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Content

RISK ASSESSMENT AND VULNERABILITY ANALYSIS

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Sample Preview of the Solved Sample Question Papers

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QUESTION PAPER

June – 2023

(Solved)

RISK ASSESSMENT AND VULNERABILITY ANALYSIS

M.P.A.-3

Time: 3 Hours] ***[Maximum Marks: 100***

Notes: *Answer* ***any five*** *questions, selecting at least* ***two*** *questions from each section.* ***All*** *questions carry equal marks.*

SECTION-I

Q. 1. "Risk is different from threat." Discuss the statement with reference to risk perception and identification.

Ans. Ref. See Chapter-1, Page No. 2, 'Understanding Risk' and Page No. 3, 'Risk Perception' and 'Risk Identification'.

Q. 2. Examine major targets for risk reduction.

Ans. Ref. See Chapter-3, Page No. 22, 'Targets for Risk Reduction'.

Q. 3. Explain the process of risk assessment.

Ans. Ref. See Chapter-4, Page No. 34, 'Process of Risk Assessment'.

Q. 4. Discuss the various approaches to vulnerability analysis.

Ans. Ref. See Chapter-6, Page No. 57, 'Approaches to Vulnerability Analysis'.

Q. 5. Write a note on flood vulnerability.

Ans. Ref. See Chapter-7, Page No. 67, 'Observation of Flood Vulnerability'.

SECTION-II

Q. 6. "Women are more vulnerable to disasters." Comment.

Ans. Ref. See Chapter-9, Page No. 81, 'Gender and Vulnerability'.

Q. 7. Analyse the reasons behind vulnerability of third world countries.

Ans. Ref. See Chapter-10, Page No. 87, 'Vulnerability in Third World Countries'.

Q. 8. "There are number of factors that increase vulnerability in cities." Elucidate.

Ans. Ref. See Chapter-11, Page No. 96, 'Driving Force of Vulnerability in Cities'.

Q. 9. Discuss the strategies for disaster prevention and control.

Ans. Ref. See Chapter-14, Page No. 119, 'Kinds of Strategies'.

Q. 10. Write a note on population growth and vulnerability.

Ans. Ref. See Chapter-17, Page No. 144, 'Population Growth and Vulnerability'.

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QUESTION PAPER

December – 2022

(Solved)

RISK ASSESSMENT AND VULNERABILITY ANALYSIS

M.P.A.-3

Time: 3 Hours] ***[Maximum Marks: 100***

Notes: *Answer* ***any five*** *questions, selecting at least* ***two*** *questions from each section.* ***All*** *questions carry equal marks.*

SECTION-I

Q. 1. Explain the concept and classification of hazards and disasters.

Ans. Ref. See Chapter-1, Page No. 1, 'Hazards and Disasters', 'Classification of Hazards' and Page No. 2, 'Classification of Disasters'.

Q. 2. Write a note on societal risk management.

Ans. Ref. See Chapter-2, Page No. 14, 'Societal Risk Management'.

Q. 3. Discuss the important measures of earthquake risk assessment.

Ans. Ref. See Chapter-4, Page No. 38, '(A) Earthquake Risk Assessment'.

Q. 4. Describe the approaches to vulnerability analysis.

Ans. Ref. See Chapter-6, Page No. 57, 'Approaches to Vulnerability Analysis'.

Q. 5. Write short notes on the following :

(a) **Participatory rural appraisal**

Ans. Ref. See Chapter-5, Page No. 51, '*(c)* Community Based Methods (CBM)'.

(b) **Integrated approach to vulnerability reduction.**

Ans. Ref. See Chapter-8, Page No. 78, 'Integrated Approach to Vulnerability Reduction'.

SECTION-II

Q. 6. Examine the important components of gender based approach to disaster management.

Ans. Ref. See Chapter-9, Page No. 82, 'Gender Based Approach to Disaster Management'.

Q. 7. "Large dams increase vulnerability to disasters." Elaborate.

Ans. Ref. See Chapter-10, Page No. 89, 'Development Projects Induced Vulnerability' and Chapter-13, Page No. 110, 'Large Dams and Vulnerability'.

Q. 8. Write a note on hazard resistant designs and construction in reducing vulnerability.

Ans. Ref. See Chapter-17, Page No. 146, 'Hazard Resistant Design and Construction'.

Q. 9. Analyse the issues involved in provision of disaster relief.

Ans. Ref. See Chapter-16, Page No. 138, 'Issues in Disaster Relief'.

Q. 10. Write short notes on each of the following:

(a) **Role of armed forces in managing disasters**

Ans. Ref. See Chapter-14, Page No. 124, Role of Armed Forces'.

(b) **Environmental hazards and human settlements**

Ans. Ref. See Chapter-11, Page No. 95, 'Environmental Hazards and Human Settlements'.

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Sample Preview of The Chapter

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RISK ASSESSMENT AND VULNERABILITY ANALYSIS

Hazard, Risk and Vulnerability

1

INTRODUCTION

Disasters are now understood not only from the techno-centric point of view but also from the social and ecological perspective. In the last two decades, a paradigmatic shift in the understanding of disasters has happened. The attempt is now to understand the sociological processes that show a community's resilience, coping capacity and response to disasters. Disaster is a more inclusive concept as it includes man-made and technological hazards.Two important perceptions on disasters are there. One school of thought says disasters are natural, vengeful acts of nature: an opportunity for man to atone for his sons, wherein death and destruction are inevitable. The other view is that disasters are man-made; an event whether a product of natural phenomena or human activities becomes a catastrophic disaster if the community or society fails to cope up with it.

CHAPTER AT A GLANCE

THEORETICAL UNDERSTANDING OF RELEVANT CONCEPTS

Hazard, risk and vulnerability are used often in disaster literature. Hazard means a potential or a latent/ dormant cause which is activated when the right configuration of factors, natural or man-made or both, present themselves. A chemical plant in a populated area is a potential threat to life and property and can be called a hazard. Hazard is not disaster which means "Any occurrence, that causes damage, ecological disruption, loss of human life, deterioration of health and health services, on a scale sufficient to warrant an extraordinary response from outside the affected community or area."

According to World Health Organisation (WHO), hazard technically is not a disaster unless the 'trigger' (natural or man-made) sets it off. The trigger could possibly the be weak legislation that failed to regulate the functioning of the facility. Hence a "Disaster should be defined on the basis of its human consequences, not on the phenomenon (hazard) that caused it. Earthquakes, floods and cyclones are 'natural hazards' which cause large-scale loss of life and property (disaster) when the trigger mechanism (natural or manmade) is activated. The vulnerability of "elements" at risk whether a hazard has turned into a disaster.

Vulnerability means the extent to which an element (animate/inanimate) is harmed in a disaster. Elements are identified as life and property likely to suffer damage in a disaster. Identification of risk involves inquiring into the specific natural, technological or chemical processes that create the vulnerability of the elements identified for risk analysis. Vulnerability can be natural or man-made. It can be physical, owing to factors like weak buildings, habitation in hazard prone areas; or socio economic, arising because of poverty or marginalisation of the weaker sections of people.

Hazards and Disasters

Hazards can be natural (geological, hydro-meteorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects.

According to the International Secretariat for Disaster Reduction (ISDR), a hazard is "A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation."

Classification of Hazards

Some general classifications of hazards are given below:

(i) **Sudden Onset Hazards:** These are geological and climatic hazards like floods, tropical storms, volcanic eruptions, landslides, earthquakes and tsunamis,

(ii) **Slow Onset Hazards:** These include environmental hazards like drought, famine, desertification, deforestation, pest infestation and environmental degradation.

(iii) **Industrial/Technological hazards:** system failures/accidents, spillages, explosions and fires cause industrial/technological hazards.

(iv) **Wars and Civil Strife:** These include insurgency, terrorism, armed aggression and other actions which make people displaced and refugees.

(v) **Epidemics:** These include water and/or food-born diseases, person-to-person diseases (contact and respiratory spread), vector-born diseases and complications from wounds.

Hazards can be divided as direct and indirect. For example, earthquake will have direct and indirect consequences.

Direct hazards are ground shaking, differential ground settlement, soil liquefaction, immediate landslides or mud slides, ground lurching and avalanches, permanent ground displacement along faults, floods from tidal waves, sea surges and tsunamis.

Indirect hazards are dam failures, pollution from damage to industrial plants, delayed landslides.

According to S. Gopalakrishnan, site risks in an earthquake prone area are:

Slope Risks: They may be slope instability, triggered by strong shaking may cause landslides. Rocks or boulders can roll considerable distances.

Natural Dams: Landslides in irregular topographic areas may create natural dams which can cause catastrophic avalanches after strong seismic shaking.

Volcanic Activity: Earthquakes may trigger volcanic activity like ash falls and/or pyroclastic flows, volcanic lava or mudflows, and volcanic gases.

Besides, as per the classification proposed by K. Smith, hazards can be of both short-term and long-term duration.

Classification of Disasters: The disasters are classified as *(i)* rapid onset or cataclysmic, and *(ii)* long-term or continuing.

In a cataclysmic disaster, a large-scale event causes most of the damage and destruction but soon dissipates. Recovery is relatively faster. In a long-term or continuing disaster, the situation after the event may remain constant or even deteriorates further. Earthquakes, volcanic eruptions, cyclonic storms and floods are examples of cataclysmic disasters. Droughts, crop failures, environmental degradation such as deforestation and desertification are examples of continuing disasters. The damaged area in a cataclysmic disaster is usually relatively small, while the area affected in a continuing disaster stretches over a wide expanse, spatially and temporally.

Disasters can be compound and complex. A compound disaster means a crisis causing other contingencies like famines followed by civil strife, or mass displacement of people. Complex disasters lead to collapse of the political authority or cause some other complexity where the problems involved/ generated are intensely political in nature like communal bias in distribution of relief, relocation of communities and disbursement of aid.

Identification of Hazards: Identification of hazards means analyzing scientific data to find out the causal path of events which causes a disaster. For example, knowing chemicals causing water pollution and their source, their impact on human health and the nature and characteristics of a hazard to differentiate the manmade and natural components in them.

It also involves policy analysis so that environment friendly legislation can be passed in the future. Sustainable development policies can be framed on the basis of hazard analysis. For example, a hazard analysis of the process of desertification can help in devising effective strategies to address the problem. Pollution of water, fire hazard and air pollution happen due to high levels of carbon monoxide (CO) and sulphur dioxide (SO2) in the atmosphere.

UNDERSTANDING RISK

ISDR defines risk as "The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions".

Risk = Hazards × Vulnerability.

Risk is different from threat. Risk is an expression of perceived threat in specific terms, while threat is a danger that has an extremely low probability of occurrence. For example, apprehension of terrorism was a threat in America. No policy can be devised to meet the threat. Threat exploits the

vulnerability to create a disaster. Risk management means minimising the vulnerabilities to reduce the impact of the threat. Risks are created, or exist because of inherent characteristics in the system. Therefore, ecological context is significant in the understanding vulnerabilities of people in different cultures. Risks are created because of excessive resource use that causes serious degradation of the environment. Factors causing intensified resource use are rapid population growth, market induced demand, greed of the rich and resource exploitative public policies such as mining.

Presentation of Risk: Risk can be precisely quantified by expressing in terms of average expected losses from a given hazard to a given element at risk, over a specified time period, For example, it can be said 15,000 lives lost over a 30 year period or as 75000 houses experiencing heavy damage or destruction within 25 years causing Rs. 5000 crore within the next ten years due to floods in India.

Specific risk refers to risk or loss estimations of either type which are expressed as a proportion of the total. For example, it can be stated as 5% of the total population killed by floods within 30 years or 10% of houses heavily damaged or destroyed in the next 25 years. Specific risk is also used for financial losses to property where is usually means the ratio if the cost of repair or reinstatement of the property to the total cost of replacement.

Specific risk gives the average rate of loss, but it can give a misleading because most of the losses actually happen through infrequent single large events, rather than in the form of a slow continuous process of destruction. Precise quantification of risk is difficult. A gross estimation of risk gives a limited idea of the likely damage from a hazard for different peoples at different places or even the probability of its occurrence.

Risk Assessment and Evaluation

Two components of risk management are: *(a)* Risk assessment, and *(b)* Risk evaluation. Risk assessment is the methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend. A risk assessment reviews the technical features of hazards like their location, intensity, frequency and probability; and the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure, while considering the coping capabilities related to the risk. Risk evaluation involves assessment of proposed risk reduction measures from the point of view of cost efficiency. Efficiency is examined by means of cost-benefit comparisons.

Disaster risk is seen as a function of the hazard, exposure and vulnerability, denoted by the mathematical function:

Disaster Risk = function (hazard, exposure, vulnerability) where "Exposure" is the element which is affected by natural disasters, people and/or property. For disaster risk reduction, bringing down the level of vulnerability and to contain 'exposure' by relocating populations and property away from the hazardous zones are needed.

Risk Perception: Risk perception means the awareness of risk. It differs in different cultures/ societies. Poor countries do not give much importance to disaster mitigation. General level of awareness among people about disaster mitigation and preparedness is also quite low. Risk perception is high in the developed world where much effort has been put into disaster mitigation efforts though vulnerability is low as compared to developing countries.

Media plays a significant role in creating awareness on disaster management among people. Risk Perception depends on four specific factors:

(i) **Exposure:** It means actual quantitative risk level as articulated through risk assessments.

(ii) **Familiarity:** It is the personal experience which makes one alive to the dangers of disasters.

(iii) **Dread:** It means the horror of the disasters' scale and consequences, which makes policy imminent

(iv) **Preventability:** It is the belief in prevention methods which leads to disaster mitigation policies.

Risk Identification: Risk should be empirically ascertained to remove subjective biases arising because of cultural or ideological inclinations. The insurance industry has the best example of risk assessment where insurers have well-defined roles of actuary, underwriter, agent, auditor and adjustor. Risk assessment should be undertaken periodically. Objectivity of the risk assessment depends on the availability of adequate and timely data.

Risks can be systematic and cumulative. In a systematic risk, the cause and effect phenomenon underlying a disaster is immediate and direct on the global system and results from production related policies. Global warming due to emission of greenhouse gases is an example.

In cumulative risks, the relation is indirect, entailing long-term consequences; and resulting due to policies in disregard of environment protection lead to accumulation and compounding of risks over time. For example, groundwater depletion, soil depletion and deforestation.

Hazard assessment, vulnerability analysis and risk analysis are conducted for risk articulation. These are structured analytical procedures for identifying hazards and estimating the probability of their occurrence and anticipating consequences.

In the case of extreme events, the risk is ascertained by the number of people affected and the damage in monetary terms that can be expected on an average per year. Risk is also linked to fragility which means the stage of deterioration to a point where damage will take place. Fragility is the sensitivity of a particular ecosystem to human induced hazards and its resilience to such hazards.

UNDERSTANDING VULNERABILITY

Vulnerability shows the extent to which a community is affected by a disaster. It includes the measure of resilience and coping capacity of a community in the face of disasters. Vulnerability of a particular community to a disaster depends on various factors such as physical factors, (geographical perspective) social (sociological perspective) and economic factors (income and employment, involving micro and macroeconomic policy), besides institutional or administrative factors, which are essentially governance related issues.

Social scientists and climate scientists differ on the term vulnerability. Social scientists view vulnerability in terms of socio-economic factors that determine people's ability to cope with stress or change. Climate scientists view vulnerability in terms of the likelihood of occurrence and impacts of weather and climate related events.

Terms like fragility, stability, resilience and sensitivity are the constituents of vulnerability. Resilience and coping capacity develop over time based on proactive government policies. Stability is the balance and gets disturbed by disasters. Restoring balance means correcting distortions. Stability depends on fragility; or the weakness of the system due to physical attributes of its ecology; sensitivity is the extent of change that is brought about due to exogenous pressures exerted by disasters.

Vulnerability Identification: Vulnerability identification means finding out the root causes of vulnerability that could be there in technological, physical, or socio-economic conditions and addressing the same through empirical research and policy. There are short-term and long-term mitigation measures to tackle vulnerability. Developmental planning is effective as it addresses the problems of poverty, class and gender discrimination, public health, education and hygiene.

VULNERABILITY AND RISK ASSESSMENT

Attempts have been made at the global level to analyse disasters. An inventory of causes that lead to disasters, the extent of damage suffered, what and how mitigation needs to be applied, and where, successfully has been prepared. Vulnerability assessment, a subset of risk assessment, analyses differential vulnerability of communities in differential areas of disaster impact.

An academic analysis of vulnerability would include:

- Developing an integrated perspective considering socio-cultural, developmental and ecological factors to develop a comprehensive framework of disaster mitigation; and
- Focusing on poverty alleviation and community empowerment, sustainability of livelihoods through democracy through local governance at the grassroots.

VULNERABILITY FACTORS

The study of the vulnerability of human and natural systems to climate change and variability, and of their ability to adapt to changes in climate hazards brings together experts from a wide range of fields, including climate science, development studies, disaster management, health, geography, policy development and economics. Some of the natural and man-made factors which contribute to vulnerability are discussed below:

Population Displacement: Population displacement is a cause as well as a consequence of disaster. Poverty and economic inequality and rural to urban migrations are related. More the level of poverty and income inequality, more is the extent of rural to urban migrations. It is most observed in poor third world countries. The social order remains '*Oligarchic'/ 'Oligopolistic'* with inequality in income and wealth distribution remains over time. Democratic options like legislation has not been successful due to corruption and other hurdles. Land reforms and social forestry legislations have not met with expected success. The