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CHARACTERISTICS OF EXTREMELY ASYMMETRIC RISK

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Abstract: *Dangers are perceived by society as threats, challenges and, in their unwarranted approach, in action, as risks. Risk implies direct, but also assumed threat.*

Modern society's greatest risks are, almost entirely, asymmetric. They engulf the whole sphere of human activities, following man in his every endeavor. The more humanity diversifies and stratifies, the more numerous and acute asymmetric threats become. Because asymmetry implies differences, or, the possibility to act and react differently, with the purpose to surprise, to destroy, to win strategic initiative and freedom of action, and, consequently, to win.

We are hereby presenting a series of theoretical aspects concerning risk analysis and techniques: the scenario technique and probability-impact matrix technique.

In the second part of the work, we will analyze critical infrastructures and the typology of asymmetric risks.

Keywords: *dangers, threats, vulnerabilities, risks, critical infrastructure, risk evaluation, extreme risk, asymmetric risk*

1. RISK ANALYSIS TECHNIQUES SCENARIO TECHNIQUE

This technique implies the gathering of a group of informed people, specialists in their fields, which are asked to apply their knowledge and imagination to describe one or more possible ways in which an event may unfold, starting from a concrete situation. This type of activity is undergone at all times by anyone who wishes to plan an activity.

There are several ways to generate scenarios, but two stand out:

– generating scenarios in perspective
– generating scenarios from perspective

Generating scenarios in perspective assumes choosing a starting point from present reality and imagining future possible scenarios. This type of a scenario answers the question "What if".

Scenarios from perspective try and determine how current reality may evolve into a given future scenario. This type of scenario answers the question "How do we get to situation X?".

PROBABILITY-IMPACT MATRIX TECHNIQUE

Risk has two fundamental aspects: probability and impact. Table 1 presents such a matrix that combines the following elements:

- Likelihood – on three levels:
  - High probability
  - Average probability
  - Low probability
- Impact – on three levels:
  - Big Impact
  - Environmental Impact
  - Low Impact

PROBABILITY						
	80,00 %- 99,99 %	Medium Risk	Medium Risk	High Risk	Very High Risk	Very High Risk
	60,00 %- 79,99 %	Medium Risk	Medium Risk	High Risk	High Risk	Very High Risk
	40,00 %- 59,99 %	Low Risk	Low Risk	Medium Risk	High Risk	High Risk
	20,00 %- 39,99 %	Very Low Risk	Low Risk	Low Risk	Medium Risk	Medium Risk
	0,00% - 19,99 %	Very Low Risk	Very Low Risk	Low Risk	Medium Risk	Medium Risk
	IMPACT	0	1	2	3	4

Table 1. *Probability-impact matrix 5 levels of risk*

The result of combing these elements is a 3 rows and 3 columns matrix. The intersection of each line with each column represents a certain level of risk. In the case of such a matrix three risk categories can be identified:

- High risk
- Medium risk
- Low risk

PROBABILITY				
	High	Low Risk	Medium Risk	High Risk
	Average	Low Risk	Medium Risk	Medium Risk
	Low	Low Risk	Low Risk	Low Risk
	IMPACT	High	Medium	Low

Table 2. Probability-Impact matrix

Of course, this matrix can have a far larger number of rows and columns, to better highlight the degree of risk. For example, we will consider a five row five column matrix, corresponding to the following categories of probabilities and effects:

Probability is expressed in 5 percentage intervals between 0 and 99.99%. Events with a 100% probability are not taken into account, as certainties do not require risk analysis.

- Between 0% -19.99%
- Between 20%-39.99%
- Between 40%-59.99%
- Between 60%-79.99%
- between 80%-99.99%

Impact is expressed on a worth scale from 0 to 4, corresponding to 5 levels of severity:

0 – the emergence of an event with 0 impact has no consequences over the analyzed risk, or if its consequences are not notable

- 1 – a 1 degree event has minor consequences
- 2 - 2nd degree impact refers to notable consequences which can affect the well-being of a project or an activity
- 3 – consequences of a level 3 event are sufficiently serious and must be further analyzed
- 4 – level 4 consequences are correspondent to a catastrophy

From this grading of risk components, the following risk categories are distinguishable in the possibility – impact matrix in table 2:

- very low risk – the probability of such an event is almost none
- low risk – this risk category implies either an event with medium chances of occurrence and low impact, or low chances of occurrence and medium impact
- medium risk – an event with a probability above average, possibly even high, but with a low impact, or the other way around, low probability but above average, possibly even high impact
- high risk – when an event has a probability of occurrence of over 40%, and its impact is above level 3
- very high risk – extremely probable events with high impact, above level 3

The probability-impact matrix is a very useful device in risk management. This technique is often used in practice, not only due to the fact that it helps management better catalog risk events to determine which require special attention.

2. CRITICAL INFRASTRUCTURE ANALYSIS

Modeling extreme asymmetric risk events is essential in assessing damage and streamlining governmental intervention. Current techniques are in pursuit of new solutions to analytically and numerically treat asymmetric distributions, with thick ends.

In order to define new solutions, we begin with the hypothesis of a need for a flexible, synergistic answer, which can ensure immediate exposure coverage from asymmetric attacks, based on market functionality and sustained by innovative alternative transfer solutions.

The classic mathematical approach in modeling extreme risks is based on the theory of probabilities and mathematical statistics. The potential value of extreme risks presents asymmetric distribution, with thick ends, difficult to analyze even with the knowledge of behavior of similar evolution. In asymmetric events, the occurrence probability is very low, but with catastrophic impact and losses.

An integrated model describes risks, their evolution and correlations between them, giving new perspective on risk interaction. The complexity and multiple subjective elements of these models turn their application into a challenge. In order to integrate in dynamic financial analysis AFD of extreme asymmetric events, the VaR and TVE concepts are analyzed from a practical evaluation point of view, filtering associated difficulties.

If traditional VaR models tend to ignore extreme events and are concentrated on risk measures for the entire distribution market, the objective is to search for answers that ensure functionality even in catastrophic risks. An answer to this problem is based on utilizing robustness tests and scenario analysis. Dynamic modifications that occur during extreme events can be simulated.

These solutions are useful, but inevitably limited, because they cannot explore all possible scenarios, and, by definition, they do not deliver any indication regarding the behavior of all considered variables.

This specific extreme risk management problem, the impossibility to correctly predict the extreme values involved, denatures results. Researchers have proposed a solution to this problem in the form of Extreme Value Theory, EVT, a branch of statistics developed for optimum usage of limited information about extreme distributions.

In the case of EVT, attention is focused on the POT (peaks-over-threshold) problem of peaks surpassing critical values. Regardless if the end distribution of losses refers to evolution, system, operational or insurance risks, the POT model is a simple, but effective instrument in risk estimation at distribution end.

An original model is being proposed by which the POT method can be embedded in a stochastic volatility framework, in order to achieve superior estimates over the classic VaR model.

A risk model, starting from selecting distributions of particular probabilities; distributions considered from empirical data analysis. In this case, TVE is an instrument that must deliver the best estimate possible of end distribution.

However, even in the absence of useful data, TVE delivers a good guideline of the type of distribution that must be selected so that extreme risks can be correctly estimated and maneuvered.

Active-passive management techniques (ALM) are representative to an extensive number of strategies used in sales and vary greatly whereas complexity is concerned. Since every category presents both advantages and disadvantages, practitioners have not been able to assert whether simple or complex models are preferable.

DANGERS, THREATS, VULNERABILITIES, RISKS

As social-economic activities develop, critical state and society infrastructures develop alongside them, especially those in industry and energy, becoming more and more vulnerable to various risks and threats.

As science and technology progress, so do vulnerabilities and the risk of an attack or accident that can affect the population, material goods and the environment. The range of dangers and threats faced by ICI and ICEn is fairly diverse, with the incidence of asymmetric dangers rising.

A classification[1] of said dangers and threats, that can be at any time completed or modified, is as follows:

- natural threats/dangers
  - symmetrical: earthquakes, floods, landslides, droughts, etc.
  - asymmetrical: extreme meteorological events, meteorites and other celestial objects, global warming, etc.
- human threats/dangers
  - symmetrical
  - physical, such as a chemical accident, conventional war, etc.
    - cybernetic, such as programming errors, etc.
  - asymmetrical:
    - physical, such as terrorism, organized crime, design faults, faulty operation and maintenance of systems, etc.
    - cybernetic: information wars, network based war

[1] Radu Andriciuc, *Dangers and threats to critical infrastructure,* Psihomedia Publishing, Sibiu, page 5, (2008).

3. TYPOLOGY OF ASYMMETRIC RISKS

Asymmetric risks do not have the same configuration for everyone. This is why they must be looked at and analyzed differentially, based on concrete conditions, strategic options and forces that are or can be engaged in the confrontation. The world is diverse and, as a consequence, so are the possibilities of action or riposte.

Asymmetric risks are, in the USA's vision, mostly different than those faced by third world countries, for example. Differences in technology, civilization, possibilities and, evidently, mentality are expressed, first and foremost, in confrontation strategies, in what we call strategic asymmetry. Thus, a certain risk-riposte asymmetric relation is formed, alongside an asymmetric offense-defense response which will, most likely, dominate conflict typology in the beginning of this new millennium.

Asymmetric threat (risk) typology imposes a new evaluation of strategically vital space, but also of a new philosophy of confrontation, as the world has changed radically and, despite globalization on an economic and information level, it remains extremely different and contradictory.

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