



## THE COMPLEXITY OF RISK AND UNCERTAINTY ASSESSMENT

DRĂGHICI Dalis Maria  
*Lucian Blaga University of Sibiu, Romania*

### **Abstract:**

*Risk reduction means diminishing uncertainties and strengthening the knowledge. There are many ways in which undesirable surprises can be understood and controlled, but the dominating one is the risk approach, on the basis of risk conceptualization, evaluation and risk management. Across time, many progresses have been accomplished in the field of risk, connected not only to the conceptual part, but also to the empirical procedures. Despite this, the premise of this domain is being represented to a substantial extend by theories and practices. This is why it is indispensable to search for trends in the risk framework, to reveal whether further development should be desired and if uncertainties' consequences are measured properly. The aim of this article is to present an analysis of some fundamental breakthroughs developed in the risk field, with a particular attention on the fundamental concepts. In addition, I also pursued to provide you with new insights on how to assess, perceive, describe and manage the unforeseen situations altogether with analyzing the uncertainty component of risk. To understand the risk has to be in continuous harmony with the acknowledgement element of the same concept.*

**Key words:** *risk conceptualization, Society for Risk Analysis, risk management*

### **1. Introduction**

The boundary between ancient humanity and modern times resides as well in the means and powerful tools of risk management that are available to us nowadays. As Bernstein stated, until the humans discovered the methods to overcome the edge and stopped being passive before nature, the future could not have been differentiated from the past and the knowledge monopoly when trying to anticipate events was held by soothsayers and the discipline of oracles (Bernstein, 1996).

Silver Nate, an American writer, statistician and editor-in-chief at ESPN has accomplished to be one of the 2009's Most Influential People worldwide, according to Time magazine. He stated in one of his books, *The Signal and Noise* that '*risk greases the wheels of a free-market economy; uncertainty grinds them to a halt*' (Silver, 2012).

Consequently, many people are making a sustained effort in order to reduce uncertainty, fact that brought again to light the *Knighitian uncertainty*.

In his 1921 book, entitled '*Risk, Uncertainty and Profit*', Frank Knight ascertained a distinction between uncertainty and risk. As he believed, a world that is changing continuously brings new opportunities, even though we possess incomplete knowledge about the future events. Therefore, according to the American economist, risk applies to situations when we do not have enough information in order to know the outcome, but the odds can be measured accurately, while the term *uncertainty* describes the situations where no one has all the information needed for measuring the exact circumstances.

Among other authors that have recently highlighted the relevance of approaching the concepts of risk and uncertainty we can mention Ricardo Caballero, MIT's head of the Department of Economics, who is also involved in international projects, lecturing about Economics and International Finance. He invoked the Knightian uncertainty in order to explain how investors behave in times of financial crisis (Caballero, 2010). In this matter, the existence of this approach represents not only a philosophical dispute, but a practical and pressing problem.

The present paper is organized as follows. Firstly, in the second section I will focus on the fundamental ideas on which the field of risk is based. The next section presents the concepts of 'risk understanding' and 'risk acknowledgement', together with the links between them. The perspectives on risk management are discussed in section 4, followed by the uncertainty assessment. The last part of this article provides some future prospects.

## **2. Risk conceptualization**

The term of risk has a long history, dating back to more than 2400 years ago, when the Athenians started using their capacities of appraising risk before making any decision (Bernstein, 1996). Despite this, the concepts of risk management and risk assessment were indicated as a scientific branch not longer than 40 years ago. From that time, the foremost methodical papers, journals and summits appeared, embracing the most important principles and fundamental ideas on how to manage and determine risk properly.

When referring to risk assessment and management, the practices that have been applied since 1970s and 1980s still form to a large extend the basis for the risk science. But, of course, despite this idea, the field continued to considerably develop since then, leading to the appearance of new analysis and more sophisticated methods. Together with this development, the analytical techniques are now used in almost all societal sectors.

Let's consider the supply chain risk management as an example, an area which has been quite recently transformed into a growing research field, from an emerging topic (Fahimnia et al., 2015). Their work describes the mathematical and

simulations models used to manage the supply chain risks, by presenting the explored sectors that have scientifically improved the discipline with fundamental know-how, techniques and methods.

In order to emphasize the development achieved in the risk field, an illustration is provided by the wide range of specialty groups that are being covered by the Society for Risk Analysis: environmental and ecological risk, habitual risk, occupational health and safety, risk policy and law, exposure assessment and so on (The Society for Risk Analysis, 2017). During the recent years, the risk science suffered some advances also in the fundamental topic, being of special interest mainly because these changes can have a significant influence on its tools and applications.

Any scientific discipline has to be built on invariably and well-explained accepted and recognized concepts and terms. Although several attempts have been made in order to identify a broadly accepted definition related to the fundamental theories of risk, they failed, because trying to agree on only one consolidated series of definitions seems unrealistic. This represented the main argument that convinced a committee of experts from the Society of Risk Analysis (SRA) to try to conduct a thinking process, which ended up in a new glossary. The committee's fundamental concepts were based on allowing different perspectives to be followed, together with distinguishing between the most qualitative definitions and the corresponding measurements. Although I will have as focal point the concept of risk, SRA's glossary also provides terminology for terms such as threat, vulnerability, safety analysis or knowledge.

Taking a closer look on SRA's unified definition, risk is described as follows: *we consider a future activity (interpreted in a wide sense to also cover, for example, natural phenomena) and define risk in relation to the consequences of this activity with respect to something that humans value. The consequences are often seen in relation to some reference values (planned values, objectives, etc.), and the focus is normally on negative, undesirable consequences. There is always at least one outcome that is considered as negative or undesirable* (The Society for Risk Analysis, 2015).

Thinking of the qualitative part of the overall definitions of risk, we can ascertain that they all encompass the possibility for realization of an unfortune occurrence, together with unwanted or negative consequences. The deviation from an expected result, plus the related uncertainties are also characteristics that have to be taken into consideration when defining the risk concept.

Risk concept can be interpreted in different ways, the entire set of definitions expressing predominantly the same thought, with the aspect of uncertainty appended to events and the effects aspect. Another simple, but complex definition, provided by the International Organization for Standardization claims that *risk represents the effect which uncertainty has on objectives* (International Organization for Standardization, 2009).

### **3. Understanding and acknowledging the risk**

The approaching of the two notions: *to understand* and *to acknowledge* the risk has given new insights regarding the practical use of the risk concept, also by being a useful bond between comprehension and action. For instance, the first concept can be outlined as the awareness possessed about a certain risk, being aware as well of the underlying probabilities. It could also be understood as having knowledge about the aspects that have the biggest influence on the risk.

Having a correct discernment of risk means that the analysts know what kind of incidents may arise and also what sort of repercussions could they lead to. With the help of some models, they can predict accurately the unforeseen results given the occurrence of some events. Furthermore, an analyst who understands the field of risk should be able to present justifications on which are the elements that contribute the most to the risk and if there exist some ways of improving the existing process, in order to maintain the risk level under control.

To make any decision about an existing or potential risk, we initially be in want of the risk apprehension approach, and then being followed by the risk acceptance part. This part deals with bearing the risk and drawing the required closures and ways of action. Although the background knowledge is a powerful one and the assumptions that assist the judgements are being discussed during the execution of the analysis, the practice guide and the method cannot be scientifically explained.

It is true that the 'risk acknowledgement' does not describe all the steps that have to be taken or how to finalize the risk assessment and the information controlled. But with this connotation, the two terms suit into a framework of managing risk, that emphasizes risk investigation as a tool for getting ideas and then informing the decision makers.

Risk problems are almost at any moment related to the situations when we have to face large uncertainties. Maybe the system is complex, blocking us from determining what will happen and which are the scenarios that could happen. Surprises always occur, and what is left to do is for us to acknowledge that despite our beliefs, risk is also about surprises and about the unforeseen.

### **4. Risk management principles**

The risk field has two main assignments that have to be accomplished. The first one refers to studying and treating the risk that arise from certain activities, by using the risk management, while the second task expects research and development to be performed, in association with methods, concepts, theories, approaches and frameworks, in order to be able to characterize, assess and understand the risk (Aven, Zio, 2014).

In the recent years, considerable work has been conducted on risk management ethics and plans. One example comes from Klinke and Renn, who

managed to provide a modern scale of management strategies and types of risk. Their pioneering contribution includes seven different features of uncertainty, together with the extent of damage, but their work did not stop here: for every risk type, they presented a group of principles, in order to manage the risk (Klinke, Renn, 2002).

Risk management handles different meanings. In any given moment, a set of alternatives are being considered and evaluated and the decision taken is the one that meets the priorities and values expected. During all this operation, it is advisable to set some constraints, as for the perceptions to be unraveled and to avoid thinking of many variables simultaneously. In the scientific literature, restrictions like this are frequently called risk acceptance criteria or tolerability criteria (Aven, 2016).

All the risk principles acknowledge that almost in every case risk cannot be treated in an objective manner, making compulsory for the risk management to provide strong solutions and methods, which can provide protection and reduce the negative consequences of the undesirable, unforeseen and black swan events. Because everyone attempts to find desirable results, not just to avoid the unpleasant ones, a proper risk management has to concentrate as well on improvements and performance.

## **5. Uncertainty assessment**

How to deal and understand the uncertainties still remains a central topic. It has been thoroughly debated in the scientific written works, starting with the first steps of risk appraisal, between 1970 and 1980 and is still continuing. What is for certain is the fact that uncertainty is a key term for risk conceptualization.

Some recent reference covers one of Taleb's concepts, *antifragility*, which emphasizes the idea that long-time fulfilment can be achieved only if variation, uncertainty and risk are acknowledged. This is why the same author proposes "to stand current approaches to prediction, prognostication, and risk management on their heads" (Taleb, 2012).

Another contemporary vision about worries, orientation and trials is being presented by Flage et al., who tried to express and picture the uncertainty in assessing the risk. Although we talk about aleatory (representing variation) or epistemic risk (due to lack of knowledge), the probabilistic analysis is the predominant method used to handle the uncertainties involved in risk analysis (Aven, 2016).

However, nowadays, more researchers and risk analysts find the approach on risk based on pure probability too narrow, motivating that it ignores important aspects in regards with uncertainty and risk. So, they have started to use non-probabilistic representation of uncertainty than before. The argument in favor of this choice relies on the fact that credible probabilities cannot be always determined so easily and a complex term as risk shouldn't be limited to just this tool. Even if the probability continues to be considered the main tool, there are other methods and approaches which can be used in large and deep uncertainties. When these situations do occur, it is critical to seek beyond probability. This is why the combination of qualitative

methods and probability can represent an adequate alternative in this research direction.

In a decision-making process, it is necessary to confer importance to uncertainties, but also care has to be shown, because people who are cautionary will have the uncertainties highlighted and they will always want a safety measure to be applied. On the other hand, the ones that think the opposite would like to stay away from focusing on the uncertainties. Hence, it is vital for a successful risk assessment to be carried out by analysts that have no connection with the stakeholders or the decision makers. Their task will be to conduct a professional analysis, in which to identify and describe the most relevant uncertainties and risk, without being objective, the assessment reflecting some judgements that are based on knowledge. The entire result should be a balanced and fair characterization of the reality.

## **6. Future prospects**

Risk management and risk assessment are proved to be a methodical area, offering significant contributions for supporting decisions. A key challenge for the future development of the risk assessment relies on the importance of changing the predictions and accurate risk estimations with knowledge or lack of knowledge approaches, in order to solve the situations of large uncertainties.

Nowadays, in situations with clearly defined boundaries the risk assessment is well established and also the statistical techniques have been improved, providing decision support for several types of applications. On the other hand, it seems that the risk decisions are, to a high extent, obliged to focus on large uncertainties, situations that call for different methods and techniques. This is why it is a main challenge the development of suitable frameworks and tools on this matter.

Although the term of emerging risk has gained increasing importance in the last few years, further evolution in the risk assessment has to be accomplished, in order to achieve the challenges that are linked to time and knowledge. There is also a demand for some unique risk management strategies to be implemented in a flexible approach, including preventive procedures.

## **7. Conclusions**

The way we assess and understand risk can have an influence on how the risk field is being analyzed, followed by possible implications in the risk management and in the process of taking decisions. In order to make improvements in the methods used, it is mandatory to possess a proper framework that can help us differentiate between the comprehensive risk image and how it can be quantified. The risk term has become a subject of major significance in all branches, covering a wide range of topics, whether we approach health, economics or engineering (Althaus, 2005).

Independent of any tool, a managerial judgement and review has to be realized, seeking to understand beyond the analysis' results, and more than that, adding the

issues that were not captured previously by the analysis, such as considerations that are linked to the presence of absence of knowledge.

Keeping in mind that probabilities are always conditional on assumptions, making judgement about risk based only on the probabilistic segment could seriously harm and misguide the decision makers. The novelty of thinking in regards to addressing the concepts of knowledge and performance when referring to risk management could lead to a diminish in the negative consequences, adding new insights into the risk field and science.

While 'risk understanding' highlights its importance by revealing the most relevant aspect of risks, such as: events, uncertainties, the background knowledge and, of course, the consequences, 'risk acknowledgement' shows a more challenging component of the decision-making process, because its methods have to be tailored in order to fit to specific issues and situation.

## **References**

- Althaus, C.E. (2005), *A disciplinary perspective on the epistemological status of risk*, Risk Analysis, Vol. 25, no. 3, pp. 567-588;
- Aven, T. (2016), *Risk assessment and risk management: Review of recent advances on their foundation*, European Journal of Operational Research, 253, pp. 1-13;
- Aven, T., Zio, E. (2014), *Foundational Issues in Risk Assessment and Risk Management*, Risk Analysis, Vol. 34, no. 7, pp. 1164–1172;
- Bernstein, P.L. (1996): *Against the Gods: The remarkable story of risk*, John Wiley & Sons, New York;
- Caballero, R.J. (2010), *Macroeconomics after the Crisis: Time to Deal with the Pretense-of-Knowledge Syndrome*, Journal of Economic Perspectives, Vol. 24, no. 4, pp. 85-102;
- Fahimnia, B., Tang, C., Davarzani, H., Sarkis, J. (2015), *Quantitative models for managing supply chains risks: A review*, European Journal of Operational Research, Vol. 247, no. 1, pp. 1-15;
- International Organization for Standardization (2009), *Risk Management – Vocabulary*, Guide 73:2009, available online at <https://www.iso.org/obp/ui/#iso:std:iso:guide:73:ed-1:v1:en>;
- Klinke, A., Renn, O. (2002), *A new approach to risk evaluation and management: Risk-based precaution-based and discourse-based strategies*, Risk Analysis, Vol. 22, no. 6, pp. 1071-1094;
- Knight, F. (1921): *Risk, Uncertainty and Profit*, Houghton Mifflin Company, Boston and New York;
- Silver, N. (2012): *The signal and the noise: why so many predictions fail – but some don't*, Penguin Books Publisher, Great Britain;
- The Society for Risk Analysis (2015), *Society for Risk Analysis Glossary*, available online at [http://www.sra.org/sites/default/files/pdf/SRA\\_glossary\\_20150622.pdf](http://www.sra.org/sites/default/files/pdf/SRA_glossary_20150622.pdf);
- The Society for Risk Analysis (2017), *Core Subjects of Risk Analysis*, available online at <http://www.sra.org/sites/default/files/pdf/SRARASubjects-May%2015%202017.pdf>;
- Taleb, N., N. (2012): *Antifragile*, Penguin, London.