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**CONCEPT OF ENVIRONMENTAL RISK MANAGEMENT  
IN THE SYSTEM OF SUSTAINABLE ENVIRONMENTAL ECONOMICS**

The main idea of this study is to show how important environmental risks are and how to manage them. First of all it is given a definition of risk and a difference in meaning of risk – damage as an effect of human activity and the probability of occurrence. The theoretical basics for the formation of an effective system of environmental risk management were studied: the theory of planned behavior, social ecological theory, theory of environmental risk disclosure, systems theory. In the author's concept a big role play tools of reducing risks. There is identified four main methods to reduce environmental risks. In concentrate view we prepare a concept of manage environmental risk in Lebanon concerning water resources. The key role goes to theory of natural capital and the assessment of the probable loss of natural resource potential. As a mechanism of reducing the loss of water resources presented the insurance.

**Key words:** risk, environmental risks, concept, insurance, natural capital.

**Introduction.** The concept of risk is based on the distinction between reality and possibility. Environmental risks refer to risks that can affect the health and viability of living things and the condition of the physical environment. Environmental risks can be caused by the release of pollutants to air, land or water. Environmental damage can also be caused by irresponsible use of energy and natural (water) resources.

Environmental risks are supported by theories, which are increasingly utilized by environmentalist and other stakeholders to minimize losses and measure the environment. The theoretical basis helps in understanding differences regarding perceptions of environmental risk and risk judgments. Decision making in environmental risk management is a complex and challenging process. As part of examining different objectives and alternatives, decision makers in environment policy and management need to use methods for control and reduce environmental risk. In this regard, there are theories and the concept that have been developed in the field of environmental policy that help to determine environmental risks especially in water management and to estimate the risk and after that to reduce the level of it.

**Main part.** The two central categories of risk are the extent (magnitude) of damage and the probability of occurrence [1]. By damage we meant an effect of a human activity (such as accidents through car driving, forest dieback through pollution) or of an event (such as a volcanic eruption, earthquake, explosion) that is evaluated negatively in the general understanding of the public (i. e. intuitively by the great majority of people). The dimension that is viewed as being violated by a damage is termed the protected interest. The damage or hazard potential is the sum total of possible adverse effects that can be caused by an activity or an event. In purely formal terms, the sum of conceivable adverse effects is always infinite, as for every event with a specific estimated number of

adverse effects an alternative damage scenario can be conceived with an even greater number of adverse effects. In actual practice it becomes apparent, however, that it is indeed possible to state ceilings of the maximum possible extent of damage.

The difficulty in defining an objective concept of risk is a consequence of these chance variations. Due to the uncertainty of future events, risk assessments must always remain approximations of the objective hazard. The latter can only be known with certainty after the damaging event has occurred. For there is no way of unequivocally revealing a risk assessment as being false at the point in time of the forecast. The probability of occurrence only tells us that when examining a very long period of time under constant boundary conditions, an event is to be expected with a certain relative frequency. Narrowing down the concept of risk to the relative frequency of undesirable events is an attempt to make limited forecasts of future events upon the basis of historical experience and modeling of the future. This attempt relies mainly upon the two risk components of probability of occurrence and extent of damage, while other risk-relevant aspects are left out of the analysis.

For this research, environmental risk can be defined as *likelihood of a catastrophe due to contamination of the environment in the result of social and economic activities of people, and natural factors*. In the context of management of water resources in Lebanon, environmental risk is defined as depletion or mismanagement of water resources in the country since Lebanon has been facing scarcity of water resources in recent years [2].

We need to study different theories in risk management for a creation a concept how to control water resources in Lebanon and reduce losses.

The theoretical basis for the formation of an effective system of environmental risk management is the Theory of Planned Behavior (TPB). This

theory seeks to enhance understanding and predict the link between attitudes and behavior. The Theory of Planned Behavior is utilized to identify the association between environmental cognition and physical activity. Therefore, the theory provides significant insights on how a person's decision on whether to be active is shaped by a supportive physical environment (Nelson et al., 2008).

Behavioral Decision Theory suggests that decision makers in this field are faced with expanded context and new challenges in environmental risk management because of environmental degradation and the focus on sustainable development. In line with this theory, environmental risk management is addressed through four different kinds of 'survival' dilemmas. These dilemmas are spatial, benefit-risk, social and temporal dilemmas and combine into different issues of environmental degradation as well as policies and strategies developed for environmental risk management. Based on these dilemmas, environmental risk management entails formulating decision problems, evaluating environmental quality and risk, identifying human factors contributing to the environmental risks, and developing and assessing measures to resolve the risks (Vlek & Keren, 1992). Behavioral Decision Theory is applied in environmental risk management to predict and explain choice behavior in relation to environmental protection and management.

One of the theoretical foundations for environmental risks is Social Ecological Theory. This theory incorporates cultural, social, and institutional contexts of relations between people and the environment, particularly elements that are not within people's control but modifiable by the society. According to UNICEF (n. d.), theory suggests that the physical environment, intrapersonal, so-

cial, and cultural elements interact and have significant impacts on each other, particularly the environment. In the case of Lebanon's water resources, it will help in examining ecological and societal aspects of water management in Lebanon.

According Sinclair-Desgagné & Gozlan (2003), a Theory of Environmental Risk Disclosure states that environmental risks' regulation focuses on stakeholder's awareness and empowerment. In this regard, the success of environmental risk management systems that are based on this theory depend on the quality of environmental disclosures. Environmental disclosure is defined as providing information to the public relating to environmental risks and management through policies and regulation. Through increased awareness and empowerment, stakeholders develop and utilize measures that enhance environmental risk management. These measures include regulation of human and/or industrial activities that pose environmental risks.

In Table we compare theories.

The experience of many countries in environmental risk management shows that at the initial stage of implementation of the environmental risk management system, relatively low investment leads to a significant reduction in the amount of risk. This process can be repeated as long as the cost of new activities does not exceed the reduction of environmental risk assessment from their implementation.

Currently, there are a large number of methods of environmental risk management. We can identify four main groups of methods to reduce environmental risks: methods of evasion from risk; methods of risk preservation; risk transfer methods; risk reduction methods.

#### Summary of the theories

Theory	Details of Theory	What we can take for risk management (water recourses in Lebanon)	Unique characteristics (why it is different from other theories)
Theory of Planned Behavior by Icek Ajzen	The theory suggests that a person's behavior is influenced mostly by his/her intention to engage in the behavior	Depletion or mismanagement of water resources in Lebanon is influenced by people's behavior	The theory provides a psychological premise for understanding management of water resources
Social Ecological Theory by Urie Bronfenbrenner	The theory provides a set of principles or framework for understanding the dynamic inter-relations between several individual and environmental factors	The theory can be used to develop a framework for suitable interrelations between people and the environment in the use of water resources	The theory provides a basis for understanding the relations between people and the environment
The Theory of Environmental Risk Disclosure by Bernard Sinclair-Desgagné and Estelle Gozlan	The theory states that environmental risks' regulation focuses on stakeholder's awareness and empowerment	The theory can be used to understand the role regulation of environmental risks play in promoting effective use of water resources	It provides a premise for understanding environmental risk regulation

Avoidance of environmental risk means the abandonment of any actions and activities that entail a possible environmental risk, as well as the termination of any activities that may entail adverse effects on the environment.

The method of preservation of environmental risk is to maintain the risk at the existing level and the recognition of possible damage, in fact, self-insurance, i. e. the creation of a special reserve fund at the organization, from which compensation for losses due to an adverse event will be made.

The method of risk transfer is the complete or partial transfer of environmental risk to a third party, which may be an insurance company.

Reduction of environmental risk can be carried out by means of such methods as limiting, reserving resources and funds to cover damage in the implementation of risk.

Assessment of options and methods of environmental risk management in the organization is carried out until the most optimal option to reduce the negative impact on the environment and human health is selected. The resulting best option is subject to further implementation.

On the optimum method of environmental risk management is influenced by such factors as the scope of activities of the organization, propensity for risk, financial possibilities, etc. But the basic rule when choosing a method of risk management is the largest environmental risk.

With a small environmental risk, it is not advisable to spend significant funds to minimize it. In this case, it is more expedient to apply the method of risk preservation or to create a special reserve fund at the enterprise.

Environmental risks of a higher level are regulated through insurance and risk distribution between the state and nature users. With a fairly accurate identification of environmental risk and the source of its occurrence, it is effective to use the method of localization (limitation) through the establishment of environmental standards and limits on environmental management.

In case of critical risks, the best option for its management is to transfer the risk to the insurance company. It should be noted that the higher level and degree of uncertainty of environmental risk, the more expensive the services of the insurance company.

In the United States and the European Union, where there is a relatively developed legal framework, there is a special area of insurance – environmental risk insurance. The decision on insurance of environmental risks is developed taking into account industry features, activity of the enterprise or the organization and its features of environmental pollution.

In most countries of the European Union, voluntary environmental insurance is used to compen-

sate for damage from accidental pollution of the environment in the framework of General insurance of civil liability of enterprises. Mandatory environmental insurance exists in Belgium, it is accepted, but not put into practice in Portugal. The most consistent policy of liability insurance for damage caused by pollution of the environment is implemented in Germany, where it is implemented within the framework of the current environmental legislation. In Germany, an enterprise that has not insured its possible environmental risk will not be able to function properly, as its business partners and stakeholders will not cooperate with it. Therefore, in order to improve their competitiveness, German enterprises, in accordance with the Law “on environmental responsibility” (1990), carry out insurance of environmental risks. There are no special laws on environmental insurance in Germany. In this case, the amount of damage is established by the court on the basis of the statement of claim to the court. The court has the right to accept or revise the amount of compensation payments. The stringency of court decisions is the main driver of environmental liability insurance.

To date, in most member countries of the European Union there is a tendency to exclude environmental risks from insurance contracts between businesses and the insurer. The main reason for this is the transition to insurance of all risks associated with environmental pollution and harm to human health.

In the United States, unlike in the European Union, the environmental insurance system is aimed not so much at preventing environmental risks, but at compensation for real damage to the environment and human health. In addition, insurance companies spend a very significant part of the money on the settlement of legal proceedings, payment of services to legal advisers and independent experts, as well as environmental risk assessors. This is, first, due to the fact that the American system of liability insurance for environmental damage is given priority over personal insurance, the cost of which for the settlement of legal proceedings is much less. Secondly, significant expenses on insurance of environmental risks are explained by the peculiarities of the American model of legal regulation of insurance.

In many countries, in order to expand the activities of insurance companies in the field of insurance of environmental risks and increase the maximum amount of insurance sums, special insurance pools (associations) are created. The first appeared in Japan for liability insurance for an emergency oil spill. In addition to Japan, these pools do exist in France, Italy, Holland, Sweden and England. The environmental insurance pool coordinates the activities of enterprises for compulsory and voluntary insurance of risks that can harm the environment and human health.

We use the research of prof. A. V. Neverov and the colleagues in managing environmental risks called “insurance” concept of environmental risk management [3]. We adapted it under lebanese situation with water resources.

The use of water resources in Lebanon is approaching unsustainable levels because of a lack of effective management policies coupled with increased consumption as a result of expansion of irrigated agricultural land and escalating uncontrolled exploitation of groundwater resources, population growth, and industrial development.

The Ministry of Energy and Water instigated steps aimed at setting the general policy for the management of the Lebanon’s water resources, through the formulation of the 10-year plan for the years 2001 till 2011 for water and wastewater management. This was a first step towards proper, sustainable, and comprehensive water management but this should be complemented by improvements in water efficiency (water harvesting schemes, water pricing policy, control pumping of groundwater), and alternative non-conventional water resource usages such as wastewater reclamation to cope with the expected water shortage during the coming decade [4]. Now the situation is following. It is a deficit in the water balance due to the waste of about 1.2 billion m<sup>3</sup>/L in the sea. Another problem water sources in Lebanon have been exposed to all kinds of contamination due to the lack of sewage systems from their areas of existence. There is a big problem of the use of fertilizers, pesticides, the throwing of oils and hydrocarbons in layers of groundwater, rivers and sea.

The proposed conceptual approach to environmental risk management in Lebanon gives general provisions and principles of mandatory insurance, features of environmental insurance as a structural element of financial relationship in nature management in terms of possible disturbance of ecological balance. Using these ideas we create a concept for lebanese conditions (Figure).

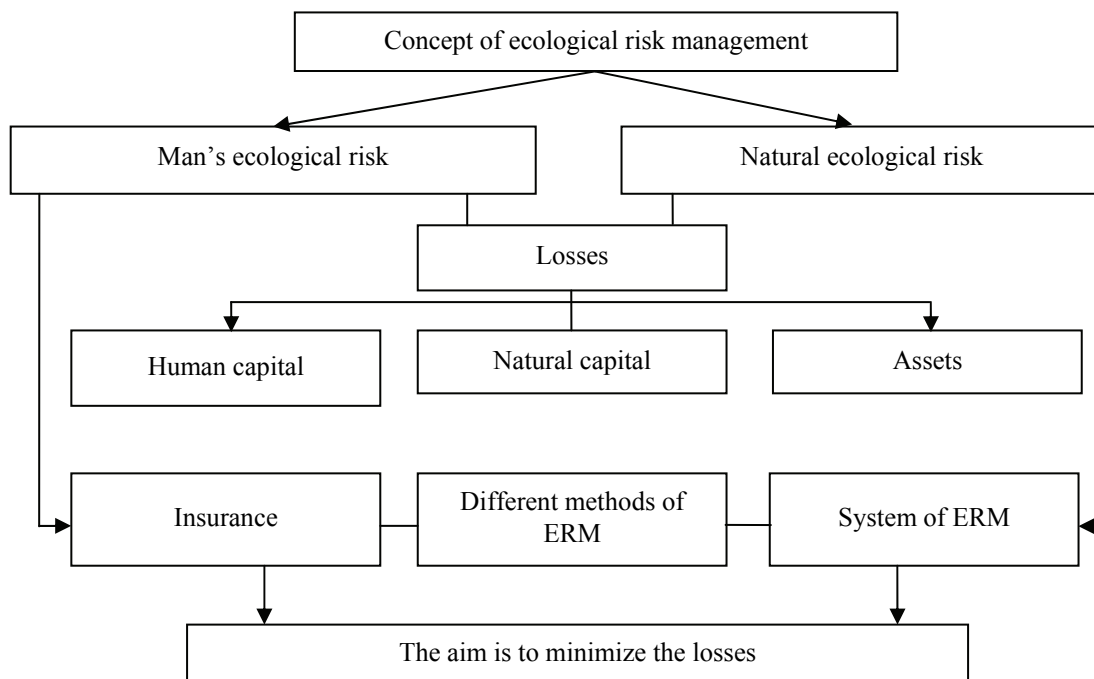
The purpose of risk management is the reduction of risk level to an acceptable from economic, social and environmental point of view. Its maximum level is determined by it is applied to the whole set of negative ecological effects in the context of valid social and economic losses.

The main elements of the concept:

- scientific and methodological approach to environmental risk management for sustainable environmental management and green economy;
- methodology of economic assessment of ecological risks for water resources in Lebanon based on the theory of natural capital and the assessment of the probable loss of natural resource potential as a result of natural disasters.

Economic assessment of environmental risk is the basis of the concept. It has a ground on the theory of risk and the theory of natural rents and therefore has a complex dual nature: economic and socio-environmental.

The central elements of the concept are tools of environmental risk management: insurance tools and non-insurance (limiting, license, etc.). The financial side of the concept links with insurance tools.



The concept of environmental risks management for water resources in Lebanon

**Conclusion.** The word “risk” has two distinct meanings. It can mean in one context a hazard or a danger, that is, an exposure to mischance or peril. In the other context risk is interpreted more narrowly to mean the probability or chance of suffering an adverse consequence or, of encountering some loss.

Thus, environmental risk management allows to determine the probability of occurrence of an adverse event, to analyze the amount of possible damage and to take certain measures to reduce environmental risk to the limits corresponding to an acceptable level of risk.

Assessing the national and foreign experience of environmental risk management, it can be noted that in practice there is no single approach to envi-

ronmental risk management. The practice of enterprises in the implementation of economic or other activities shows that it is impossible to completely avoid risks, but they can and should be properly managed.

The efficient management of water resources is crucial if the water imbalance in Lebanon is to be addressed. New management and planning policies are necessary to overcome the problems and constraints outlined above. The concept of environmental risk management can solve these problems because it is based on the theory of natural capital and the assessment of the probable loss of natural resource potential and uses insurance as a tool of minimizing losses.

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