Risk Management
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Report

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The Risk Management International Workshop was held at HTW Berlin in connection with the Enviroinfo 2009 Conference. It was organized by GI TC 4.6 Environmental Informatics WG on Risk Management in cooperation with CODATA-Germany, the German National Committee on Data for Science and Technology.

The workshop, dedicated to the data science and information system aspects of risk model structure, implementation, and application on an interdisciplinary level, provided an overview of a range of risk models, their applications, and approaches to analysis of pertinent data from different perspectives.

Keywords: Situation, Scenario, Process Models, Environmental and Risk Communication, User-Centric information provision, Context Models, Impact Data Bases, Risk Information Systems Structure

1 Introduction

There is growing concern over the need to increase preparedness and substantially support decision making for actions to be taken in environmental and technical risk situations. These areas are related to follow-up legislation and management for authorities on all spatial levels as well as for factories owners and of transnational companies.

All involved stakeholders are welcome in the debate. Decision makers, users, civil servants, technicians, and researchers from the private and public sector in the EU and other regions are invited to communicate

their experiences and to discuss the necessary strategies for methodological, technical and managerial improvements.

Key to the workshop was having an overview on the use of risk management techniques and computer science methods for risk analysis. The context was to have an overview of risk assessment in aviation, bio-safety, incident management, critical installations, disaster management related to climate change, hazards in urban areas, and transportation of dangerous goods by road, rail, or pipeline. Of additional importance was the legal context: regulations, sustainability risk within banking regulatory framework, and licenses related to the Seveso II directive, in particular to the land use planning process.

Visualization and GIS representations of technological and natural risks, the development of specialized databases, as well as data handling, remote sensing and methodological work on crisis management risks were identified for mitigation.

2 Technical, Methodological, and Strategic Aspects

Despite their different starting points, the presentations and the panel discussion reached consensus in both problems and solutions. The detailed discussion following each presentation was of great value to all workshop participants. Among the discussion items, the following were considered for further technical, methodological, and strategic aspects:

- National and regional programs of research and development in the area of disaster risk management are mainly created for Homeland Security (e.g. Germany, Netherlands) and also from the viewpoints of prevention of major hazards, emergency response, and land use planning (Portugal, Czech Republic). These programs should be integrated and coordinated at least for Europe.
- Risk information models typically comprise a large number of variables and complex dependencies of functional, analytical, and operational boundary conditions.
- The appropriate complex model construct is situational. Scenario techniques allow for the derivation of variations in decision alternatives and consequences. There are web-based scenario tools available that allow public users to vary facts and contexts for variation investigations, but it is not clear to what extent a non-expert (with regard to data and model) decision-maker would be able to draw reliable information from doing so.
- Simplification and generalization of risk models, coupled with the use of different public databases and regional geo-data servers, makes the risk mapping process accessible to regional managers.
- A high degree of transferability of data-result and methodology to other natural hazard types or even analytical tasks in the domain of applied geosciences can be sought to maximize scientific connectivity as well as a prospective commercial value of the different results.
- Risk models must be communicated. The whole risk communication process requires substantially more investigation in order to become reliable and efficient enough to achieve the overall goal of better understanding, decision making, and action in all exceptional cases of risk.
- Aggregates of certain parameters must be visualized in a more or less standard way (agreement on visual style and cartographic models) to prevent multi-actor and multicultural misunderstanding or misinterpretation.
- The risk perception and cognition of community and social behavior should be further investigated. An integrated approach that includes planning, decision-making and communicative strategies and tools is highly relevant. Social behavior, interaction, communication, and the resulting influence on decision making needs to be taken into account.

- The International Center of Training for Disaster Management in Torino, Italy is extending its competence in concrete answers to situations and training for better preparedness and management of natural hazard crisis situations elsewhere in the world.
- Risk modeling is part of a holistic approach to process management. Risk needs to be discussed in the context of processes and an integrated approach to risk-aware process modeling to integrate stakeholders, activities and objects to be developed. Effective knowledge transfer and sharing between persons with different fields of expertise and policies is crucial for the quality of the processes leading to the design and implementation of risk prevention, reduction, and mitigation. Some tools concerning transfer and sharing must emerge, with improved knowledge transfer between research institutions and local structures of civil protection or between local structures of civil protection and other public agencies/actors. It is also crucial that the quality of the processes improve the capacity to identify and include local non-expert knowledge in the design and implementation of risk prevention and emergency planning measures.
- Structure and content of an international data base on the impact of natural and technological disasters should be developed beyond existing first level metainformation degrees of detailed documentation.

3 Topics of Research and Development Deficits

Techniques

- ICT integration of technical and natural risks
- disaster management and emergency preparedness, prevention, alert, response, and mitigation
- frameworks for technological integration at the syntactic, semantic, and pragmatic levels
- reliable, accurate, precise, high fidelity (calibrated) information
- performance and scalability of components, functions, and services

Methods

- data processing related to risk management issues, especially structural aspects of information systems, and risk model methodology and implementation
- scenario models (facts, functions, structure, decision, action)
- risk of model overflow (increasing number of contradicting models)
- creation of a technical testbed for mutual and independent control of models and as a basis for creating pilot application implementations
- incorporation of strength methodological approaches through available data and the diverse databases

Benchmarking

- threshold definitions and consequences
- definition of acceptable levels of risk
- cost-benefit analysis and open documentation of alternatives to "implemented" levels of risk (e.g., 100-year flood level)
- societal awareness of possible alternatives to current risk situations
- individual and community perceptions and related local non-expert knowledge

Cartography

- deriving standards of visualization
- risk, cumulative risk, and multi-risk cartographic issues
- rapid mapping from space-borne and remote sensing images
- scalar output and input
- na-tech (natural and techhnological) hazard cartography
- adaptive cartographic visualization for an effective communication of risk situations
- scalable visual analysis of highly complex and dynamic systems

Communication

- risk communication: from techniques to behavioral sciences
- multi-lingual to multi-cultural context-dependent information communication
- communication of risk in the public domain, including different phases of the disaster cycle (e.g., preparedness, rapid response)
- proper communication of data which is both relevant and understandable
- decision making to trigger the correct actions
- communication between research institutions and structures of civil protection
- communication between local structures of civil protection and other public agencies/agents (local and otherwise)
- communication between local and national structures of civil protection
- integrated strategies to consider land-use planning practices, decision-making and communication instruments
- role of the media
- confidence in available information
- reduction in communication gaps, and promotion of the exchange of successful experiences
- communication of uncertainty through mass media

Mathematical Aspects and Modeling

- mathematical representation and models of multi-hazard situations which involve multi-agency coordination efforts
- increased role of modern mathematical theory in development of aggregation and generalization methods for multi-level decision making
- analysis of invariants and assessment of the model-derived results, consistency of macro- and micro- approaches
- decision making in highly dynamic situations
- evaluation of systems stability and sensitivity to actual and anticipated parameter variations
- risk-aware process modeling techniques
- neural networks techniques
- context models

Legal Aspect

- effectiveness of current laws and regulations
  (freedom of information acts, Berlin Declaration, etc.)
- top-down and bottom up approaches
- rules and guidelines in territorial context
- rules and guidelines in sectorial context
- steps of regulatory measures to deliver operational services
- integration of process modeling, decision making, and action issues (pragmatics)

Data

- one-stop portal for all actors in natural and technical disaster situations
- need for improved procedures for data quality analysis and documentation
- data verification and independent control (primary data, derived data, including quality, reliability, and suitability (goal reaching) issues)
- absence of interdisciplinary integrated framework for data, models, and actions at the syntactic, semantic, and pragmatic levels (formats, meaning, action/behavior)
- selection and filtering procedures to derive decision-specific information from an overflow of data
- information generation, primarily for the purpose of specific goal-reaching (via decision and action)
- data methodology validation
- access to real time or near real time sensor network data and its fusion with geo-information infrastructure
- role of agencies and organizations

4 Miscellaneous and Future Activities

The eNewslist RISK_List is available for the exchange of any information related to this domain. To join this eNewslist, visit http://www.codata-germany.org/RISK_2009 or contact Horst Kremers.

The workshop chairs wish to express their appreciation to the Enviroinfo 2009 Group and to the ICT-Ensure project management board for their support. The chairs hope that such cooperation will continue in further symposia on similar topics.

The overall goal of this workshop from the viewpoint of computer science is to develop a general methodology of risk modeling and to initiate recommendations for adequate information system components.

One of the primary goals of this research is to elaborate the necessary framework for all countries to have access to, and to develop the capacity to use, information of all types and descriptions in decision-making during all phases of the disaster cycle.

Owing to the lack of scientific and technical investigations, research strategies should be developed at the local, regional, national, multi-national, and global levels by appropriate agencies and organizations.

The next workshop is scheduled to be held in Berlin, August 26/27, 2010.
http://www.codata-germany.org/RMA_2010

5 Main Issues

From users to decision makers and actors

Information science in the area of disaster and risk management has undergone a substantial paradigm change in the last several years. This has affected the entire methodological chain: starting with data collection, next making the data available by means of interoperable tools and technology, and then moving towards complex information systems for operational decision support in order to both achieve goals, and set up controls to do so.

Data verification and independent control by international bodies

There is a pressing need for a broad investigation into information quality issues and integrated statistical methods which collect and evaluate data on a global scale. In order to be reliable and conducive to selecting the appropriate course of action, the data derived from a situation description must be balanced with the effects and consequences of alternative decisions.

Information society, future culture issues

Information society aspects are scarcely treated in current disaster and risk research. Although basic information is often made available to the public, it is but rudimentary in the context of a full-scale society-related situation. Multi-lingual, multi-cultural, user (group) specific context consideration and implementations are generally lacking.

Political relevance

In the end, the amount of effort and resources dedicated to all phases of the disaster cycle is a political decision. Clearly, there should be a much broader cultural awareness of the limitations of civic support concerning technical and natural risk in everyday situations.

Highly dynamic and complex situation scenarios

Owing to the marked shortage in highly dynamic scenarios, funding bodies should be encouraged to provide an adequate amount of resources.

Considering the vast humanitarian and economic consequences, strategic supports should exist for raising the issues depicted in this workshop to national and international discussions in the disaster and risk domain, as well as on Information Society aspects (e.g. WSIS) and towards the discussion of our common cultural future (UNESCO).

This report also will be published in the upcoming volume of

Lecture Notes in Information Sciences (a CODATA-Germany publication series)

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RISK Models and Applications Selected Papers

to be published in early 2010