

M.V. LOMONOSOV MOSCOW STATE UNIVERSITY

PROF. IGOR N. BECKMAN

THEORY OF RISK

A LECTURE COURSE

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Annotation:

The lecture course “Risk” provides an overview of risks, associated with daily life of an individual in modern world. It characterizes collective risks which are associated with functioning of large groups of people, communities and society as a whole. In a similar vein, lecture notes describe risks that might occur in industry, during operation of manufacturing equipment, economic, political and management risks, risks of natural disasters and anthropogenic threats to environment.

Numerous case-studies explain both qualitative and quantitative characteristics of different types of risk. The author outlines methods for quantitative assessment of risks and applicable mathematical tools (statistical analysis, equations of mathematical physics, computer sciences, fractal geometry, catastrophe theory etc.). The course helps to develop a range of skills for analysis and management of risks.

These lectures might be interesting for politicians, medical doctors and their patients, public administrators, lawyers, journalists, financiers, economists, travelers, Liberal Arts graduates and STEM scientists – anyone, who deals with threats and risks in their daily life, but strives to preserve their health and life without causing much damage to family, colleagues, society and environment.

Table of Contents

Foreword. Nothing ventured, nothing gained!

Introduction. Threats, security and risks. Theory and practice of risk.

1. Historical backgrounds of risk.
2. Defining the terms: risk, acceptable risk, risk homeostasis.
3. Classification of risks. Static and dynamic risks. Emergencies. Protection and security systems. factors.
4. Analyzing and managing risks: risk rate, analysis of risk structure, measurement of risk (probabilistic and deterministic approaches).
5. Decision-making and risk: management and risk, strategy of risk, accountability, assessment and prediction of emergencies.
6. Theory of risk and its mathematical tools.
7. Mathematical statistics and theory of probability. Probabilistic assessment of key risk factors.
8. Games theory
9. Equations of mathematical physics
10. Fractal geometry
11. Catastrophe theory
12. Informatics of risk theory. Price and value of information. Specialized databases for risk-analysis.
13. Mathematical methods for risk modeling. Software for risk prognosis and risk management.
14. Psychology of risk: risks perception. Perceived and real risks. Planned risks.
15. Risks related to health and safety. Risks in public administration.

16. Global risks: space cataclysms, natural disasters, climate change, pandemics, financial crisis.
17. Large-scale risks: revolutions, overthrow of government by force (*coup d'état*), rapid changes of economical and political system, army invasion, insurrections, actions of irregular military, international sanctions, terrorism (international and domestic), demographic risks, risks associated with large-scale uncontrolled migration, failure of crops and associated famine, natural disasters (earthquakes, tsunami etc.), large-scale man-made disasters, financial default, depletion of natural resources.
18. Environmental risks: monitoring, environmental safety, integral environmental risk, local, regional and global pollution, environmental concerns (natural and man-made), migration of pollutants in natural and anthropogenic environments, risks related to flora and fauna resources. Artificial improvement of ecosystems.
19. Radiation, nuclear and radionuclide risks. Radon-proof housing. Nuclear disasters, leaks of radioactive materials and their ecological impact. Various scenarios of emergency situations related to production and usage of radioactive materials. Preventive measures and mitigation of nuclear disaster consequences.
20. Risks in industry. Sources of danger. Chronical and emergency risks. Industrial accidents and catastrophes, their consequences. Transportation risks (commercial aviation, marine transport, railroads, automobile transportation). Environmental protection and applicable government regulations. Industrial, occupational health and safety regulations. Preventive measures. Accidental release measures. Damage assessment. Indemnities for losses.
21. Financial risks: inflation, rapid change of the refinancing rate by central banks, change of interest rate, fluctuations of currency exchange rate, stock market volatility, associated legal risks.
22. Risks associated with sport: circus performers, alpinist and rock climbers, racers and yachtsman
23. Personal risks: diseases, sudden death, poverty, accidents, infliction of harm by authorities, damage caused by elements, risks caused by crime and alcohol/drug abuse.
24. Medical risks: diagnostics, therapy, surgery, CT scans, radiation and nuclear medicine.
25. Criminal risks: filibusters, gamblers, robbers, pick-pockets, burglars, terrorists.

26. Commercial risks: default on commitments, decline in demand for products, aggressive competitors, loss of non-profit assets, rent-seeking behavior and corruption of public administration, influence of criminal environment, risks, associated with loans, lost profits, liquidity shortage, transportation risks, insurance, customs and taxation risks.
27. Risks in industry: production of defective goods; engineering and manufacturing mistakes; social risks in industry; risks associated with personnel; risks, related to illegal activities.

Conclusions.

Recommended reading.

Addendum: terms and definitions; questions and exercises.



The annotation and ToC were translated by: Dr. V. Deineko