

ENVIRONMENTAL RISK ASSESSMENT AND MANAGEMENT RESEARCH

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ABSTRACT: Environmental Risk Assessment (ERA) is a powerful technical and analytical set of instruments for analyzing adverse environmental impacts, and has found some application in supporting the decision-making process over the last two decades. Risk assessment provides information on potential health or ecological risks, and risk management is the action taken based on consideration of that and other information. Risk assessment techniques identify and evaluate potential losses and that can be easily expanded to include adverse environmental effects. It provides theoretical and scientific frameworks for environmental risk management and decision making. Environmental Risk Management (ERM) is becoming a critical component of corporate strategy. Until the 1960s, there was a little concern with environmental risk on the part of business, governments and societies. Environmental risk management was termed command and control basically involved compliance with various regulations. Compliance responsibilities were typically handled by Engineering Departments with little involvement of risk managers. Companies and organizations must assess, mitigate, and monitor certain risks involved with their daily operations. A specific area of risk that must be identified is that on the local and global environment. Accidents, natural events, and deliberate assaults are all possible ways for an enterprise to cause pollution or other risks. This paper presents an environmental risk assessment and management research to assess the basic concept, methods and results as well as their applications and also discuss the existing problems and corporate strategies practices prospectus for decision making.

KEYWORDS: Environmental Risk Assessment, Risk Management, Global Environment & Decision Making.

INTRODUCTION

The environmental risk assessment is a new aspect of environmental impact assessment. Environmental risk assessment is not only the inevitable result of environment scientific development, but also is an urgent need for social security. It has become the scientific and important basis of the environmental risk management and environmental decision-making. The risk assessment may include an evaluation of what the risks mean in practice to those effected. This will depend heavily on how the risk is perceived. Risk perception involves people's beliefs, attitudes, judgments and feelings, as well as the wider social or cultural values that people adopt towards hazards and their benefits. The way in which people perceive risk is vital in the process of assessing and managing risk. Risk perception will be a major determinant in whether a risk is deemed to be "acceptable" and whether the risk management measures imposed are seen to resolve the problem. The technique of risk assessment is used in a wide range of professions and academic subjects. Engineers "risk assess" bridges to determine the likelihood and effect of failure of components, and social welfare workers "risk assess" their clients to determine the likelihood of the re occurrence of anti-social behavior. Risk assessment has become a commonly used approach in examining environmental problems. It is used to examine risks of very different natures. Risk assessment is carried out to enable a risk management decision to be made. It has been argued that the scientific risk assessment process should be separated from the policy risk management process but it is now widely recognized that this is not possible. The two are intimately linked. Risk management is the decision-making process through which choices can be made between a range of options which achieve the "required outcome". The "required outcome" may be specified by legislation by way of environmental standards, may be determined by a formalized risk-cost-benefit analysis or may be determined by another process for instance "industry norms" or "good practice". It is important to note that although risk assessment is used extensively in environmental policy and regulation it is not without controversy is also true for risk management.

Risk assessment and management was established as a scientific field some 30–40 years ago. Principles and methods were developed for how to conceptualize, assess and manage risk. These principles and methods still represent to a large extent the foundation of his field today, but many advances have been made, linked to both the theoretical platform and practical models and procedures. To a large extent, these ideas and principles still form the basis for the field today. New and more sophisticated analysis methods and techniques have been developed, and risk analytical approaches and methods are now used in most societal sectors. The risk field has two main tasks, (I) to use risk assessments and risk management to study and treat the risk of specific activities (for example the operation of an offshore installation or an investment), and (II) to perform generic risk research and development, related to concepts, theories, frameworks, approaches, principles, methods and models to understand, assess, characterize, communicate and (in a wide sense) manage/govern risk. The generic part (II) provides the concepts and the assessment and management tools to be used in the specific assessment and management problems of (I). Simplified, we can say that the risk field is about understanding the world (in relation to risk) and how we can and should understand, assess and manage this world.

The aim of the present paper is to perform a review of recent advances made in the risk field, having a special focus on the fundamental ideas, concept and thinking that form the generic research to assess the basic methods, results as well as their applications and also discuss the existing problems and corporate strategies practices for decision making.

RESEARCH METHODOLOGY

In the risk assessment and management methodology defined as the degree of adverse effects, mathematically probability the consequences and its unit of measurement, technical study and survey. This methodology also include the key issue in risk assessment there possible outcomes. It therefore, provides a methodology to identify existing problems and strategies for decision making.

ENVIRONMENTAL RISK ASSESSMENT PURPOSE

Environmental risk assessment is an iterative process. The aspect register generated as a result of the risk assessment workshop will be reviewed and updated as required. These reviews will be informed by ongoing environmental monitoring conducted as part of the environmental management system. This is critical for achieving continual improvement. The purpose of a risk assessment is to systematically identify all of the risks associated with a task, activity or process, and put appropriate controls in place to eliminate or reduce the risks associated with that activity.

ENVIRONMENTAL RISK MANAGEMENT SYSTEM

More recently, a newer, second level approach environmental risk management is seen as an integral part of overall business and strategic management. Environmental risk management systems have been developing at a rapid pace. These system include both organization-based and individual company-based programs. It is the opinion that corporate risk managers can and should be the a part of developing and operating environmental risk management systems. While many risk managers are currently involved in environmental issues, they could be much bigger contributors. Indeed, as will be argued below, risk management training and techniques as well suited to contribute to effective environmental risk management system. Environmental risk management systems are seen as adding value to products and services, creating a competitive advantage, improving community image, reducing costs and increasing the bottom line.

MANAGING RISK- A GENERIC APPROACH

This comprises the analysis and evaluation of risk through processes of identification, description and estimation. Identification: this aims to determine an organization's exposure to uncertainty. It requires a thorough knowledge of the organization's strategy, its products/services and markets, and the legal, social, political, economic and technological environment in which it exists. Identification requires a methodical approach to ensure all significant activities within the organization have been identified and all risks flowing from those activities are defined. Methods of identifying risks include:

- risk workshops
- stakeholder consultations
- benchmarking
- scenario or 'what if' analysis
- auditing and inspection
- research methods (interviews, surveys, etc.)
- cause and effect diagrams.

MAJOR RESEARCH METHODS OF RISK ASSESSMENT AND MANAGEMENT

The identification, assessment and reduction of risks are some of the most important issues of safety in the workplace to effectively address and safety problems. Currently, there are a variety of methods used to assess risks in the workplace: quantitative and qualitative or their combination, but there are no single and efficient model for the risk assessment and management. The risk is a complex concept, which covers the accident probability and the estimate of possible side effects of this accident. There are several types of risk : risk in work environment, identified risk, unwinding (unexpected) risk and risk of environmental pollution. By its nature, the risk can be controlled, if there is legal basis for risk assessment procedure, as well as certain special requirement for risk reduction.

- Probability, which determines whether the adverse event will occur;
- Unintended consequences of the accident;
- The expected consequences or mathematical probability of consequences;
- Deviation from the acceptable level of risk (adverse effects), which investor are willing to tolerate or endure.

In the risk management methodology, risk is defined as the degree of adverse effects arising from a hazard, taking into account the probability of damage and side effects :

$$\text{Risk} = \text{Probability} \times \text{Consequences, or } R = Q \times P$$

Q --- probability (probability of an accident).

P --- consequences (amount of the loss).

This formula is the base for a number of quantitative risk analysis methods and can be applied to each adverse event. Thus, summarizing the risks in all cases, it is possible to assess the overall risk of the operation. From the mathematical point of view, the risk in the risk management methodology is the mathematical probability the consequences, and its unit of measurement is equal to recovery unit.

Risk can also be described by the equation :

$$R = E \times A \times S$$

The Equation includes:

E --- probability that there are certain risks,

A --- probability of avoiding risks,

S --- Category, which determines the severity of risk.

Risk can be assessed quantitatively and qualitatively, both types of estimates reflect the measurement and calculation results. Using quantitative risk assessment, the effects of injury level and the risk of effects are determined in the appropriate unit of measurement. Quantitative estimates of risks are based on mathematical calculations, but a qualitative risk assessment describes the origin of potential hazards. Qualitative risk assessment does not in the fact determine a dangerous probability of the event and the amount of loss or consequences. Numerical risk assessment allows judging the degree of hazard objectively, makes it possible to develop a package of measures and the risk management system.

RISK ASSESSMENT: TECHNICAL STUDIES AND SURVEY

Risk assessment address the uncertainties or knowledge gaps that were identified at the risk scoping and preliminary risk assessment stage, a range of environmental surveys and modeling studies were undertaken. These included the following:

- marine water and sediment quality studies
- marine ecology and benthic community studies
- terrestrial ecology studies
- hydrology and hydro geology studies
- oil spill trajectory modeling for the near shore and offshore development areas.
- dredge plume modeling for the near shore development areas
- plume modeling for waste water discharges in the near shore and offshore development areas
- air quality modeling for the onshore and near shore development areas.
- noise modeling, both underwater and terrestrial

EXISTING PROBLEMS IN RISK ASSESSMENT AND MANEGEMENT:

Although the form and application of environmental risk assessment has made great progress and there have be many new approaches and methods developed over past decades, some problems still exist in the current development of ERA. But the traditional ERA is an important support tool to provide scientific evidence for risk management, it only focuses on providing some technical procedure and corresponding methods for risk analysis and evaluation which are difficult to closely connect with DMP and their final results. The main problems are as follows:

- Most applications of traditional ERA focused on project level. Some applications of ERA focused on natural disaster risk assessment and regional risk assessment.
- Many techniques of decision analysis have been developed for integrating the results to support the optimal options for environmental management.

The key issue in risk assessment is accuracy, and the avoidance of either over-prediction or under-prediction. In any risk assessment there are four possible outcomes. These are displayed in Figure 1

Prediction Outcomes			
		Prediction	
		Yes	No
O U T C O M E	Yes	A True Positive Prediction	B False Negative Prediction
	No	C False Positive Prediction	D True Negative Prediction

Risk predictions can be right by predicting correctly that a harmful behavior will occur (Box A), or by predicting correctly that a harmful behavior will not occur (Box D). However, errors are also likely and they carry substantial costs. Box B identifies those cases in which a risk of harm is not identified but does occur, whereas Box C identifies those cases in which harm is predicted but does not occur. In Box B cases, the consequences can be particularly severe. Victims may be harmed or killed, and workers and their agencies can be brought into disrepute. In Box C cases, the criminal justice system can be accused of over-intervening, with an impact on civil liberties and waste of precious resources. Box B cases encourage a move towards more defensive practice, caution and over-prediction amongst practitioners and their agencies as a response to costly failures. Box C cases tend to raise significant ethical dilemmas for practitioners, and resistance from those concerned with the erosion of civil liberties. Whilst Box B and Box C errors can be reduced, it is usually at the expense of increasing the other type of error and not by increasing true positive or true negative predictions. Tolerance of false positives and false negatives can be a matter of moral and political acceptability.

OTHER EXISTING PROBLEMS

- Theory divorced from practice. At present, the theoretical and technical line have been shaped. However, in practice the process has many deficiencies.
- The problems of uncertainty due to the no scientific Knowledge, lack of basic information, to evaluate the result uncertain.
- The field of study needs to be expanded. The field of study not including the other environmental pollution caused by noise and solid waste treatment and disposal.
- The link between evaluation and decision making is not enough. The ultimate goal of environmental risk assessment is to provide scientific basis for risk management, but the study of this aspect lacking comprehensive and systematic study.

ERA/ERM DECISION MAKING PROCESS:

The procedure of ERA serviced for DMP could be divided into two different approaches by using two types of decision-making tools.

Risk evaluation based on RCB

First is the approach put on risk assessment and Risk Management which can be considered in six main steps: problem/objectives definitions; risk assessment; options formulations; decision-making according to the result of risk assessment (selection and determination of the managerial options); take actions; monitoring, evaluation and feedback. These approaches of risk evaluation based on RCB commonly emphasize using a quantitative economical method "Benefit Cost Analysis" (BCA) as the main technical tool to support the selection and determination of any preferred managerial option which has the highest benefit and the lowest cost from perspective.

Based on the methods of MCDA

CRA has commonly applied in the areas of environmental policy analysis. A CRA (Comparative Risk Assessment) is generally comprised of three components.

Problem List	Determination of the set of environmental problems areas to be analyzed and compared.
Criteria for evaluating problem	A set of analytical criteria to define what the participant thinks is important to measure, such as pollution level or other risks to human health,ecosystem, or quality of life.
Ranking	A process that participants use to sort out data and draw conclusions about the relative severity of the problems or their sub-components.

Thus, CRA based on the methods of MCDA, has been a prevailing methodology for environmental decision-making. This approach emphasized on that the decision-making process not only includes th integration of models and techniques of environmental but also includes the interaction among policy makers,scientists and stakeholders. These approaches consider multiple criteria including economical,ecological,social and other factors in decision-making options based on MCDA methods to determine the optimal managerial option from risk perspective.

STRATEGIES OF RISK ASSESSMENT AND MANAGEMENT

The Strategic risk assessment process we describe is designed to be tailored to an organization's specific needs and culture. If the risk assessment and management processes aren't embedded and owned by management as an integral part of their business processes,then the risk management process will rapidly lose its impact and not add to or deliver on its expected role. To help you conduct Strategic Risk Assessments, we have shown key Strategic Risk Management tools and diagnostics at their appropriate points in the process. Before looking into recent developments in fundamental risk management principles and strategies, it is useful to review two well-established pillars of risk management: Basically, three major strategies are commonly used to management risk.

- Risk-informed.
- Cautionary/precautionary.
- Discursive strategies.

The cautionary/precautionary strategy is also referred to as a strategy of robustness and resilience. In most cases the appropriate strategy would be a mixture of these three strategies. The risk-informed strategy refers to the treatment of risk avoidance, reduction, transfer and retention using risk assessments in an absolute or relative way. The cautionary/precautionary strategy highlights features like containment, the development of substitutes, safety factors, redundancy in designing safety devices, as well as strengthening of the immune system, diversification of the means for approaching identical or similar ends, design of systems with flexible response options and the improvement of conditions for emergency management and system adaptation. An important aspect here is the ability to adequately read signals and the precursors of serious events. All risk regulations are based on some level of such principles strategies to meet the uncertainties, risks and the potential for surprises. The discursive strategy uses measures to build confidence and trustworthiness, through reduction of UN-certainties and ambiguities, clarifications of facts, involvement of affected people, deliberation and accountability.

FUTURE RISK ASSESSMENT AND MANAGEMENT

A key challenge is related to the development of the risk field, as having a focus on knowledge and lack of knowledge characterizations, instead of accurate risk estimations and predictions, to meet situations of large uncertainties. Today risk assessments are well established in situations with considerable data and clearly defined boundaries for their use. Statistical and probabilistic tools have been developed and provide useful decision support for many types of applications. However, risk decisions are, to an increasing extent, about situations characterized by large uncertainties and emergence. Such situations call for different types of approaches and methods, and it is a main challenge for the risk field to develop suitable frameworks and tools for this purpose. There is a general research focus on dynamic risk assessment and management rather than static or traditional risk assessment.

CONCLUSION

Risk assessment and risk management are established as a scientific field and provide important contributions in supporting decision-making in practice. The research of environmental risk assessment is bound to make new contributions to human survival and to protect and improve the natural environment, and to advance the theory research of environmental science. Basic principles, theories and methods exist and are developing. This review paper has placed its focus on recent work and advances covering the fundamental ideas and thinking on which the risk fields are based. The scientific foundation of risk assessment and risk management is still somewhat shaky on some issues, in the sense that both theoretical work and practice rely on perspectives and principles that could seriously misguide decision-makers. In recent years several attempts at integrative research have been conducted, establishing broader perspectives on the conceptualization, assessment and management of risk. The present time we sees this way of thinking as essential for developing the risk field and obtaining a strong unifying scientific platform for this field. Risks must be analyzed and managed as part of the strategic management process. Proper response typically involves strategic levels such as changes in corporate scope, business model, or key activities and capabilities. Today, environmental risk

management is seen by many business,countries and economic regions as contributing positively to a firm's profits and competitive advantage. As we push the bounds of science, as with genetically modified organisms, or the bounds of climate change as with global warming, environmental risk management strategies will become increasingly important.

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