *Lepofsky et al.* describe methods for employing a GIS that can provide the capability to perform transportation hazard analysis and incident management. *Johnson* discusses the application of GISs in emergency management.

The third section deals with operational decision making in risk management. *Parker et al.* present the on-line nuclear power reactor accident monitoring system of the Illinois Department of Nuclear Safety. *Shavit* introduces an integrated platform for major emergency management. *Hunter* discusses a method for integrating GIS with new automatic dialing telecommunications technology to improve the delivery of public safety warnings and to assist emergency service agencies in monitoring the response and effectiveness of their message. *Beroggi and Wallace* discuss the challenges for the risk management community in the light of new information and communications technologies using the cases of hazardous material transportation and emergency management.

The fourth section is devoted to commercial applications. *Fedra and Weigkricht* discuss integrated information systems for technological risk assessment. *Gheorghe et al.* present InterClair, an environmental decision support system for air pollution simulation and control. *Moskowitz et al.* present the results of a mail survey about models used to support decision making at hazardous and radioactive waste sites. *Bouchard et al.* discuss the present environmental modeling software at the U.S. Environmental Protection Agency's Center for Exposure Assessment Modeling.

The audience of this book consists of: *researchers*, who will find the emerging issues in risk management that are motivated by the encounter of new tasks and novel technology; *practitioners* who will have descriptions and references of the state-of-the-art models and software; and *students* who will learn the basic concepts needed to develop advanced information and decision support systems in risk management.

Further information on the Polyproject and its publication series can be obtained form:

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